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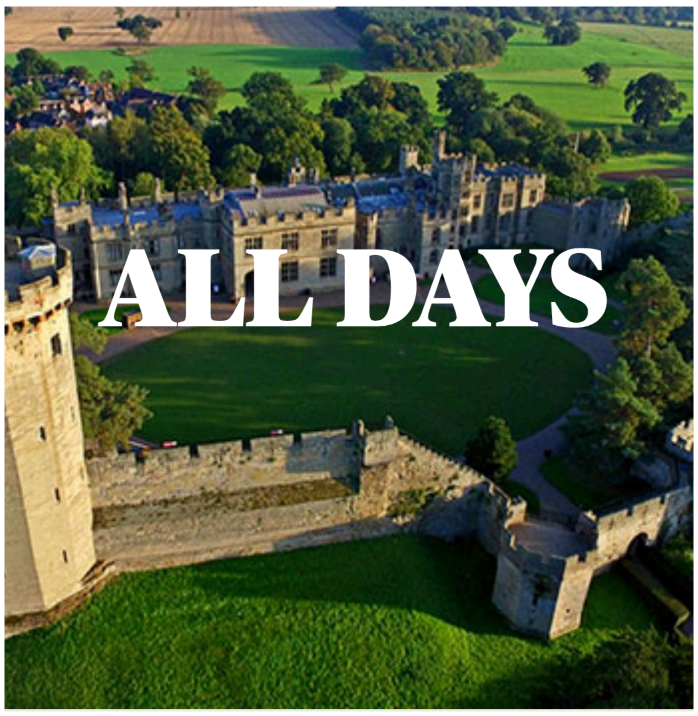

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<table>
<tr><td>**Day:1-
10:30:11:15**</td><td>**Professor Charlotte Williams - University of Oxford
BUTTERWORTH HALL**</td></tr>
<tr><td colspan="2">Designing Sustainable Polymers: Activating Renewable Resources to Make Better Materials through to End-Life Recycling</td></tr>
<tr><td colspan="2">We need to re-design polymers to try to tackle sustainability concerns and also reduce the greenhouse gas emissions prevalent through their life cycle. The lecture will describe recent research from the Williams team in the development of polymerizations using renewable resources such as carbon dioxide and biomass. It will focus on how to improve the activity and selectivity of catalysts, using kinetic, spectroscopic and computational methods to investigate the polymerization mechanisms. The resulting oxygenated polymers can be tailored to show different properties and case studies will focus on improving the properties of plastics and using block polymers as binders for solid state lithium ion batteries. The end-life recycling of the polymers, by both re-processing and catalyzed depolymerizations, will be discussed.</td></tr>
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<tr><td>**Day:1-
11:15:12:00**</td><td>**Professor Rachel Segalman -
BUTTERWORTH HALL**</td></tr>
<tr><td colspan="2">Using bioinspired polypeptoids to understand how chain shape influences self-assembly and to design new materials</td></tr>
<tr><td colspan="2">Polypeptoids are non-natural, sequence specific polymers that offer the opportunity to probe the effect of monomer sequence, charge, chirality, and chain shape on self-assembly and surface properties. Although examples of hierarchical polypeptide structures abound in nature, the de novo design of such systems for specific functions is still a major challenge. The polypeptoid system with its much simplified set of inter and intramolecular interactions provides an opportunity to explore this design space with more tractable systems. In this talk, I will discuss experimental efforts to design peptoid structures with controlled chain shape on a fundamental level as well as use of this platform to design highly functional materials ranging from marine anti-fouling coatings to next-generation photoresists.</td></tr>
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<tr><td>**Day:1-
12:00:12:45**</td><td>**Professor Tanja Weil -
BUTTERWORTH HALL**</td></tr>
<tr><td colspan="2">The polymer synthesizer: Making (nano)particles</td></tr>
<tr><td colspan="2">Digital chemistry and data driven synthesis approaches have rapidly moved from being an oddity in the synthetic chemistry space to drivers in research. Machines are ultimately faster and more accurate in providing screening, optimization or scaling of synthesis than even experienced researchers. Robotic synthesis is enabled by a plenitude of methods, from actual mobile robots over liquid handler platforms to flow chemistry. All provide high throughput experimentation and ideally possess online monitoring qualities in order to allow for feedback-controlled synthesis.
Synthesis of polymers of almost all facets have by now been demonstrated in robotic synthesis procedures. Also particles have routinely been synthesized in this way, most prominently via flow chemistry techniques. In this contribution we will briefly discuss the advantages of data driven high throughput experimentation, and then turn to formation of nanoaggregates form amphiphilic block copolymers.</td></tr>
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<table>
<tr><td>**Day:1-
14:00:14:30**</td><td>**Professor Marc Hillmyer - University of Minnesota
ARTS CENTRE THEATRE**</td></tr>
<tr><td colspan="2">Tandem ring-opening metathesis polymerization and post-polymerization saturation using a single catalytic system</td></tr>
<tr><td colspan="2">Ring-opening metathesis polymerization (ROMP) continues to be a very powerful technique for the preparation of polymeric materials from cyclic olefins. Examples of functional group tolerance of ruthenium-based metathesis catalysts developed by Grubbs for the preparation of functional polymers are manifold. Upon completion of the polymerization, the metathesis catalyst can be liberated from the chain ends of the polymer chains by adding an end-capping reagent such as ethyl vinyl ether. The</td></tr>
</table>

ruthenium carbene species can also be converted into a hydrogenation catalyst upon the addition of molecular hydrogen. We took advantage of the dual reactive nature of such ruthenium-based compounds to generate telechelic polyethylene utilizing a bio-based hydroxy-containing chain transfer agent during ROMP agent to install functional endgroups. These telechelics can be used as reactive compatibilizers in blends of polyethylene and polyethylene terephthalate. We also utilized this tandem approach to generate crosslinked polyethylene/hydrogenated polydicyclopentadiene thermosets that were resistant to oxidation as compared to their unsaturated precursors. Importantly, in both examples we utilized very low levels of ruthenium and carried out the hydrogenations in the absence of solvent. In this talk, I will report on both approaches and our current efforts in this area.

Day:1- 14:30:15:00	**Professor Frederik Wurm - University of Twente ARTS CENTRE THEATRE**

Towards Sustainable Plant Protection by Lignin-encapsulated Agrochemicals and Biologicals

Devastating plant diseases and soil depletion rationalize the extensive use of agrochemicals to secure food production worldwide. Extensive spraying harms the environment. The sustained release of pesticides in agriculture is a promising solution to the eco-toxicological impacts and it might reduce the amount and increase the effectiveness of agrochemicals administration in the field. This talk will present our recent works on nano- and microcarriers that promote the sustained release of actives and can be used to treat plant diseases. Biopolymer nanocarriers represent a potentially environmentally friendly alternative due to their renewable origin and biodegradability, which prevents the formation of microplastics. Lignin and other lignocellulosic feedstocks have been the focus of our research and how they can be used to prepare enzyme-responsive release systems in planta. The presentation will show the latest results on chemical and biological encapsulation and release.

Day:1- 15:00:15:15	**Professor Chris Kozak - Memorial University of Newfoundland ARTS CENTRE THEATRE**

Metal-catalyzed Polymer Synthesis from Carbon Dioxide, Epoxides and Anhydrides

The reaction of CO2 and epoxides to give cyclic carbonates or polycarbonates is becoming a promising method of utilizing CO2 as a C-1 feedstock. Catalysts to-date include Co, Zn, Cr and Fe-containing complexes with multidentate ligands, and the design of the ligands is of course imperative to exacting high activity and selectivity. We have been exploring the amino-phenolate ligand system as a scaffold for active catalysts for CO2/epoxide and anhydride/epoxide ring-opening copolymerization (ROCOP), and recently turned our attention to incorporating other monomers into the feedstock. With changes to ligand coordination geometry around the metal centre, and to the steric and electronic nature of ligands, selectivity for epoxide ring-opening polymerization (ROP), vs. CO2/epoxide ROCOP can be found. Furthermore, copolymers and terpolymers can be obtained under mild conditions with good activity and control.

Day:1- 15:15:15:30	**Dr Fannie Burgevin - University of Bath ARTS CENTRE THEATRE**

Degradability of biodegradable polymers: direct comparison of the degradation of PLA, PBAT, PBS and PHBV polymers under different artificial and environmental conditions.

The persistence of plastic in the environment has become a major issue in the last decades and biodegradable products are presented by many as part of the solution to this global plastics crisis. However not enough is known about the precise fate of these materials in the open environment and the literature is not yet able to propose clear standard methods to test polymer material in a systematically comparable way.

The aim of this study is to be able to directly compare the degradation behaviour of 4 common biodegradable polymers on the market, Poly(lactic acid) (PLA), Poly(butylene adipate-co-terephthalate (PBAT), Poly(butylene succinate) (PBS) and Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV), in different conditions: in the lab in aqueous accelerated conditions and in the open environment (in soil, marine and air environments). Using different techniques such as size exclusion chromatography (SEC), scanning electron microscopy (SEM), differential scanning calorimetry (DSC) and pyrolysis coupled to gas chromatography and mass spectrometry (Py-GC-MS), the degradation of the polymers was followed for up to 1.5 years in the different environments. Clear signs of hydrolysis were observed in aqueous conditions at temperatures between 30 and 50 ^{0}C, while the signs of degradation were very limited in soil, seawater, and air for PLA, PBAT and PBS in the field. On the other hand, PHBV showed more significant signs of degradation in field conditions due to surface enzymatic degradation. These results highlight the need to test materials in different conditions, including natural environments in a more systematic way to be able to better compare results.

Day:1- 16:00:16:30	**Professor Sophie GUILLAUME - CNRS University of Rennes France ARTS CENTRE THEATRE**

Bridging the gap from catalyst and monomer design to functional stereoregular polyhydroxyalkanoates (PHAs)

Poly(hydroxyalkanoate)s (PHAs) are natural or synthetic aliphatic polyesters that are biocompatible, degradable and recyclable thereby attracting considerable interest as circular engineering plastics, in particular as single-use plastics, packaging, or biomedical device.

Our recent highlights in the field include tunable catalytic systems for the ring-opening (co)polymerization (ROP) of functional b-propiolactones BPLFG (FG = (fluoro)alkyl, (di)methylene (thio)alkoxide, ester), into their corresponding stereoregular and sequence controlled/alternated PHAs (co)polymers featuring a high degree of control over molecular and microstructural characteristics.

Emphasis will be placed on the close relationship between the catalytic system, the chemical structure, the composition and topology of the macromolecules. The combination of the stereoelectronic environment on the catalyst/active species and of the b-lactone substituent FG is a key parameter for the tuning of the stereochemistry.

Day:1- 16:30:16:40	**Dr Purabi Bhagabati - Post doctoral researcher ARTS CENTRE THEATRE**

Synthesis of poly(l-lactic acid) [PLA] from Brewers' Spent Grain (BSG)

PLA is a commercially available biodegradable plastic from first generation feedstocks like potatoes and corn starch which brings it in massive criticism. However, from sustainability point of view, second generation feedstocks are more attractive option to synthesize PLA. Brewers' Spent Grain (BSG) is the waste from brewing industry can be utilized to produce L-lactic acid. The work presents lab-scale synthesis of poly(L-lactic acid) [PLA] from L-lactic acid from the BSG waste by following ring-opening polymerization technique. Optimization of reaction and associated process parameters was conducted in controlled lab-scale environment to achieve optimum molecular weight and crystallinity of PLA. The chemical structure and purity of the synthesized products were confirmed by 1H NMR, FTIR and Raman spectroscopy studies while the polarimeter indicated the % optical purity. The molecular weight of resultant PLA was determined using Gel Permeation Chromatography (GPC) technique.

Day:1- 16:45:17:00	**Dr Diego Resendiz Lara - University of Oxford ARTS CENTRE THEATRE**

Bio-derived and Degradable Polymers for use in formulations

Polymers are important for liquid formulations, including as surfactants, thickeners, emulsifiers and binders for home and personal care applications. This presentation focusses on preparation and properties of well-defined, low molar mass polyesters and polycarbonates, containing hydrophilic substituents, which are targeted for such formulations. The polymers are prepared by epoxide/anhydride or carbon dioxide ring-opening copolymerizations (ROCOP) in high conversions and selectivity. The properties of the resulting materials are described, including some preliminary evaluation of degradation processes and products.

Day:1- 14:00:14:30	**Mr Cyrille Boyer - University of New South Wales ARTS CENTRE WOODS SCAWEN**
Fabrication of Nanostructured Materials via 3D printing	
Currently, there are no straightforward methods to 3D print materials with nanoscale control over morphological and functional properties. In this talk, a novel approach for the fabrication of materials with controlled nanoscale morphologies using a rapid and commercially available Digital Light Processing 3D printing technique will be presented. The approach uses a controlled/living radical polymerization technique, more specifically, reversible addition-fragmentation chain-transfer (RAFT) polymerization, to control the topologies of the polymers.	

Day:1- 14:30:15:00	**Professor Theoni Georgiou - Imperial College London ARTS CENTRE WOODS SCAWEN**
How does the monomer sequence affect the thermoresponsive properties?	
Themoresponsive polymers are stimuli responsive polymers that respond to changes in temperature and are used in a plethora of applications. Controlling the temperature that the material responds is crucial for many of these applications. Our group has been working in this area for more than 15 years and this talk will summarise our results. Emphasis will be giving how the monomer sequence/architecture affects the thermoresponsive properties of the polymers. All polymers were synthesised with group transfer polymerisation (GTP), an anionic, living polymerisation techniques that allows the easy scale up synthesis of well-defined methacrylate polymers and to easily tailor the polymeric characteristics like molar mass, composition and monomer sequence.	

Day:1- 15:00:15:30	**Professor Edmondo M. Benetti - Laboratory for Macromolecular and Organic Chemistry - University of Padova ARTS CENTRE WOODS SCAWEN**
Topology and Dispersity Regulate the Properties of Polymer Interfaces	
In addition to polymer composition and molar mass, also the topology and the dispersity of polymer adsorbates represent tuning parameters for modulating the interfacial characteristics of polymer brushes, especially when these are applied as biointerfaces. When cyclic polymers are used to form brushes on surfaces, they provide enhanced steric stabilization and a superlubricious behavior, surpassing the attractive characteristics provided by commonly applied, linear brushes. Besides their architecture, the dispersity of polymer adsorbates appears to be an additional, major factor in controlling interfacial physicochemical properties. This is revealed in the case of brushes comprising a poly(methacrylate) backbone and oligomeric side segments, which are broadly employed in biomaterials, and feature a structure reminiscent of a large array of biomacromolecules. A variation in dispersity within polymer brushes regulates the occurrence of hydrophobic, van der Waals interactions between grafts, in turn determining technologically relevant characteristics, such as hydration, adhesive character and lubrication.	

Day:1- 16:00:16:30	**Professor Richard Hoogenboom - Ghent University ARTS CENTRE WOODS SCAWEN**
Functional polymers through amidation of poly(methyl acrylate)	
In this lecture, the recent progress from our group in this area will be discussed. First of all, we developed a 1,5,7-triazabicyclo[4.4.0]dec-5-ene (TBD) catalyzed procedure allowing efficient full or partial amidation of the side chains of poly(methyl acrylate), allowing accurate control over the introduction of functional side chains, such as allyl or cyclohexenyl groups that allowed crosslinking into polymer networks. Moreover, we discovered that the amidation is strongly accelerated when a secondary hydrogen bond donating or accepting group is present on the utilized primary amine-containing reagent. Furthermore, efficient introduction of secondary amine groups will be discussed through amidation with N-ethyl-ethylenediamine, whereby selective amidation of the primary amine occurred. These results from our	

group provide a sound basis for future development of functional polyacrylamide based materials through amidation of poly(methyl acrylate) and also provide a first step towards

Day:1- 16:30:17:00	**Dr Kristian Kempe - Monash University ARTS CENTRE WOODS SCAWEN**

Biocompatible Poly(2-oxazoline) Nanorods as a Tuneable Drug Delivery Platform

The morphology of polymer nanoparticles critically influences their biological interactions contributing to the determination of their in vivo fate.[1] However, currently there is a lack of robust methods for the preparation of non-spherical particles from biocompatible materials. Recently, we developed a promising drug delivery platform through the combination of 'living' crystallisation-driven self-assembly (CDSA), a seeded growth method that enables the preparation of rod-like polymer nanoparticles of controlled length, with poly(2-oxazoline)s (POx), a polymer class that exhibits high structural versatility, 'stealth' behaviour, and excellent biocompatibility.[2-4]

In this presentation the potential to modulate the interaction of POx nanorods with biological entities through variation of size, shape and surface modifications will be discussed. Specifically, we carefully optimised the assembly and disassembly of the nanorods and studied their interaction with white blood cells in a human blood assay.[5], [6] Variation of the nanorod corona and their surface modification with nanobodies allowed to fine-tune their cellular interactions.[7], [8] Moreover, first insights into their drug delivery potential will be given.

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Day:1- 14:00:14:30	**Professor Harm-Anton Klok - EPFL ARTS CENTRE CINEMA**

Expanding the Scope of Surface-Initiated Polymerization

Surface-grafted polymer thin films, which are commonly referred to as polymer brushes, have emerged as a unique class of surface coatings. This presentation will highlight recent discoveries from our laboratory that take advantage of surface-initiated polymerization reactions to generate polymer surface coatings with unique properties. In a first example, it will be shown how surface-grafted polymer films can be designed and prepared that display piezo- and pyroelectric properties, which is of interest e.g. for energy harvesting applications. In a second example, it will be shown how, for a polymer film of a given thickness and composition, solvent uptake and swelling can be controlled, essentially by molecular engineering at the polymer brush – substrate interface. Since solvent swelling is essential to non-fouling and lubrication applications, this provides a new approach to engineer such properties.

Day:1-14:30:15:00

Professor Ulrich S. Schubert - Friedrich Schiller University Jena
ARTS CENTRE CINEMA

Polymer-based batteries: Thin-film printable batteries and scalable, polymer-based redox-flow batteries

To enable the integration of renewable energies into the energy mix, new types of electricity storage systems are needed, which have to rapidly store and release large amounts of electrical energy in order to compensate supply peaks as well as bottlenecks. Similarly, the number of mobile devices that rely on mechanically stable, space-efficient and safe batteries is steadily increasing. The active materials used so far are based mainly on metals, which can hardly meet the requirements for safety and sustainability. Therefore, polymeric compounds are developed as active materials, which offer a benign raw material base and disposal, superior charging times and performance, and improved safety and toxicity. They are mainly based on established redox-active moieties, such as quinone and anthraquinone derivatives, stable organic radicals (e.g. TEMPO) or viologen compounds, which are incorporated into suitable (co)polymer structures.

In comparison to small-molecule organic active materials, polymers allow for a more facile thin-film processing via casting and printing techniques (e.g. inkjet printing, screen printing), while cross linking leads to highly insoluble compounds. Both enables the utilization in solid-state thin-film batteries suitable for application in small, flexible mobile devices (,ÄúInternet of Things,Äù, smart clothes, intelligent packaging). On the other hand, solubilizing comonomers enable the preparation of highly soluble active compounds. These are suited as charge-storage materials in solution-based redox-flow batteries, which are mainly used for storing large amounts of electricity (e.g. in wind and solar parks). Here, the large molar masses of the polymers allow for the usage of cost-efficient dialysis instead of more expensive ion-selective membranes, which have to be used for small-molecule- and metal-based redox-flow batteries.

ChemSusChem 2023, 16, e202300296; J. Phys. Chem. C 2023, 127, 1333; J. Power Sources 2023, 556, 232293; ACS Appl. Energy Mater. 2023, 6, 302; ACS Appl. Energy Mater. 2022, 5, 15019; J. Power Sources 2022, 525, 231061; ChemSusChem 2022, 15, e202200830; Material Advances 2022, 3, 4278; Adv. Science 2022, 9, 2200535; Macromolecules 2022, 55, 1576; ACS Appl. Mater. Interfaces 2022, 14, 6638; Energy Conversion Management: X 2022, 14, 100188; Macromol. Chem. Phys. 2022, 223, 2100373; J. Power Sources 2022, 525, 230996; Progr. Polym. Sci. 2022, 125, 101474.

Day:1-15:00:15:15

Dr Kate Leslie - Durham University
ARTS CENTRE CINEMA

Fluorescent glycopolymer sensor arrays for imaging bacterial infections on surfaces

Chronic bacterial infections can evolve and diversify across the infection site, resulting in spatially distinct pathoadapted areas that require different treatment strategies. Monitoring the non-homogenous infection site is difficult even with state of the art genomic techniques, as many different genetic changes can lead to the same phenotypic presentation. We have developed a fluorescent array sensing system, based on glycopolymer probes, which can discriminate both different types of bacteria, and pathoadaptations within a bacterial species, based on changes in their surface lectin expression. We are implementing this technology into a surface imaging system, in order to directly monitor and capture the diversity within bacterial infections.

Day:1-15:15:15:30

Ms Inga Litzen - DWI Leibniz Institute for Interactive Materials, RWTH Aachen University
ARTS CENTRE CINEMA

Multifunctional Microstructured Surfaces using Microcontact Printing of Microgels

The implementation of reactive microgels for substrate modification enables the incorporation of multiple tunable functionalities at once. This present work combines surface structuring techniques with reactive (post-)modification to design complex interfaces providing structural, chemical and mechanical cues on the basis of N-Vinylcaprolactam microgels with reactive groups. Soft lithography techniques were employed to create micrometer-sized line patterns on glass surfaces. The successful transfer of the printed pattern for microgels with varying chemical composition was proven by light and atomic force microscopy. Reactive moieties such as epoxy or amine groups in the microgels enabled stable binding to functional surfaces. Post-functional coupling to reactive fluorescent dyes was used to demonstrate reactivity on the surface. Such modified surfaces were applied in cell culture to study the influence of different cues on their behaviour.

Day:1- 16:00:16:30	**Dr Delphine Chan-Seng - CNRS ARTS CENTRE CINEMA**

Topology of polymers as a tool to tune properties towards biomedical applications

Day:1- 16:30:17:00	**Professor Yin NING - Jinan University ARTS CENTRE CINEMA**

Interfacial Supra-Assembly of Copolymer Nanoparticles Enables the Formation of Nanocomposite Crystals with a Tunable Internal Structure

We demonstrate a versatile pathway to tune the spatial distribution of guest species within a host crystal via an incorporation strategy. Specifically, well-defined block copolymer nanoparticles, poly(methacrylic acid)x-block-poly(styrene-alt-N-phenylmaleimide)y, are synthesized by polymerization-induced self-assembly. Such anionic nanoparticles can supra-assemble onto the surface of larger cationic nanoparticles via electrostatic interaction, forming colloidal nanocomposite particles (CNPs). Remarkably, such CNPs can be incorporated into calcite crystals in a spatially-controlled manner: the depth of CNPs incorporation into calcite is tunable. Systematic investigation indicates that this interesting phenomenon is governed by the colloidal stability of CNPs, which in turn is dictated by the copolymer adsorption density and [Ca2+] concentration. This study enables the preparation of a wide range of crystalline hybrid materials with controlled internal composition and structure.

Day:1- 14:00:14:30	**Associate Professor Nicholas Warren - University of Leeds OC105**

Artificially Intelligent Flow Reactor Platforms for Accelerating Discovery of Next Generation Polymers

Applying enabling technologies such as automation and artificial intelligence in materials science is one of the only options when it comes to meeting the need for the next-generation materials required to sustain society. Despite considerable uptake of emerging technologies in small-molecule chemical synthesis, it is still yet to become commonplace within polymer science and there is little sign of a significant shift away from traditional ‘flask based’ techniques. By making advances in reactor design, online monitoring and automation, our research explores technologies which have the potential to accelerate discovery and development of polymers. This talk outlines development and implementation of automated flow reactors equipped with online monitoring and computational intelligence. These are capable of autonomously exploring polymerisation reaction parameter space with minimal human interaction.

Day:1- 14:30:15:00	**Associate Professor Roza Szweda - Adam Mickiewicz University in Poznan OC105**

Unveiling the Interplay: Influence of Stereocontrol on the Properties of Sequence-Defined Polymers

Natural macromolecules, such as proteins and nucleic acids, show a diverse range of complex functionalities within biological systems. These functions are intricately tied to the polymer sequence. In the past decade, there has been notable progress in developing non-biological polymers with precisely defined monomer sequences, aiming to replicate the functionalities observed in biological polymers. However, achieving complex functions necessitates attention to chirality, a key feature of biopolymers.

Hence, we developed a synthetic approach to abiotic polyurethanes with a well-defined stereochemical structure. The presented methodology integrates one-pot synthesis with iterative exponential growth, enabling the creation of long macromolecule chains. This discussion aims to shed light on the intricate relationship between stereocontrol and the properties of synthetic polymers, offering insights into their potential applications and relevance in mimicking biological systems.

Day:1-15:00:15:15

Associate Professor Nicholas Ballard - Polymat - University of the Basque Country UPV/EHU
OC105

Reinforcement learning for the optimization and online control of emulsion polymerization reactors

Online control of emulsion polymerization reactors is notoriously challenging due to the complex nature of the polymerization process, which causes difficulties for both online measurement and real-time predictions of future trajectories. In this work, the use of reinforcement learning to overcome these challenges is explored for the case of online control of molecular weight distribution. It is shown that assuming knowledge of the system dynamics in the form of a mathematical model, reinforcement learning can be used to train a neural network that can select optimal control actions in real-time to target a desired final polymer product. Moreover, it is shown that a second neural network model can be utilized as a state estimator to allow for full online control, even of variables that cannot be directly measured online. Overall, this work highlights the general potential of machine learning for polymerization reactor optimization and control in challenging polymerization systems.

Day:1-15:15:15:30

Dr Petra Bacova - University of Cádiz
OC105

Polymer Informatics Tools for Sustainable Practices

In pursuance of making the polymer industry more sustainable, computational studies have been enriched with biodegradable polymers. However, owing to their complex structure resembling proteins, investigating the structure-properties-performance relationship of these polymers by simulations is still challenging.

We present a systematic bottom-up approach starting from the atomistic description and involving multiple computational techniques. We focus on poly(lactic acid) due to its wide usage in additive manufacturing. We build a chemistry-specific coarse-grained (CG) model to extend the time and length scales to those relevant for experimental studies. To close the loop, we reinsert the atomistic details into CG models by applying a machine-learning based methodology.

Since computational techniques are considered to be a more sustainable alternative to the experimental characterization, the presented generic and open-access methodology aims to facilitate the digital polymer design.

Day:1-16:00:16:30

Dr Joshua Holloway - Queensland University of Technology
OC105

Photo-induced synthesis of polymeric nanoparticles and chemiluminescent degradable materials via flow chemistry

There is widespread interest in polymer science in nano- and microspheric structures on account of their versatility in terms of size, morphology and functionality, with applications ranging from chromatographic separation, point-of-care testing devices, and coatings for drug delivery systems. Whilst typically the preparation of microspheres is via heterogeneous polymerisation techniques such as emulsion or suspension polymerisations, these require stabilisers or surfactants to insure colloidal stability. We herein present an additive-free synthetic approach, which results in the formation of nanoparticles under ambient conditions via a solely light-induced precipitation polymerisation. Polymerisation occurs because of an AA + BB-type [2+2] cycloaddition (Diels-Alder reaction), where AA is a novel dialdehyde compound and BB is a bismaleimide compound.1 Most importantly, we have successfully demonstrated the scalability of the nanoparticle synthesis platform due to the utilisation of flow chemistry, thus demonstrating the potential of using a continuous processing technique in terms of automation, increased throughput and yield (Fig. 1a). The synthesis was carefully optimised, aided by machine learning, which involved exploring various parameters such as solvent, flow rate, and concentration. Analysis of the resulting nanoparticles was carried out using Scanning Electron Microscopy (SEM) (Fig. 1b), where the yield, apparent diameter, dispersity and roundness were measured. These nanoparticles have the potential to be used as chemiluminescent markers through the introduction of a tailor-made BB-type monomer containing a degradable bond, resulting in a chemiluminescent response, with degradation products visible by SEM.

Day:1-16:30:16:45

Ms Lakshani Weerarathna - Monash University
OC105

Revolutionizing micelle synthesis: An advanced automated continuous flow platform for high-throughput screening of particle size and morphology

Amphiphilic block copolymers can self-assemble into nanoaggregates, which are widely used in biomedical applications. Their morphology determination is vital since it directly impacts, for example their interaction with cells. Both thermodynamic and kinetic parameters affect the particle morphology, and we demonstrate that using flow mixing, one can perfectly tune nanoparticle morphologies. So far, the ability to perform systematic micelle morphology screening over various synthesis parameters has been hindered by traditional batch procedures, where data reproducibility and time efficiency poses significant challenges. To address this, we have developed an automated platform integrating continuous flow synthesis and online analysis (DLS and SANS), in which micelles are generated with exceptional precision, adapting to dynamic flow conditions. This breakthrough allows extensive exploration of micelle synthesis parameters, offering high reproducibility, versatility, and time efficiency.

Day:1-16:45:17:00

Dr Marjolaine Thomas - Queen Mary University of London
OC105

Reading defined monomer sequence polymers with nanopores

The generation of data continues to outpace the production of silicon devices available for data storage. These conventional storage devices occupy considerable space in dedicated data centres, the long-term stability of data storage is questionable, and their manufacture and operation requires resources and energy. New storage media and technologies are urgently needed to provide a solution to this widening data-capacity gap and to make data storage more sustainable. This has spurred exploration into natural and non-natural polymers as potential alternatives, with the promise of renewability and high storage density. A new and promising sequencing technique for both natural and synthetic polymers is nanopore sequencing, which analyses the polymer structure by translocation through a biological or synthetic pore. Thus far, only few studies using biological nanopores have been reported. Here, we seek to advance this field by matching polymer design to solid state nanopore properties.

Day:1-14:00:14:30

Assistant Professor Athina Anastasaki - ETH Zurich
OC003

Unmaking Polymers by Controlled Radical Polymerization

Although the high end-group functionality of polymers made by controlled radical polymerization has been overwhelmingly exploited for chain extensions and block copolymer synthesis in thousands of publications, it has rarely been explored for the polar opposite: reversing controlled radical polymerization and regenerating the monomer. In this talk I will first discuss about a near-quantitative and catalyst-free depolymerization of various linear, bulky, cross-linked, and functional polymethacrylates made by RAFT polymerization. Notably, the depolymerization product can be utilized to either reconstruct the linear polymer or create an entirely new insoluble gel that can also be subjected to depolymerization. As this approach only operates under very high dilution, I will then discuss a solvent-free chemical recycling methodology that efficiently operates for both ATRP and RAFT synthesized materials.

Day:1-
14:30:15:00

Professor Lutz Nuhn - Julius-Maximilians-University Würzburg
OC003

pH-responsive 2-propionic-3-methylmaleic anhydride-based RAFT polymers for immunodrug delivery

The design of functional polymers bearing pH-responsive, traceless release mechanisms is a promising too to control the activity of potent immune modulatory drugs.

We introduce polymethacrylamides with pendant 2-propionic-3-methylmaleic anhydrides that quantitatively conjugate amines but remain resistant under radical polymerization conditions. Via RAFT polymerization, well-defined homo and block copolymers are accessed whose amine-reactive anhydrides are sequentially derivatized into water-soluble polymers. The acidic pH-triggered release from the polymeric systems, however, can only be achieved for secondary amines quantitatively, while primary amines lead to irreversible imides.

In vitro and in vivo, the observed pH-responsiveness contributes to a traceless release of immune stimulatory drugs, yet, only the secondary amine modified derivatives yield sufficient immune responses according to their pH-sensitive release mechanism (JACS 2023, 145, 27424).

Day:1-
15:00:15:15

Professor Justin Kennemur - Florida State University
OC003

Synthesis of Precision Non-Fluoronated Polyolefins towards New Proton and Ion Conducting Membranes

For decades, Nafion has been the industrial standard for use in proton conduction membranes in fuel cell technologies. Owing to highly polar sulfonic acid functionalities covalently bound within a non-polar polyfluorocarbon matrix, the mechanism of this technology relies of nanophase separation of polar/non-polar moieties to engage in percolated acid networks, within which, the protons transport. These networks permit proton transport that is decoupled from polymer chain dynamics and ultimately result in fast (Arrhenius) channel-driven conduction. The cost and environmental concerns associated with perfluorocarbon syntheses has ushered new research towards non-fluoronated polymers that mimic the function of Nafion. In this presentation, the discovery of a novel precision polyethylene bearing a phenylsulfonic acid pendant on exactly every fifth backbone carbon will be discussed. This relatively cheap and scalable material from ring opening metathesis polymerization shows promise.

Day:1-
15:00:15:30

Professor Rongrong Hu - South China University of Technology
OC003

Multicomponent Polymerizations of Elemental Chalcogen

Day:1-
16:00:16:30

Professor Cameron Alexander - University of Nottingham
OC003

Bioresponsive polymers in therapeutic and vaccine delivery

The extraordinary success of lipid-based systems for delivery of RNA in Covid vaccines has led to their adoption for many new therapeutic candidates. However, issues relating to the long-term stability and lack of targeting of the current lipid nanoparticles is inspiring polymer scientists to develop new alternative systems for delivery of a wide range of actives. In this talk i will feature the latest work from our group in this area, with examples ranging from infectious diseases to brain and breast cancers.

Day:1-
16:30:17:00

Professor Karen Wooley - Texas A&M University
OC003

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Day:1-
14:00:14:50

Professor Zhibo Li - Qingdao University of Science and Technology
ARTS CENTRE STUDIO

Synthesis of Close-loop Recyclable Polyesters and Thermoplastic Elastomers

The development of chemically recyclable polymers or elastomers represents the most appealing solution to address white pollution challenge. Despite the recent advancements, it is highly desirable to use develop chemically recyclable polymers from commercially available monomers and avoid the costly and time-consuming synthesis of new monomers. Here, we studied the effects of substitutes on the ROP of six membered ring monomers. We successfully achieved the controlled ROP of bio-sourced Œ¥-caprolactone (Œ¥CL) and functional Œ±-Methylene-Œ¥-valerolactone (MVL) using strong base/urea binary catalysts at room temperature. The obtained PŒ¥CL is capable of chemical recycling to Œ¥CL by thermolysis. Later, a one-pot strategy by cascade ROP of Œ¥CL and step-growth polymerization of PŒ¥CL diol precursors with diisocyanate under solvent-free conditions produced thermoplastic polyurethane elastomers, which can be chemically recycled to recover Œ¥CL with high purity and excellent yield by thermolysis.

Day:1-
14:30:15:00

Professor Guoliang (Greg) Liu - Virginia Tech
ARTS CENTRE STUDIO

Chemical Upcycling of PE, PP, and PS into Value-added Chemicals and Materials

I will present the upcycling of plastic waste into high-value chemicals. We will discuss a tandem degradation-upcycling strategy to exploit high-value chemicals from PS, PE, and PP with high selectivity. We first degrade plastics to intermediates and then valorize them to high-value chemicals, such as fragrance, drug precursors, surfactants, detergents, etc.. The low-value-input and high-value-output approach is more sustainable and economically viable than conventional processes. The cascade strategy is resilient to impurities from plastic wastes and is generalizable to other high-value chemicals. The upcycling is tested at 1-kg laboratory scale and attested by industrial-scale techno-economic analysis, demonstrating sustainability and economic viability without government subsidies or tax credits.

Day:1-
15:00:15:15

Dr Manon Rolland - EPFL, Lausanne
ARTS CENTRE STUDIO

Sustainable Thermal Paper Formulations by Valorization of Lignocellulosic Biomass

TBC-confidential

Day:1-
15:15:15:30

Dr Melissa Stanfield - University of Tasmania
ARTS CENTRE STUDIO

Wood waste to plastic: bio-based monomers as next generation polymer material

More than 90% of today's synthetic polymers are derived from fossil fuels, the largest source of renewable carbon-based energy is biomass waste. Cellulose accounts for up to 40-50 % of biomass waste. Biomass waste is a renewable source of valuable monomer and polymeric material. Chemical modifications of biomass waste products can yield desired scaffold monomers. The polymerised materials are viable alternatives to petrochemical derived polymers. The work herein, attempts to find an alternative to petrochemical derived polymers via the synthesis of monomers and polymers to create biobased plastics. A catalogue of monomer derivatives is readily available at hand, with selective, tailored chemical functionality. The novel plastic materials have been characterised via mechanical analysis, thermalgravimetric analysis (TGA) and the rapid (<60s) cure kinetics have been examined. Exploring applications for new polymers as biobased 3D printing inks or surface coatings.

Day:1-
16:00:16:30

Professor Szczepan Zapotoczny - Jagiellonian University
ARTS CENTRE STUDIO

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Day:1- 16:30:16:45	**Dr Ruiting Li - Max Planck Institute of Colloids and Interfaces ARTS CENTRE STUDIO**

Self-assembled photonic pigments from bottlebrush block copolymers

Bottlebrush block copolymers (BBCPs) have emerged as a versatile material for constructing photonic materials. In contrast to alternative photonic materials, BBCPs offers several distinct advantages, including: rapid assembly kinetics, ordering over macroscopic dimensions, and the capacity to accommodate substantial functionality.

In this talk we will introduce a robust strategy for the fabrication of hierarchical photonic pigments via the confined self-assembly of BBCPs within emulsified microdroplets. By optimising the BBCP composition and the emulsification conditions, we demonstrate that microparticles with a well-resolved concentric lamellar structure can be formed. The fundamental optical response (i.e. colour) is determined via the BBCP molecular weight, however we will show that by exploiting new macromonomers it is possible to produce "photonic pigments" that are mechanochromic, unlocking potential application as ultrasensitive pressure sensors.

Day:1- 16:45:17:00	**None Matthew Elardo - University of Washington ARTS CENTRE STUDIO**

Cyclic Bottlebrush Copolymers for Self-Assembled Materials in Energy Storage

Bottlebrush polymers (BBPs) are a class of polymeric materials composed of a polymer backbone with densely grafted polymeric sidechains. While there are a variety of routes towards BBPs with linear topologies, routes towards cyclic BBPs are currently limited. The development of more robust synthetic routes towards bottlebrush polymers is attractive because these materials are expected to self-assemble into mesoporous materials with discrete channels. Furthermore, cyclic polymers typically have greater thermal stability and processability (better solubility, lower Tg) when compared to their linear counterparts. These properties make cyclic BBPs attractive targets in the field of energy storage, for instance as membranes in next-generation batteries. Herein, we describe an approach towards cyclic BBPs via ring expansion metathesis polymerization (REMP) and describe the self-assembly of BBP copolymers with "hard" (polystyrene) and "soft" (PDMS) grafted sidechains.

Day:1- 14:00:14:30	**Professor Yujun Feng - Sichuan University OC002**

Smart polymers assists CO2 storage underground

Day:1- 14:30:15:00	**Dr Georgina Gregory - University of Oxford OC002**

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Day:1- 15:15:15:30	**Assistant Professor Etienne Grau - UNIVERSITY OF BORDEAUX - CNRS OC002**

Bio-based poly(hydroxy urethane)s for efficient organic high-power energy storage

Day:1- 16:00:16:30	**Associate Professor Stuart Thickett - University of Tasmania OC002**

Polymerizable Eutectics for the Preparation of Functional Materials

I will present our recent work on the design of thermoresponsive hydrogels, porous monoliths, and block copolymers based on the free-radical or controlled-radical polymerization of eutectics based on various vinyl amides (e.g. N-isopropylacrylamide, acrylamide) and other (meth)acrylates. Low melting point mixtures were formed by mixing these monomers with various quaternary ammonium salts in specific ratios that were characterised by 1D/2D NMR, DSC and thermogravimetric analysis. Hydrogels prepared from these eutectics showed greatly enhanced polymerization kinetics compared to the equivalent synthesis in water, in addition to displaying greater mechanical strength due to an increase in cross-linking density. Thermoresponsive macroporous polymer monoliths were prepared from high internal phase emulsions (HIPEs) where the eutectic was the polymerizable continuous phase displayed remarkably different internal morphologies and mechanical properties compared to those made in water.

Day:1-16:30:16:45

Professor Stefan Bon - The University of Warwick
OC002

tba (if there is a slot)

tba

Day:1-16:45:17:00

Dr Alexander Cook - Eindhoven University of Technology
OC002

Polymer-based complex coacervates as biomimicking systems

The mimicking of biological communication and information transfer in artificial multicellular systems has been a target for researchers over the past few years. Development of artificial protocell systems has the potential to increase our understanding of cellular processes, and produce therapeutic technologies for advancement of global healthcare.

While signalling usually involves diffusion of small molecules from sender protocells to receiver protocells,[1] recently, this diffusion-based signalling has been expanded to include naked nucleic acids, which is a significant step towards more life-like information processing in synthetic cells.[2] However, in nature, transfer of genetic information between cell populations occurs with nucleic acids protected in further subcellular compartments.[3] Light responsive charge switching polymersomes are here investigated for the encapsulation of RNA and transfer of genetic information from coacervates to living cells.

Day:1-14:00:14:30

Professor Kelly Velonia - University of Crete
OC004

Protein-polymer Conjugates: Synthesis, Innovations and Challenges

The crucial role of proteins in all essential physiological processes of life makes them exceptional biomaterials. However, the instability and innate immunogenicity of most native proteins have long limited research into protein-based biomaterials. To overcome this limitation, the synthesis of precisely engineered protein-polymer conjugates is considered a promising strategy. Along this vein, high-yielding and facile methodologies that offer significant advantages over traditional bioconjugation will be discussed. These involve oxygen-tolerant, controlled radical polymerization approaches as well as a new organocatalytic approach allowing the synthesis of hybrid conjugates under biologically benign conditions. The resulting hydrophilic, responsive or/and amphiphilic protein-polymer conjugates display interesting assembling profiles with a wide range of potential applications.

Day:1-14:30:15:00

Professor Michael Whittaker - Monash University
OC004

Nanoscale tools to probe and manipulate fundamental biology

Synthetic soft matter which can respond to specific biological cues, offers new opportunities for probing fundamental biology, and new pathways to treatment. This talk will highlight our most recent research in the following areas:

- Accessing Cell Communication Pathways: Materials designed to interact with, attenuate, or recruit, those cell communication pathways underpinned by RNS, ROS or H2S, may assist in renormalising cellular dysfunction.

- Improved Subcellular Targeting: Materials that respond to unique biochemical cues found within intracellular environments, are useful platforms for the delivery of therapeutics to specific subcellular locations.

- Designed Biomimetic Materials: Translating the functional motifs of antibacterial lipopeptides to synthetic materials/surfaces, can offer new strategies for addressing MDR bacteria/fungi.

Day:1- 15:00:15:15	**Ms Lydia Grace Smith - Durham University OC004**

Targeted prostate cancer drug delivery system via diblock copolymer micelles

Polymeric micelles are gaining attention for their role in enhancing drug solubility, stability and targeted delivery, particularly for hydrophobic drugs. This project focuses on synthesising diblock polymers using single electron transfer-living radical polymerization (SET-LRP) to create micelles for a prostate cancer treatment drug.

The diblock polymers PDMAEA and POEOMEA, provide hydrophobic and hydrophilic components for micelle formation. To enable bioconjugation with prostate-specific antigen, the polymer's end groups will be modified with a β-hydroxy aldehyde functional group. This reactive species serves as a linker for OPAL, a mild and efficient bioconjugation method performed at neutral pH.1

The study will evaluate drug encapsulation and release behavior through in vitro UV/Vis drug release studies, offering insights into the potential of this drug delivery system for applications in prostate cancer treatment.

[1] M. A. Fascione, et. al., Chem. Sci., 2018, 9, 5585

Day:1- 15:15:15:30	**Mr Adrian Hauck - Julius-Maximilians-University Würzburg OC004**

Poly(benzylketal-carbonate)s as Dual pH-Responsive Immunodrug Carriers

Aliphatic polycarbonates provide excellent biocompatibility and biodegradability features for immunodrug delivery. Poly(benzylester-carbonates)-derived block copolymer micelles can be used for encapsulation of hydrophobic immunodrugs with remarkable blood circulation performance. In order to foster biostimulatory on-demand release, we introduce poly(benyzlketal-carbonate)s as dual pH-responsive immunodrug carriers. Beyond base-catalyzed hydrolytic carbonate backbone degradation, the ketal group renders acid-sensitivity and is cleaved off upon cell internalization in acidified intracellular compartments. The benzyl moiety guarantees efficient micelle stability and drug loading but falls apart upon intracellular ketal hydrolysis. Subsequently, micelle disintegration and drug release can be observed. We demonstrate such drug loading and dual pH-degradation profile using TLR7/8 agonists and thereby confirm poly(benzylketal-carbonate)s' remarkable immunodrug delivery performance.

Day:1- 16:00:16:30	**Associate Professor Sylvain Catrouillet - University of Montpellier OC004**

Switchable pH-responsive morphologies of supramolecular water soluble self-assembled nucleobase copolymers

Similarly to DNA, the self-assembly of nucleobase copolymers occurs via H-bonds and hydrophobic interactions. However, the self-assembly of nucleobase copolymer systems faces two significant challenges: low water solubility of the copolymers and difficult control of the system dynamics.

Our study aims at answering these two major problematics by varying the hydrophobic/hydrophilic balance of the copolymers. Thus, a range of methacrylate copolymers bearing uracil or adenine as nucleobases was synthesized with various degree of polymerization and of the nucleobase ratio. Then, the selected polymer structures containing complementary nucleobases were mixed in water and their resulting co-assemblies were studied.

The effect of the polymer structure on the self-assembled morphologies will be underlined and preliminary investigations on the dynamics of selected self-assembled systems will be discussed, with a focus on the H-bond interactions between complementary nucleobases.

Day:1-16:30:16:45

Dr Sam Parkinson - University of Liverpool
OC004

Tunable Nanoparticle Self-Assembly Behaviour Via Non-Canonical Nucleobase Interactions

Nucleobases are one of the building blocks of nucleic acids and, through their highly specific hydrogen bonding, they can easily dictate macromolecular structure. By combing these unique molecules with state-of-the-art synthetic polymers, it is possible to exert greater control over the self-assembly of polymers. Herein, we report the synthesis of nucleobase-containing nanoparticles via aqueous RAFT-PISA. A poly(N-acryloylmorpholine) macro-CTA was chain extended with either adenine-, thymine- or cytosine-based monomers and complete morphological phase diagrams were constructed. Under acidic conditions, which enabled alternative hydrogen bonding in cytosine-containing polymers, previously inaccessible polymer compositions generated nanoparticles with unique thermo-responsive properties. Small angle x-ray scattering (SAXS) studies were performed to confirm nanoparticle morphology of these responsive particles and to elucidate the polymers self-assembly pathway under thermal cycling.

Day:1-16:45:17:00

Mr Bailey Richardson - Queensland University of Technology
OC004

Peptide Self-Assembly Controlled Photoligation of Polymers

Highly efficient chemical ligations that operate in water under mild conditions are the foundation of bioorthogonal chemistry. Conventional approaches to expand this toolbox aim at altering the inherent reactivity of functional groups to design new reactions that meet the required benchmarks. Inspired by controlled reaction environments that enzymes provide, we report a fundamentally different approach that makes inefficient reactions highly efficient within defined local environments. Targeting [2 + 2] photocycloadditions, which are inefficient at low concentrations and readily quenched by oxygen, short pH – responsive β-sheet encoded peptide sequences are inserted between a hydrophobic photoreactive styrylpyrene unit and a hydrophilic polymer. In alkaline aqueous conditions, highly efficient photoligation of the polymers were obtained ~90% within 2 min (3.4 μM). In acidic conditions, the self-assembly into 1D fibres altered photophysical properties to switch the photoligation “OFF”.

Day:1-14:00:14:30

Dr Katharina Ehrmann - TU Wien
OC104

Stereolithographic 3D Printing Beyond Radical Photopolymerization

Photopolymerization is a convenient curing technique for 3D printing soft matter materials with light (stereolithography, SL). While resin variability in SL allows for some flexibility of material properties, this flexibility is considerably restricted by a narrow process window. Most critically, formulation viscosities must remain low and curing times until the resin becomes solid (gel point) should be fast. Therefore, SL has traditionally been confined to the use of radical photopolymerization.

Recent engineering developments, however, have enlarged this processing window, which creates an avenue towards utilization of radical-free polymerization mechanisms. For example, by increasing the printing temperature we were able to produce printed parts via ionic photopolymerization, which would typically be too slow for SL at room temperature. This unlocks entirely new polymer classes such as aliphatic polyester and polycarbonate networks with near-zero shrinkage for the first time.

Day:1- 14:30:15:00	**Professor Brady Worrell - University of Denver OC104**

A Formulator's Guide to Catalytic Chain Transfer Agents in Crosslinked Photopolymers

A detailed account of the development and implementation of macrocyclic cobaloxime complexes as catalytic chain transfer agents (CTAs) to alter and improve the performance of crosslinked photopolymers is presented. The addition of ppm quantities of this catalyst to commercial monomer feedstocks can create photopolymers like those using state-of-the-art CTAs, but at 10,000x lower loadings. As the catalyst takes up little free volume in the resin, the positives of CTAs can be realized without disruption of desirable secondary interactions between functional monomers (e.g. liquid crystals, urethanes). It is our long-term ambition for catalytic, cobalt-based CTAs to supplant existing consumptive, sulfur-based CTAs to provide unexplored and previously inaccessible photopolymeric materials. Practitioners in dentistry, additive manufacturing, and responsive materials will be given best practices and guidelines for applying and formulating with this catalyst.

Day:1- 15:00:15:15	**Professor Jeremy Odent - University of Mons OC104**

3D-Printed Stacked Ionic Assemblies for Iontronic Touch Sensors

Brand-new iontronic sensors, which utilize touch-induced ionic charge separation in ionically conductive hydrogels, are introduced for use in object mapping, recognition and localization. This is accomplished using high resolution stereolithography 3D printing of stacked ionic assemblies consisting of discrete compartments having different transport properties. The latter assemblies readily allow programming directional sensing response with output signal amplification/attenuation by means of variations in ion type, charge density and crosslinking density within the iontronic device. The resulting tactile sensors also exhibit sensitive touch-pressure monitoring and localization for activity recognition applications, simplifying the relevant sensing systems and favoring integration. In addition, we propose a fundamental understanding aiming at elucidating the underlying mechanism behind iontronic touch sensors.

Day:1- 15:15:15:30	**Dr Elisabeth Rossegger - Polymer Competence Center Leoben GmbH OC104**

Exploiting orthogonal photoreactions for local control of dynamic bond exchange reactions

Using light to control properties and the formation of polymers is one of the most powerful tools in polymer science. Recently, we also showed that it enables local control of dynamic properties in polymer networks. The usage of photoacid generators as latent transesterification catalysts leads to the local formation of Brønsted acids, which can efficiently catalyze thermo-activated transesterification reactions. By utilizing a dual-wavelength 3D printer the orthogonality between the curing (405 nm) and the activation of the catalyst (365 nm) was exploited. Lately, the concept of chemical amplification was used to control the dynamic behavior in thiol-ene networks. Therefore, photolatent sulfonic acids were synthesized to catalyze the deprotection reaction of a tert-butoxycarbonyl group, which was introduced to mask the hydroxy groups. Simultaneously, the formed acid served as a catalyst for thermo-activated exchange reactions in an orthogonally-cured (450 nm) photopolymer.

Day:1- 16:00:16:30	**Dr Dmitrij Bondarev - Polymer Institute of Slovak Academy of Sciences OC104**

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Day:1- 16:30:16:45	**Dr Jian Chang - Stockholm University OC104**

Tailor-Made White Photothermal Fabrics: a Bridge between Pragmatism and Aesthetic

Maintaining human thermal comfort in cold wild is crucial for diverse outdoor activities, e.g., sports and recreation, health-care, and special occupations. To date, advanced clothes are employed to collect solar energy as heat source to stand cold climates, while their dull dark photothermal coating may hinder pragmatism in wild and visual sense considering fashion. Herein, tailor-made white webs with strong photothermal effect are proposed. With the embedding of CsxWO3 nanoparticles (NPs) as additive inside nylon nanofibers, these webs are capable of drawing both NIR and UV light in sunlight for heating. Their exceptional photothermal conversion capability enables 2.5-10.5 °C warmer than that of a commercial sweatshirt of 6 times thicker under different climates. Remarkably, this smart fabric can upgrade its photothermal conversion efficiency by more than doubled in a wet state, which makes it a competitive candidate for quick-drying of sports clothes frequently wetted by sweat under

Day:1- 16:45:17:00	**Professor Fanny Bonnet - University of Lille OC104**

High impact resistance PLLA-based composites designed by TP-RTM

Among the various composites production processes, Resin Transfer Molding (RTM) is a specific process which relies on the injection, into a mold containing fibers, of a monomer and a catalyst in order to carry out the in situ polymerization of the matrix. The major advantage over conventional melt processes is the possibility of reaching a high amount of fibers while improving their wetting by the matrix. While a wide selection of thermosetting matrix resins are available on the market for RTM process, there are only a few commercial resins for thermoplastic matrices (TP-RTM). We present here current work aiming at strengthening the mechanical properties of PLLA matrix by producing a novel composites family by copolymerization of L-LA with E-caprolactone (PLCL), with various reinforcements. PLCL/glass fabric prototype with 30 % E-CL displays an impact resistance 80% higher than pure PLLA analog. F. Bonnet* et. al. ACS Appl. Polym. Mater, 2022, 4, 6797-6802.

Day:1- 14:00:14:30	**Professor Yoan Simon - Arizona State University OC106**

Harnessing weak interactions to control function in polymers

Nature has a range of methods for converting mechanical force into a useful signal, such as cell sensing and haptic perception. It also leverages non-covalent interactions and has perfected multiple reversible systems to accomplish complex functions. Drawing inspiration from these abilities, we have created a series of polymeric materials that include weak links capable of reporting on mechanical activation and/or to achieve reprocessability. We believe that these findings can have huge influence on understanding impact mitigation, transport properties, and reprocessability of polymeric materials.

Day:1- 14:30:15:00	**Dr Elodie Bourgeat-Lami - University Claude Bernard Lyon 1 OC106**

Synthesis of vitrimer latex particles

Vitrimers aim at combining the benefits of thermoplastics and thermosets by incorporating in polymer networks dynamic covalent crosslinks governed by associative, exchangeable reactions in chemical equilibrium. At high temperatures or in the presence of catalysts, chemical equilibria are fast enough to enable large scale reorganization and stress relaxation of the network, and as a consequence plastic deformation, reprocessing and welding of the sample. In contrast with dissociative reversible networks that depolymerize at high temperatures, associative vitrimer networks remain crosslinked at all times and display a high melt elasticity.

This versatile concept has been successfully applied to different polymer systems by taking advantage of a variety of equilibrated reactions. Yet, polymerization methodologies and processing of vitrimers are strongly focused on solution or bulk polymerization of thermosetting formulations. In view of expanding further the uses and applications of vitrimers, we recently developed syntheses in dispersed media in order to obtain vitrimer nanoparticles that can form films or composites by sintering across particles. We will show a few examples of such latex synthesis through miniemulsion polymerization using different chemistries such as epoxy-acid addition or direct synthesis of imine-based acrylic vitrimers from benzylamine precursors

Day:1-15:00:15:15
Assistant Professor Volkan Can - Yeditepe University
OC106

Silver Nanowire Double Network Hydrogels with Enhanced Electrical and Mechanical Properties

This talk explores the dual role of silver nanowires (AgNWs) in enhancing the mechanical and electrical properties of polyacrylic acid and polyacrylamide hydrogels, designed for in-body sensors. It has been observed that AgNWs not only contribute to the structural integrity of the hydrogel but also significantly improve its electrical properties, which are crucial for sensor functionality. The novel AgNW-enhanced hydrogels exhibit tailored mechanical robustness and frequency-dependent conductivity, suitable for pH monitoring applications, with a unique response to environmental pH changes. The change in the electrical conductivity with respect to pH change in the medium has been monitored. Additionally, the activation of the radicalic initiator, ammonium persulfate, without the addition of conventional accelerator TEMED in the presence of AgNW has been investigated through the gelation kinetics. Effect of silver content on the electrical and mechanical properties as well as gelation kinetics will be discussed.

Day:1-15:15:15:30
Mr Loc Tan Nguyen - Ghent University
OC106

Navigating Reversibility of the Aza-Michael Addition for the Controlled Dynamicity of Reprocessable Thermosets

In the era of sustainable materials, Covalent Adaptable Networks (CANs), which combine the high performance of thermosets with the (re)processability of thermoplastics, have emerged as a potential solution to replace non-recyclable traditional thermosets. Among number of dynamic chemistry platforms, aza-Michael reaction is well-known as a simple and accessible addition reaction typically performed without catalysts and by-products. Its versatility renders potential for the design of polymeric networks from various readily available building blocks. Moreover, the reversibility of the aza-Michael adduct was investigated recently and has caught much interest from scientists.

This work focuses on designing and understanding the reversibility of different Michael adducts, incorporating them into polymeric network perspectives. The tunable dynamicity of Michael adducts results in the controlled flow of CANs, offering various potential applications to the circular lifetime of thermosets.

Day:1-16:00:16:30
Professor Yusuf Menceloglu - Sabancı University
OC106

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Day:1-16:30:16:45
Professor S. Eileen Seo - Arizona State University
OC106

Dynamic Polymer Nanocomposites Engineered via Particle-Based Crosslinks

Inherent self-healing properties make materials formed from noncovalent networks attractive as they can repair fractured surfaces facilitated by highly mobile chain segments and by possibilities of achieving fast reversible associations at ambient conditions. However, noncovalent networks are prone to creep and considerable material deformation on loading. Multivalent binding of ligands on one entity via noncovalent interactions is collectively much stronger and display qualitatively different properties than those of underlying monovalent interactions. Here, we introduce the concept of nanoparticle-based crosslinks with enhanced bond strength and systematically studying the effect of positive cooperativity in polymer networks. Secondly, these materials are designed to have access to two or more thermodynamic states where the bond dynamics of polymer networks are reversibly programmed using tunable interfacial interactions between nanoparticles and polymers.

Day:1- 16:45:17:00	**Dr Noverra Mardhatillah Nizardo - Universitas Indonesia OC106**

Modification of Cellulose Nanofibrils and Its Prospect as a Coating Material on Paper for Food Packaging

Cellulose nanofibrils (CNF) is abundant and biodegradable, which make it an ideal candidate to replace plastic coatings in the paper industry. The ability to form interconnected networks through H-bonds makes coated paper with CNF has good strength, but poor barrier properties. By modifying CNF, the barrier properties can be improved and the coating material on the paper will become environmentally friendly. Thus, we explored the attempt to modify CNF to enhance the barrier properties of the paper. Our studies on the physical modification showed that CMC addition to CNF/PVA composites might increase the viscosity and provide good stability. In addition, the coated paper with CNF/PVA/CMC could have a low oil and water absorption. Notably, the chemical modification of CNF was also carried out, by grafting, e.g., lactic acid onto CNF backbones, resulting in low hydrophilicity of the coated paper. These results suggested a potential of applying modified CNF for coatings on packaging paper.

Day:1- 14:00:14:30	**Professor Jeremy Wulff - University of Victoria OC109**

Universal Polymer Crosslinkers: Synthesis, Structure–Function Relationships, and Applications in Materials Science

We developed a family of rationally designed, diazirine-based crosslinker reagents that allow for the on-demand introduction of strong covalent bonds to virtually any aliphatic polymer material, through rapid C–H, O–H, and N–H insertion reactions. This presentation will focus on the design, synthesis, and mechanism-driven optimization of this new class of polymer crosslinkers, and will describe several applications, which arise through operationally simple, topical treatment of existing polymer materials. Selected applications may include: (1) adhesion of low surface energy materials, (2) upgrading the mechanical strength of ballistic protective fabric, (3) construction of novel fiber-reinforced UHMWPE–epoxy composites, (4) development of self-sterilizing fabrics, (5) enhancement of the mechanical robustness of omniphobic PDMS coatings, (6) upgrading of perovskite solar cell stability and performance, and (7) photopatterning of electroluminescent quantum dots and bioreagents.

Day:1- 14:30:15:00	**Professor Matthew Golder - University of Washington OC109**

Masquerading Soft Materials: Anomalous Behavior in Macromolecular Design

The Golder Research Team utilizes fundamental principles of molecular structure to control synthetic polymer function. Many of society's greatest advancements spanning health, sanitation, construction, electronics, and transportation have been enabled by the invention and application of plastics. Simultaneously, these materials have created significant concerns about global sustainability, climate impact, and environmental pollution. My laboratory aims to discover new materials and methods that unveil unexpected phenomena on the macroscopic scale; this overarching strategy will produce next‑generation designer plastics and reform how commodity plastics are utilized. In this talk, the team's efforts towards these common goals will be outlined in the context of recent work centered on: (1) synthetic transformations fueled by initiator and methodology development, and (2) molecular design of new soft materials.

Day:1- 15:00:15:15	**Mr Klaus Ableidinger - TU Wien OC109**

From thiol-ene to oxa-ene: Investigating the Photobase catalyzed Oxa-Michael Polyaddition

In additive manufacturing the demand for light-induced step-growth polymerization is still high, as those materials allow for tougher materials compared to free radical polymerization. The thiol-ene reaction leads to less shrinkage and tougher photopolymers, but it also comes with drawbacks, like the availability of thiols, their strong odor and a short storage stability. Replacing the thiols with alcohols allows for a wider variety of available monomers without the odor. The oxa-ene reaction is a Michael-type addition needing a base catalyst. We hereby report the development of a set of new Lewis-type photobase generators for oxa-Michael formulations. Our work includes the synthesis of those photobase generators, their characterization, and application in both model reactions and polymeric formulations. In the model reactions, the mechanism of photobase generator catalyzed oxa-Michael reaction was investigated compared to free base catalyzed oxa-Michael reactions.

Day:1-15:15:15:30	**Mr Benajmin Grob - Ivoclar Vivadent AG** **OC109**

Development of low-shrinkage dental composites based on allyl sulfones

Polymerization shrinkage and the corresponding shrinkage stress in methacrylate-based dental composites are crucial drawbacks for restorative dentistry. It has been shown that polymerization shrinkage and the resulting shrinkage stress may result in marginal leakage which could induce several clinical issues like postoperative sensitivity or the formation of secondary caries. An effective way for the reduction of shrinkage stress is the incorporation of addition fragmentation chain transfer agents (AFCT agents) like allyl sulfones. However, the commonly used allyl sulfones lead to a reduction in the mechanical properties (flexural modulus) of the cured composites if they are used in higher quantities. In this contribution, the adaption of the photoinitiator system for allyl sulfone-based composites and the preparation and evaluation of allyl sulfones bearing a methacrylate group will be presented, as they should compensate the decrease of the mechanical properties in cured composites.

Day:1-16:00:16:30	**Dr Stephanie Schubert - Friedrich-Schiller-University Jena** **OC109**

Nature inspired polymeric nanoparticles for drug delivery

Nature inspired polymers such as modified polysaccharides and synthetic polypeptides are promising materials for controlled drug delivery due to their biocompatibility and potential biodegradability. The well-known polysaccharide dextran was modified with acetal functions to tailor its hydrophobicity and pH-responsiveness. Various anti-inflammatory agents are formulated with the polymers into nanoparticles, which showed even better efficacy in vitro and in vivo compared to established and commonly used polyesters. Polypeptides as biocompatible materials provide another material platform for nanoparticles for drug delivery. Small libraries have shown the importance of a balance between hydrophilicity and hydrophobicity for efficient transfection with plasmid DNA. Such structure-property analysis is essential for the development of high-performance materials for controlled drug delivery.

Day:1-16:30:16:45	**Ms Sarah Nieto - LCPO** **OC109**

Biodegradable polymersomes as controlled drug delivery system for the treatment of neurodegenerative diseases

We aim to develop nanoscale vesicles called "polymersomes" loaded with specific drugs and composed of biodegradable polymers in order to obtain a dual action of restoring lysosomal activity in dopaminergic neurons, one of the issues leading to the development of Parkinson’s disease.

PEG-b-PLA and PEG-b-PLGA amphiphilic diblock copolymers offers a tunable degradability and a good biocompatibility. The degradation of the lactide and glycolide-based blocks generates an acidity that regulates lysosomal activity in deficient neurons.

Monodispersed and nanosized polymer vesicles of 150 nm were formulated by nanoprecipitation technique. Encapsulation of drugs was performed during the self-assembly process.

In-vitro study shows a colocalization of polymersomes in lysosome of neurons. Surface-functionalized polymersomes for active-targeting was developed to cross the blood-brain barrier and target specifically neurons.

Day:1- 16:45:17:00	**Ms Jin Sol Shin - KAIST OC109**

PEGylated DNA Helper Molecules for Enhanced Oligonucleotide Condensation

Condensation of DNA by complexation with cationic polymers is crucial to gene delivery. The condensed DNA has a particle size suitable for cell transfection. When cationic polymers are applied to short oligonucleotides, complexation behavior is different and the complexes show poor colloidal stability. In this contribution, we report the successful condensation of short oligoDNA with polycationic polymers by utilizing PEGylated DNA helper molecules. The PEGylated single-stranded (ss) DNA helper molecules are hybridized to the ends of the target oligoDNA to create a pseudo PEG-oligoDNA-PEG triblock copolymer structure. Following the complexation with branched polyethylenimine (PEI), polyelectrolyte complex micelles (PCMs) are formed consisting of an oligoDNA/PEI core and a PEG corona. The PCMs exhibit a spherical morphology with an average diameter of 80 nm. Moreover, the PCMs show excellent colloidal stability and the condensed target oligoDNAs are resistant to degradation by nuclease.

Day:1- 14:00:14:30	**Professor Filip Du Prez - Ghent University FAB003**

Dynamic Covalent Chemistry for Reprocessable Thermosets: What is needed for their industrial implementation?

One of the major developments in thermoset research is the incorporation of exchangeable chemical bonds. This concept of covalent adaptable networks (CANs) is a result of the introduction of dynamic covalent bonds, thereby enabling a combination of benefits of the fast processing of thermoplastics and the high durability and resistance of thermosets. However, despite the rapid progress made in this field during the last decade, such CANs have not yet been picked up largely by industry because of several challenges. For example, the processing temperatures that are required to achieve sufficiently fast processing are beyond the thermal stability limits of most dynamic chemistry platforms. This prevents bulk processing techniques such as extrusion or injection moulding.

This presentation will highlight a number of our actual research efforts to overcome remaining limitations for the industrial implementation of this new generation of sustainable thermoset materials.

Day:1- 14:30:00:15:00	**Professor Pengfei Cao - Beijing University of Chemical Technology FAB003**

Exceptionally Recyclable Elastomers via Combined Physical and Chemical Networks

Recently developed elastomers with adaptable covalent network, e.g., elastic vitrimers, have the great potential as sustainable materials, while most of them suffer from limited recyclability and unsatisfied mechanical properties. Herein, we report a novel polydimethylsiloxane (PDMS)-based recyclable elastic network (REN), combining permanent chemical and high-density dynamic physical crosslinks utilizing side chain reactions, which provides energy dissipation for superb toughness and enable efficient chain rearrangement for excellent recyclability. The optimal elastic network achieves an unprecedented recyclability of 70 cycles, one order of magnitude higher than existing elastic vitrimers, extraordinary toughness of 66 MJ/m3, significantly higher than previously reported PDMS elastomers, excellent chemical resistance and vitrimer-like rheological behavior. Physical analysis is also performed to provide the accurate estimation of bond exchange dynamics excluding the often-neglected chain dynamics and offer insight into the superb performance. We anticipate that such a design principle enables an alternative approach for developing superior recyclable polymer networks.

Day:1- 15:00:15:15	**Dr Tom Hasell - University of Liverpool FAB003**

Making polymers from elemental sulfur

Sulfur waste by-product produced on a vast scale. Inverse vulcanisation has made possible the production of high sulfur content polymers, with many unique and exiting properties and applications – such as the dynamic nature of the S-S bonds allowing vitrimer behaviour. The synthesis and properties of these polymers will be discussed, as well as their applications in shape memory, antimicrobial applications, and heavy metal capture. We recently reported a catalytic route that reduces the required reaction time, temperature, and by-products – and allows otherwise unreactive crosslinkers to be used. Also discussed will be methods to improve the physical properties of the polymers, and to make them by photoinitiated or milling routes.

[1] Chem.-Eur. J. 2019, 25, 10433-10440
[2] Nat. Commun. 2019, 10, 647
[3] Angew.Chem.Int.Ed.2020,59,13371–13378
[4] Chem. Mater. 2022, 34, 3, 1167–1178
[5] Nat. Chem. 2022, 14, 1249–1257
[6] Nat. Commun. 2022, 13, 4824

Day:1- 15:15:15:30	**Ms Solène Guggari - Softmat - CNRS FAB003**

Dynamic exchange acceleration promoted by aliphatic disulfide hardener in vanillin-based epoxy vitrimers

Improving the efficiency and the sustainability of polymers is a crucial challenge in materials science due to their important role in our society. Indeed, conventional resins show excellent bonding strength required for engineering applications, but they also show recyclability issues. Thus, the development of vitrimers represents a considerable interest to address the issue of recyclability while maintaining high thermomechanical performances. Epoxy vitrimers are one of the most versatile materials and this class of vitrimers encompasses many advantages compared to traditional materials. These properties are quite uniquely induced by the incorporation of dynamic reversible covalent bonds.

In this work, we present the aliphatic disulfide cystamine hardener with a vanillin-derived epoxy to prepare fully bio-based epoxy vitrimers. Here, the exchange dynamics offered by cystamine could become considerably attractive as a viable alternative to the petrochemical-based conterparts.

Day:1- 16:00:16:30	**Dr Sylvain CAILLOL - Institut Charles Gerhardt FAB003**

FROM BIOBASED MONOMERS TO MATERIAL RECYCLING: CLOSING THE LOOP OF SUSTAINABLE POLYMERS

Recent years have witnessed an increasing demand for environmentally friendly materials, particularly for polymers, which are ubiquitous in our society. We have proposed a platform approach for the synthesis of biobased monomers and polymers, including aromatic polymers. Furthermore, in order to reduce the environmental impact, we have also proposed the substitution of harmful monomers and additives. In the aim to manage polymers at the end of their life, we have followed two paths, either self-healing to increase the lifespan of the materials, or recycling using dynamic exchange reactions of vitrimers.

Day:1- 16:30:16:45	**Ms Milena Gleirscher - Polymer Competence Center Leoben FAB003**

Positive tone surface patterning via a photo-latent base catalyst-induced transesterification pathway

Adding micro- or nano-patterned structures to a surface represents a convenient and versatile strategy to engineer material properties. Our work combines photolithography with dynamic covalent bonds to create positive tone patterns on photopolymers. For this, we pursue a solvent-assisted transesterification approach, which can be spatially controlled by selective photoactivation of a photo-latent base catalyst in a 3D covalently crosslinked thiol-ene network. By ensuring orthogonality between the curing and the activation reaction, the photoreactive resin is processable via vat photopolymerization (at 450 nm) without prior activation of the transesterification catalyst. Micropatterns are then inscribed into the surface by selective exposure to visible light (405 nm). Furthermore, this work targets ways to characterize and tune selected surface properties (e.g., friction) as a function of the micropattern (e.g., size, geometry), resulting in highly versatile functional photopolymers.

Day:1-16:45:17:00

Dr Simon Fawcett - The University of Chicago
FAB003

Investigation of dual-responsive dynamic polyurethane-urea networks in the glassy state

Dynamic covalent polymer networks improve upon traditionally inert thermosetting materials on account of their ability to be reprocessed and recycled. Reversibly forming and breaking covalent bonds in the presence of specific stimuli affords dynamic material properties on-demand. While this class of polymer is relatively well studied within the literature as elastomers, there is little research on dynamic polymer glasses. By offering orthogonal mechanical performance in response to a desired stimulus, the current gap between material strength (glass) and toughness (elastomer) could be bridged. This work aims to gain insight into the poorly understood response behavior of polymer networks in the glassy state. By fabricating a small library of polyurethane-urea networks, the effects that multiple factors have on the timescale and extent of response within polymer glasses could be studied at once.

Day:1-14:00:14:30

Professor Katja Loos - University of Groningen
FAB008

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Day:1-14:30:15:00

Dr Franck D'Agosto - CNRS
FAB008

Controlled polymerizations of ethylene and polymerization-induced self-assembly of PE-based block copolymers

While catalytic coordination-insertion and free radical polymerizations can provide industrially a variety of polyethylene (PE) grades, complex macromolecular architectures based on PE are difficult to obtain. In this context, controlled polymerizations or the right combination of different controlled polymerization techniques are expected to lead to a new generation of sophisticated polyethylene-based materials.

This paper will highlight that for both radical and coordination-insertion polymerization of ethylene, the conditions can be adjusted to lead to controlled polymerization systems for which the synthesis of original block copolymers incorporating a PE block is possible. In addition, as the PE block is often introduced as a second segment, the corresponding block copolymers can self-assemble upon polyethylene block growth leading to original dispersions of nanoparticles.

Day:1-15:00:15:15

Dr Jingxin Shao - Eindhoven University of Technology
FAB008

Polymersomes with Programmable Morphology and Engineered Functions

Polymersomes, serving as drug carriers and therapeutic platform, have garnered significant attention in the last decade. We have recently developed a novel class of amphiphilic block copolymers comprising poly(ethylene glycol) (PEG) and AIEgenic poly(trimethylene carbonate) (PTMC) segments. Through the adjustment of hydrophobic segment lengths in the block copolymers and variations in dialysis conditions, we successfully established a diverse library of AIE-polymersomes with distinct morphologies. By implementing surface modifications and cargo encapsulation, we have engineered the functions of polymersomes for various applications. These include self-propelled nanomotors, photo-mediated therapeutic systems, cargo carriers for intracellular delivery, targeted delivery to mitochondria, and more. Certainly, all these properties render polymersome-based systems more versatile and powerful.

Day:1- 15:15:15:30	**Mr Niccolo Lusiani - Charles University FAB008**

Cationic ring-opening polymerization-induced self-assembly of 2-oxazolines

Polymerization-induced self-assembly (PISA) has been performed for the first time by cationic ring-opening polymerization (CROP). Specifically, block copolymers comprising 2-(3-ethylheptyl)-2-oxazoline and 2-phenyl-2-oxazoline were synthesized in dodecane. Characteristic polymerization kinetics and micellization upon formation of the second block were observed and diverse formulations were prepared, featuring varying block lengths and solid weight percentages, leading to nanodispersions with distinctive morphologies and physical properties. Additionally, we obtained polymer nanoparticle dispersions through gradient copolymerization of these monomers, employing a streamlined one-pot, one-step procedure. This approach granted access to nanoformulations with monomer compositions otherwise unattainable through the block copolymerization method.

Financial support from Czech Science Foundation (22-03102S) and from the Grant Agency of Charles University (326622) is gratefully acknowledged.

Day:1- 16:00:16:30	**Professor Johannes Brendel - University of Bayreuth FAB008**

Shape control in polymer self-assembly and its impact on tissue interaction

Self-assembly is ubiquitous in nature, and of course, materials scientists have tried to mimic it to create functional materials. One prominent approach is the self-assembly of amphiphilic block copolymers. However, thorough control of the final shape of the resulting nanostructures remains challenging due to limited predictability of the energy landscape and kinetic trapping. Our research focuses on the evaluation of key parameters determining the formation of different morphologies besides polymer composition changes. We are particularly interested in 1D or wormlike shapes, which are difficult to target but of interest, because their large surface area and high aspect ratio provide unique advantages for cellular interaction and tissue penetration. Recently, we have demonstrated that wormlike micelles allow passive and exclusive targeting of inflamed areas in inflammatory bowel disease (IBD), whereas all spherical structures such as spherical micelles or vesicles are non-selective.

Day:1- 16:30:16:45	**Dr Jeppe Madsen - Technical University of Denmark FAB008**

Formation of well-defined block copolymer vesicles with a narrow size distribution induced by targeted hydrolysis of a PEG-PDMS-PEG triblock copolymer

A near-symmetrical PEG-PDMS-PEG triblock copolymer was prepared by first polymerizing hexamethyltrisiloxane from the hydroxy-terminus of a methoxypoly(ethylene glycol), mPEG. A hydrosilane end-group was then introduced and this was coupled to a vinyl-terminated PEG. The resulting triblock copolymer consists of one PEG block that is connected through a hydrolytically cleavable silyl ether bond, whereas the other PEG block is connected through a non-cleavable Si-C bond. An aqueous dispersion of the copolymer initially gave large, poorly defined aggregates as determined by light scattering. Upon standing, the shedding of one bond led to formation of a diblock PEG-PDMS copolymer with a lower hydrophilic volume than the original triblock copolymer. This led to a morphology change into well-defined polymer vesicles with a diameter of around 100 nm as determined by cryo-TEM and light scattering.

Day:1- 16:30:16:45	**Ms Hannah Beauseroy - Univ Bordeaux, CNRS, Bordeaux INP FAB008**

Aqueous Ring-Opening Polymerization Induced Self-Assembly of N-Carboxyanhydrides for the design of smart nanomedicines

We have recently integrated the ring-opening polymerization (ROP) methodology with a polymerization-induced self-assembly (PISA) approach, enabling the one-step synthesis of amphiphilic polypeptides and the formation of anisotropic nano-objects with high solid content. Conducted in an aqueous medium, this ROPISA process was initially established using alpha-amino-polyethylene glycol (PEG-NH2) as the macroinitiator and gamma-benzyl-L-glutamate NCA (BLG-NCA) and L-leucine NCA (Leu-NCA) as monomers. In this contribution, we will present the latest results demonstrating the versatility and robustness of ROPISA by varying both the hydrophilic macroinitiator, using synthetic polypept(o)ides, and the NCAs. The elucidation of the ROPISA mechanism will also be presented through a comprehensive study employing in situ SAXS/WAXS coupled to srCD. Furthermore, we have studied the in vivo fate of the obtained nanoparticles in mice, and we will present the related results.

Day:1- 14:00:14:30	**Professor Jan Vermant - ETH zurich S021**

Efficient processing of polymeric materials using advective assemblers

Energy efficiency in the processing of soft materials, particularly polymers, remains an important in various industries. In this context, we will discuss the use of advective flows to shape spatial concentration profiles and manipulate dissimilar materials. The use of 'multiplicative advective assembly' has emerged as a research field where deconstructed static mixer elements are connected in a sequential arrangement with a "programmed" division, rotation, and recombination of layered flows, leading to the amplification of interfacial area or refinement of spatial concentration profiles. We will discuss application in the additive manufacturing of hydrogel or elastomeric actuators, for energy efficient polymer in water emulsification, and even protein extrusion for marbled meat replacements

Day:1- 14:30:15:00	**Professor Luyi Sun - University of Connecticut S021**

Multifunctional Biomimetic Nanocoatings from One-step Coassembly

Large-scale biomimetic organic/inorganic hybrid nanocoatings with a nacre-like microstructure were prepared via a facile co-assembly process. Different from conventional polymer nanocomposites, such nanocoatings contain a high concentration of nanosheets, which can be well aligned along the substrate surface. Moreover, the nanosheets and polymer matrix can be chemically co-crosslinked. As a result, the nanocoatings exhibit exceptional mechanical properties (high stiffness and strength), barrier properties (to both oxygen and water vapor), and flame retardancy, but meanwhile they are highly transparent (maintaining more than 85% of their original transmittance to visible light). The nanocoatings can be applied to various substrates and regular or irregular surfaces (e.g., films as well as foams). Because of their excellent performance and high versatility, such nanocoatings are expected to find widespread application.

Day:1- 15:00:15:15	**Professor Sergejs Gaidukovs - Riga Technical University S021**

Synthesis of biobased polymers for TENG and Soft robotics

Vegetable oil based polymers can be used as materials to prepares TENG and soft actuators. We report several synthesis of rapeseed oil acrylates and epoxides, blend formulations and bioresin processing using light assisted 3D printing methods. DLP and DIW methods were chosen to print demonstrators. The first demonstartors is a pneumatic grip prototype. While the second demostrator is a TENG device of cellular structure. The synthesized biopolymers showed good performance in both demostrator types. Structure and properties of the biopolymers are discussed. Demonstrators properties is also reported.

Day:1- 15:15:15:30	**Professor SUPRAKAS SINHA RAY - Council for Scientific and Industrial Research and University of Johannesburg S021**

Development of Polylactide-Based Sustainable Composites for Durable Applications

Industry and academia have recently shown great interest in biopolymers, including polylactide (PLA). PLA, the primary representative of biodegradable and bio-resourced polymers, is a linear aliphatic thermoplastic polyester generally produced through ring-opening polymerization of the lactide monomer obtained from the fermentation of renewable resources, such as corn. Although it is expected to be a sustainable alternative to traditional petroleum-based plastics, its low flexibility, low impact strength, poor thermal stability during melt processing, low melt strength, and slow crystallization rates could limit its widespread application. This presentation focuses on the recent research effort to address PLA's inherent toughness vs. strength and heat resistance conflict. Various types of PLA-based blends and composites designed to obtain desired mechanical and mechanical properties will be covered. In addition, the relationship between morphology and crystallinity with the toughness a

Day:1- 16:00:16:30	**Professor Suryasarathi Bose - IISc Campus** **S021**
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Day:1- 16:30:16:45	**Mr Marco Caliari - POLYMAT, UPV/EHU** **S021**
CO2-derived, Self-Reinforcing Dissociative Networks for Isotropic 3D printing	
This study presents a new paradigm for the reinforcement of 3D printing materials by spontaneous phase separation in submicron-sized hard and soft domains. We developed a series of dissociative thermosets, networks that can behave like thermoplastics upon heating, based on a new CO2-derived monomer and the acidic thiol-ene reaction. The particular asymmetrical reactivity of the monomer allowed to form both labile and non labile bond during curing. This yielded the formation of hard, permanently crosslinked domains in a dynamic matrix that could be melted upon heating. The material at printing temperature showed low melting viscosity and afforded isotropic 3D printed parts. Their mechanical properties could be controlled by regulating the domain size, covering a range between elastomeric to rigid materials and were maintained over ten recycling cycles. This new strategy avoids the addition of external fillers to 3D printing resins, enabling simpler recycling processes.	

Day:1- 16:45:17:00	**Mr Yougourthen Boumekla - ENSICAEN** **S021**
Towards Sustainable polymers: Transforming Waste Tires into Thermoreversible Elastomers.	
Since the annual rubber production reaches 26 million tons (2016), the chemical recycling of rubber wastes is an important societal challenge. Among the few known methods, Ruthenium catalyzed Cross-Metathesis (Ru-CM) reaction was successfully applied to depolymerize waste truck tires (which contain almost 60% of polydienes), synthesizing functionalized elastomers with various chemical groups such as alcohol, phosphonate.... The aim of this project is to explore for the first time, the Ru-CM reaction to recover Diels-Alder (DA) adducts elastically active chains via the use of difunctionalized alkenes as CTA. The reaction will be studied on polyisoprene to obtain telechelic polymers, and then extended to ground waste tires for their chemical valorization. Finally, we will investigate the influence of diene adduct nature, crosslink density, and flexible block length on the physico-chemical properties of networks and their recyclability.	

Day:1- 14:00:14:30	**Professor Rachel AUZELY - Universite Grenoble Alpes** **S020**
Smart hyaluronic acid hydrogels: from rational design to in vivo applications for tissue repair and cell activity monitoring	
The use of hydrogels for stimulating tissue repair and monitoring cell behavior/activity in the body is of growing interest in regenerative medicine and biosensing applications. We have been interested in the design of injectable hydrogels based on hyaluronic acid (HA), a major glycosaminoglycan (GAG) of the extracellular matrix in animal tissues, for biomedical applications. Herein, we will report original injectable self-healing HA hydrogels by tailoring the structure of the boronic acid derivative/sugar pair acting as small molecular crosslinker. After in vivo injection, the unique properties of these hydrogels enable the creation	

of a transient network that attenuates cartilage degradation in a rodent model of osteoarthritis. Furthermore, we will show how precise control over functionalization of HA, is key to enable its application as a bioresorbable neural interface for recording neuronal activity in vivo.

Day:1- 14:30:15:00	**Professor Amitav Sanyal - Bogazici University S020**

Redox-Responsive Polymeric Scaffolds: Nano, Micro, and Bulk Gels for Biomedical Applications

Stimuli-responsive polymeric materials such as nanogels, microgels, and bulk hydrogels are attractive platforms for addressing many challenges in conventional diagnostics and therapies. The talk will report our approaches toward the fabrication of novel stimuli-responsive nanogels, microgels, and bulk hydrogels that are either fabricated, functionalized, or degraded using the thiol-disulfide exchange reaction. These soft materials can be obtained through the crosslinking of either functional monomers or appropriately designed polymers. To obtain these materials in the desired size scale, fabrication techniques ranging from self-assembly, microfluidics, and cryogelation can be utilized. Applications related to on-demand protein/cell capture and release, and delivery of therapeutic agents in a stimuli-responsive manner will be presented.

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Day:1- 15:00:15:15	**Dr Sébastien ROLERE - CEA S020**

3D printing of high-resolution hydrogels based on photosensitive cellulosic formulation dedicated to biomedical applications

Lately, 3D printing of hydrogels was proposed for innovative medical devices, with versatile shapes and mechanical properties. Notably, Digital Light Processing (DLP) and Two Photons Polymerization (TPP) allow the printing of complex hydrogels from photo-crosslinkable resins. Such resins can contain biopolymers with inherent biocompatibility, controlled biodegradability, and specific biological properties.

Herein, modified carboxymethylcellulose was used to develop 3D-printable aqueous biocompatible resins. 3D-printed hydrogel scaffolds with X-/Y- resolutions of ~80 and 10 µm, were obtained with DLP and TPP, respectively. Hydrogels did not exhibit any cytotoxicity, and showed viscoelastic properties compatible with soft tissues reparation. Hydrogel were then freeze-dried into cryogels to preserve the objects lifetime, and fully characterized in terms of swelling, pore size, and viscoelasticity.

Day:1- 15:15:15:30	**Dr Nicola Judge - Duke University S020**

Degradable aromatic polyesters for local anti-inflammatory agent delivery in tissue engineering applications

Polyesters are widely employed in tissue engineering applications, from cardiovascular to cartilage, as biologically inert supporting material due to their diverse compositional range, wide mechanical property scope, and biologically relevant degradation mechanism. However, native tissue-implant property disparities inhibit revascularisation and invoke a heightened cell inflammatory response. To overcome these challenges, a two-fold approach was devised: simulating natural tissue mechanical load in concert with local delivery of anti-inflammatory active compounds. This work describes semi-crystalline polyester scaffolds with tuneable thermal, mechanical, and degradation profiles through copolymerization with an aromatic ester monomer which releases salicylic acid upon hydrolytic degradation. This material library benefits from facile and reproducible synthesis, alongside its degradation induced active compound release, shows promise for multifunctional implantable polymeric devices.

Day:1- 16:00:16:30	**Dr Georgina Rayner - Harvard Art Museums S020**

Falling to pieces: the problem of plastic art

Plastic materials have been incorporated into works of art, starting with the semi-synthetic polymers cellulose nitrate and acetate, in the early 20th century. Mistakenly assumed to be stable, plastics in fact represent one of the most vulnerable materials that can be found in museum collections. For example, the ready-made plastic food in Claes Oldenburg's False Food Selection (1966) has discolored, deflated and bloomed. The spoiling of the food is undoubtedly due to its materials; a combination of polyurethane, poly(vinyl chloride) and rubber – three of the most at-risk plastics. Over the past 8 years, the conservation department at the Harvard Art Museums has been surveying the polymeric materials in the collection. Whilst the degradation of these materials cannot be stopped, identifying the types of polymers present in the collection allows for the museum to develop protocols to treat damaged objects and tailor storage conditions to prolong the lifetime of a plastic object.

Day:1-
16:30:16:45

Dr Etienne SAVONNET - L'Or√©al
S020

Opportunities and Challenges of Polyhydroxyalkanoate for Cosmetic applications

The design of new cosmetic ingredients is closely linked to polymer science. Polymers are widely used in cosmetic formulations thanks to their wide variety of physicochemical properties. In long-wear make-up products, polymers are used as film-formers or binders for pigments to deliver the non-transfer and lastingness of color under daily conditions.

Currently, the common film-formers or resins used in such products are silicone or polyacrylate type. However, the cosmetic industry is undergoing a major transformation with strong commitments in terms of naturalness, bio-sourcing and environmental impact.

To meet these objectives, a family polymer has been explored: the Poly-3-HydroxyAlkanoate (PHA). These biopolymers are naturally produced by microorganisms to build up energy reserves and are known for their biodegradability and their film-forming properties. They can also be produced using optimized biotechnological processes and tunable through chemical modifications. PHA polymer family is increasingly used today in various industries and is seen as promising candidates for replacing petrochemical polymers.

Day:1-
16:45:17:00

Dr SiangYin LEE - Malaysian Rubber Board
S020

Macromolecules from Hevea brasiliensis: Synergistic Interaction with Palm-based oleochemicals towards Green Chemistry and Sustainable Future

Natural Rubber (NR) is recognized as a Critical Raw Material by the European Union (EU) since 2017, acquiring a priority status in EU policies ,Äì from trade to research. Cis-1,4-Polyisoprene is a naturally occurring macromolecule extracted from the latex of the Hevea Brasiliensis tree grown on plantations. Facing strong competition from petrochemicals in producing a synthetic equivalent of NR and competitive development of a unique Europe-based alternative to NR latex, strategies such as shifting towards using palm-based oleochemicals as green material will allow for a sustainable future of macromolecules from Hevea brasilliensis. We have been synthesizing novel polymers from palm oleo chemicals, investigating their reaction kinetics and physicochemical properties. In addition to the promising results of toxicity and antimicrobial activity, palm-based polymers were proven to have synergistic interactions with NR. These important features have been utilized for key product developments of medical devices and rubbery goods. In this presentation, we will briefly summarize the development of palm-based polymers and the recent advances in producing NR green products thereof.

Day:1-
14:00:14:30

Associate Professor Sheng Li - Korea Advanced Institute of Science and Technology
S019

Stable nanosized polyelectrolyte complexes formed by poly(ethylene glycol)-oligonucleotide conjugates

Small oligonucleotides have important therapeutic effects. However, the delivery of oligonucleotides is challenging as they fail to complex with cationic polymers to form nanosized structures with good colloidal stability. We take the approach of synthesizing poly(ethylene glycol)-oligoDNA (PEG-oligoDNA) conjugates and then complexing them with cationic molecules to form polyelectrolyte complexes suitable for gene delivery applications. PEG-conjugated single-stranded (ss) oligoDNA and double-stranded (ds) oligoDNA are prepared following solution-phase coupling reactions. The conjugates are complexed with either small cationic molecules in the form of imidazolium-based ionic liquids or large cationic polymers in the form of linear and branched polyethylenimine (PEI). The binding strength of each system is investigated, and the resulting complex morphology is characterized by a combination of dynamic light scattering, small-angle X-ray scattering, and transmission electron microscopy.

Day:1-
14:30:15:00

Dr Robert Chapman - University of Newcastle
S019

Synthetic mimics of the TRAIL protein

Since its discovery in the late 1990s, the TRAIL protein has been widely pursued as a highly selective and potent chemotherapeutic across a wide variety of cancers. TRAIL drives apoptosis by clustering death receptors DR4 and DR5 into a trimeric assembly on the cell surface. Unfortunately TRAIL has so far failed in the clinic due to its incredibly short circulation half-life.

By using a high throughput screening process we have developed star-shaped polymer mimics of TRAIL that display DR4/5 binding peptide ligands from their periphery. By directing the way in which the polymer folds in solution we are able to achieve very similar in-vitro activities to the native protein. Because these materials have much longer in-vivo circulation half lives (20-50h) they should make much more effective drugs.

Day:1-
15:00:15:15

Dr jian cheng - University of Science and Technology of China
S019

Biofilm heterogeneity-adaptive photoredox catalysis enables red light-triggered nitric oxide release for combating drug-resistant infections

The formation of biofilms is closely associated with persistent and chronic infections, and physiological heterogeneity such as pH and oxygen gradientsrenders biofilms highly resistant to conventional antibiotics. Herein, we report the fabrication of micellar nanoparticles adapted to heterogeneous biofilm microenvironments, enabling nitric oxide (NO) release through two distinct photoredox catalysis mechanisms. The key design feature involves the use of tertiary amine (TA) moieties, which function as sacrificial agents to avoid the quenching of photocatalysts under normoxic and neutral pH conditions and proton acceptors at acidic pH to allow deep biofilm penetration. This biofilm-adaptive NO-releasing platform shows excellent antibiofilm activity against ciprofloxacin-resistant Pseudomonas aeruginosa (CRPA) biofilms both in vitro and in a mouse skin infection model, providing a strategy for combating biofilm heterogeneity and biofilm-related infections.

Day:1-
15:15:15:30

None Maria Malgorzata Marcinek - Ecole Polytechnique Fédérale de Lausanne (EPFL)
S019

Bacterial carriers for the delivery of polymeric nanoparticles

The concept of using nanoparticle-decorated cells as targeted drug delivery systems has been successfully shown in medicine. Using natural targeting properties of a living bacterium to deliver a polymeric cargo in a controlled manner could also be attractive in agriculture, potentially leading to improved plant growth and reduced environmental pollution.

The key step required to construct such a hybrid system is the attachment of the polymeric cargo to the cell surface. A wide range of chemical immobilization strategies exist, however not much is known how the surface chemistry of different bacterial strains influences the cargo attachment, especially in a quantitative manner. In this work, a library of nanoparticle-bacteria hybrids was produced to study the correlation between different conjugation strategies and the immobilization efficiency of polystyrene nanoparticles on the surface of two plant-beneficial bacterial strains, using fluorescence microscopy and flow cytometry.

Day:1-16:00:16:30	**Professor Aleksandr Zhukhovitskiy - University of North Carolina at Chapel Hill** **S019**

Skeletal editing of polymer backbones

The polymer backbone is fundamental to the polymer's identity and properties. My seminar will focus on the development of new editing tools to transform existing polymer backbones into different ones and to depolymerize commodity polymeric materials into valuable small molecules. Specifically, I will discuss an array of rearrangement transformations—including Ireland-Claisen and aza-Cope—applied to edit the backbones of polyesters, polyurethanes, and polyolefins, and provide examples of how these rearrangements transform the properties of soft materials.

Day:1-16:30:16:45	**Ms Maartje Otten - Utrecht University** **S019**

Post Polymerisation Modification of Polyethylene by Photochemical Oximation

We present a novel strategy for polyethylene post polymerisation modification through a solvent-free photochemical oximation with inexpensive, commercially available and easy to handle reagents. The photochemical oximation is carried out in the absence of a catalyst using a LED long-wave ultraviolet lamp and under aerobic conditions. Using alkanes as model substrates we have validated and optimised the reaction conditions and obtained valuable insights into how the various parameters, like the wavelength and intensity of the lamp, and the irradiation and reaction time, influence the conversion, selectivity and (side)product formation. We have used a variety of 2D-heteronuclear NMR-spectroscopic techniques on the model compounds to design an analysis method for the polymeric compounds. These non-destructive techniques in combination with the use of 15N isotopic labelling experiments yielded us with insights into the chemical composition of the targeted oxime polymeric product.

Day:1-16:45:17:00	**None Mercie Hodges - University of Washington, Seattle** **S019**

Post-Polymerization Modification of Polybutadiene via Selenium-Catalyzed Allylic Aminations

Polymer upcycling—chemically changing the structure and function polymers to add value—is a promising way to mitigate plastic waste. This presentation will outline polymer upcycling via post-polymerization modification, utilizing allylic aminations to add sulfonamides and sulfamates to polybutadiene (PBD). Initial work shows amination changes the thermal properties and wettability of PBD; current efforts target two materials: crosslinked rubber and solid-state electrolytes. The first targets an alternative to vulcanized rubber by using sulfamates to aminate PBD across polymer chains; we are exploring both one- and two-step methods to make a material more reprocessable than traditional rubber. Secondly, we are creating solid-state lithium electrolytes for energy storage, as solid-state materials are potentially more stable than solvent-based batteries. To this end, we are aminating PBD with aromatic sulfonamides which can then undergo lithiation, forming lithium-ion batteries.

Day:1- 14:00:14:30	**Dr Maria Chiara Arno - University of Birmingham S018**
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Day:1- 14:30:14:45	**Dr Min Zeng - University of Warwick S018**
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Day:1- 14:45:15:00	**Ms Seyedeh Maliheh Razavi Esfali - University of Liege S018**
Facile synthesis of functional poly(oxazolidone)s via thiol-ene click polymerization	
Despite being one of the most versatile plastic materials, most polyurethanes suffer from insufficient heat resistance. To solve that, the solution was found in polyoxazolidones (POxa), a specialized class of polyurethanes distinguished by their exceptional thermal stability, thanks to the presence of five-membered cyclic urethane linkages. However, the synthesis of POxa typically entails the high-temperature copolymerization of hazardous diisocyanates and polyepoxides, presenting a notable environmental risk. Here, we present the synthesis of isocyanate-free POxa bearing thioether linkages starting from chemical upcycling of CO2-based polycarbonates. By aminolysis using allylamine, the polycarbonate undergoes complete decomposition, yielding allyl-functionalized bis(hydroxyoxazolidone)s, which are subsequently co-polymerized with dithiols via UV-initiated thiol-ene polymerization. A diverse range of poly(oxazolidone-co-thioether) copolymers was readily obtainable under mild condition	

Day:1- 15:00:15:15	**Ms Abigail Clapperton - University of Toronto S018**
Iterative Exponential Growth for Stereo- and Sequence-defined Peptoid Polymers	
The precise structural organization of functional domains within sequence-defined biopolymers allows for highly selective interactions in signalling and recognition pathways. Peptoid polymers draw inspiration from these ordered biological scaffolds and can self-assemble into two-dimensional nanosheets capable of displaying molecular recognition motifs for biosensing. The traditional solid-phase synthesis of peptoids offers sequence-control but is limited by the reaction scale and attainable chain lengths. Solution-phase alternatives can be scalable but sacrifice the sequence specificity needed to precisely control the position of molecular recognition sites. To address this divide, we present the use of iterative exponential growth (IEG) as a scalable method for the synthesis of peptoid polymers. We report the use of this IEG strategy to synthesize peptoids with unique polymer microstructures and stereoconfiguration. Post-modifications using thiol-ene coupling is also demonstrated.	

Day:1- 15:15:15:30	**Ms Yiyi Deng - Leibniz-Institut für Polymerforschung Dresden e. V. S018**
Radical Ring-Opening Polymerisation of Amine-bearing Cyclic Ketene Acetals: A Route Towards pH-responsive and (Bio)degradable Polyesters/Nanoparticles	
Radical ring-opening polymerisation (RROP) of cyclic ketene acetals (CKAs) is a promising tool to yield polyesters. RROP of amine-bearing CKAs (Alk-MACs) could produce degradable polymers with attracting pH-responsiveness, owing to the protonation of the tertiary amine under acidic condition. A series of Alk-MACs functionalised with several alkyl substituents were synthesised and then copolymerised with hydrophilic CKA 2-methylene-1,3,6-trioxocane (MTC) to yield smart copolymers, which displayed pKa* values varying from 5.7 to 7.2. Moreover, MTC was reported to promote the degradation in both accelerated and physiological conditions. PEG-b-PMTC block-copolymers with distinct PMTC chain length were prepared subsequently and we performed self-assemblies in PBS buffer. The outstanding degradation	

properties and great biocompatibility of these nanoparticles could be observed. We hence envision poly-CKA-based materials possessing great potentials for future applications.

Day:1-16:00:16:30

Associate Professor Markus Muellner - The University of Sydney
S018

A General and Direct Self-Assembly Approach Toward Amorphous and Functional Polymer Nanodiscs in Water

Polymer nanodiscs are challenging to make. This is because, self-assembly processes typically yield micelle shapes of minimised energy, like spheres or vesicles. Flattening such assemblies is more intricate, as block ratios and solvent—polymer interactions alone cannot compensate for the energy costs to flatten a curved surface or interface. Taking on this challenge, we designed an amphiphilic, tadpole-like copolymer featuring a hydrophilic linear block and a hydrophobic bottlebrush block. The linear segment assumes a coil-like conformation, while the bottlebrush segment adopts a stiffened, rod-like structure. Using this rod-coil architecture facilitated planar packing of brush segments and yielded nanoscale polymer discs via spontaneous self-assembly. A characteristic feature of this methodology is the possibility to select the chemical composition of the brush segment without compromising the disc formation. This allows the introduction of functionality into these amorphous core-shell nanodiscs, enabling triggered disassembly and/or drug release, depolymerisation, or shape-transformation. My talk will introduce our general approach.

Day:1-16:30:16:45

Ms Emma Mongkhoun - Sorbonne Université - Institut Parisien de Chimie Moléculaire
S018

A new grafting-from synthesis method for the generation of peptide-polymer conjugates

Peptide-polymer conjugates are a class of material with great therapeutic potentials: they combine the biological activity and hierarchical structure of the peptide with the stability and processability of the polymer. The synthesis of biohybrids by a grafting-from approach consists in the initiation of the polymerization by the peptide. Up to now, this method has been explored in radical polymerization requiring a prior chemical modification of the peptide.

In this work, we propose to use peptides as initiators for the grafting-from synthesis of conjugates by AROP avoiding peptides modification prior use. Our group developed a one pot two steps method to initiate the AROP of episulfides using primary amine and N-acetyl homocysteine thiolactone (NHTL) as initiating system. The thiolation selectivity with NHTL of amines from amino-acids and short peptides has been investigated, and subsequent propylene sulfide AROP has been performed.

Day:1-16:45:17:00

Dr Laurence Moine - CNRS
S018

Poly(malic acid)-based functional polyesters as a versatile platform for biomedical applications

Polyesters are an important class of biomaterial and play an essential role in biomedical applications. However, they are generally hydrophobic and lack functionality. A versatile platform with the possibility of post-synthesis functionalization is highly desirable. In our work, poly(malic acid), a branched polyester with pendant carboxylic acid groups, was synthesized by a simple polycondensation reaction without the need of any catalyst. The lateral functional groups on PMA provide an active tool for making functionalized polyesters on demand. We have already grafted a wide range of bioactive molecules such as corticoids, antibiotics and fluorophores onto these polymers at different concentrations, demonstrating the flexibility and effectiveness of this approach. The resulting branched drug-based polymers significantly enhance drug loading capacity with minimal use of inert materials, and increase drug transport stability by suppressing premature burst release.

Day:1- 14:00:14:30	**Professor Youliang ZHAO - Soochow University S013**

Synthesis and properties of multifunctional Y-junction-bearing polymers

With the incorporation of stimuli-responsive Y junctions, the resultant smart polymers can hold great promise in regulating thermoresponsive behaviors and constructing hierarchical self-assembly systems. Given the great promise of thiol-related linking reactions in advanced polymer synthesis, we have efficiently adopted thiolactone chemistry and other post-polymerization modification to construct novel multi-responsive architectural polymers. The physical properties can be significantly affected by some factors involving topology, chemical composition, external stimuli and solvent isotope. Rational design of Y-junction-bearing polymers allows to achieve multi-tunable thermoresponsive and aggregation behaviors as well as fluorescence properties. This presentation will highlight the latest progress in synthesis, properties and potential applications of stimuli-responsive linear, cyclic, miktoarm star, graft and toothbrush-like polymers with heterofunctional Y junctions.

Day:1- 14:30:14:45	**Mr Linh Duy Thai - Queensland University of Technology (QUT) S013**

Access to Main-chain Light-Responsive Polymers via Head-to-tail Acyclic Diene METathesis (ADMET) Polymerization

In the realm of advanced functional polymers, main-chain light-responsive macromolecular structures are scarcely explored compared to their side-chain counterparts despite their unique property characteristics, including larger morphological changes upon irradiation. Herein, we demonstrate how head-to-tail Acyclic Diene METathesis (ADMET) polymerization can be employed for installing photoswitches, i.e., a-bisimine, hydrazones, and spiropyrans, as main-chain repeating units into the polymer backbone. On an overarching level, we demonstrate that light-responsive main chain polymers can be obtained via head-to-tail ADMET polymerization as a mild and effective technique for their synthesis and light responsive nature.

Day:1- 14:45:15:00	**Ms Laetitia Bourgeois - Université Claude Bernard Lyon 1 S013**

Study of the tetrazene function and its role in free radical polymerization

The tetrazene function is composed of four successively bonded nitrogen atoms, providing three consecutive nitrogen-nitrogen bonds. Its decomposition under heating, irradiation or by the addition of an activating agent leads to the extrusion of nitrogen and the formation of radicals whose involvement in initiating free radical polymerization may be worth studying. This presentation will focus on the role of tetramethyl-2-tetrazene (TMTZ) as a radical polymerization initiator. Thanks to the formation of C-centered radicals, the tetrazene moiety is introduced at the ends of polymer chains. The decomposition of this function offers the opportunity to control polymer depolymerization. Depending on the experimental conditions, its decomposition can also form macroradicals, which can lead to diblock polymers upon re-initiation. These results open up a number of possibilities to interesting macromolecular architectures for 3D or 4D printing applications.

Day:1- 15:00:15:15	**Mr Florent Mohimont - Sorbonne Université S013**

A new family of UCST (co)polymers in water: poly(N-cyanoalkylacrylamide)

For the last few years, polymers possessing an Upper Critical Solution Temperature (UCST) in water have raised a growing interest due to their potential application in smart systems for biomedical applications.[1] However, few examples of neutral UCST polymers in water can be found in the literature. [2] In this context, we have recently developed a new family of polymers based on N-cyanoalkylacrylamide monomers, with some of these polymers possessing an UCST or even dual LCST/UCST behavior in water. [3,4] Using these new monomers, we were able to develop thermosensitive nano-objects with diverse morphologies such as spheres, fibers and vesicles using the Polymerization-Induced Self-Assembly (PISA) process in water. [5,6]

[1] A. Bordat et al. 2019
[2] Y-J. Kim et al. 2017
[3,5] N. Audureau et al. 2021
[4,6] N. Audureau et al. 2022

Day:1- 15:15:15:30	**Ms Opeyemi Ajogbeje - Queen's University S013**

Multicomponent Polymerization of 2-(Dimethylamino)ethyl Methacrylate in Homogeneous Conditions

Amino-functional monomers are used to synthesize stimuli-responsive polymers via conventional radical or reversible-deactivation radical polymerization. The pulsed laser polymerization – size exclusion chromatography (PLP-SEC) technique has been employed to determine the copolymerization propagation rate coefficients of 2-(dimethylamino)ethyl methacrylate (DMAEMA) and methyl acrylate. An in-situ nuclear magnetic resonance (NMR) spectroscopy technique is used to study polymerization kinetics. When DMAEMA is polymerized at pH ≥ 8 in water, a copolymer of methacrylic acid (MAA) and DMAEMA is generated in solution. Although NMR analysis indicates some hydrolysis and ethanolysis take place in addition to polymerization, the rates of the side reactions are greatly reduced in aqueous-alcohol compared to the pure aqueous system. A mechanistic PREDICI® model is being implemented for protonated/unprotonated DMAEMA and MAA terpolymerization to guide efficient homo- and co-polymer syntheses.

Day:1- 16:00:16:30	**Professor LinGe WANG - South China University of Technology S013**

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Day:1- 16:30:16:45	**Associate Professor Luis Branco - LAQV-REQUIMTE S013**

Polymeric Ionic Liquids and Ionogels as versatile Functional Materials for Energy Storage

Polymeric ionic liquids (PILs) are a class of materials that combine the unique properties of ionic liquids with the structural characteristics of polymers. The combination of organic polymeric cations or anions imparts both the flexibility and processability of polymers and the ionic conductivity and thermal stability of ionic liquids. Ionogels are another interested class of materials that emerge from the combination of ionic liquids and gels. The suitable combination of polymers and ionic liquids can be explored to form ionogels. The resulting material exhibits the properties of both ionic liquids and gels, offering advantages such as high ionic conductivity, mechanical stability, and the ability to be molded into specific shapes.

In this work, we will present novel PILs and ionogels based on imidazolium and pyridinium scaffolds for application in material science and energy storage including as electrolytes for dye sensitized solar cells (DSSCs) and electrochemical devices.

Day:1- 16:45:17:00	**Professor Roger C. Hiorns - CNRS/UNESP S013**

Taking fullerene into the next dimension: syntheses of linear poly(fullerene-co-xylene)s for solar cells

Main-chain fullerene-based polymers are still rare. However, because they combine the properties of fullerene, such as exceptional electron acceptance capability and semiconductivity, with those of polymers such as good solubility and excellent film-forming characteristics, they are gaining interest for their use as interlayers in photovoltaics and organic electronics. For examples, recent work has demonstrated their use as interlayers in perovskite solar cells to give efficiencies around 23% and good stabilities. The way in which a poly(fullerene) is made can impact heavily on its final physico-chemical properties. Therefore in this work, by way of introduction, we review the different known methods of preparing main-chain poly(fullerene)s and how those methods might lead to different properties. We reveal two new methods of preparing poly(fullerene)s, and show that it is possible to prepare amphiphilic poly(fullerene) block copolymers using biocompatible starting materials. It is expected that these new materials might be of interest for 'green' processing of interlayers and drug delivery systems.

Day:1- 14:00:14:30	**Professor Rebekka Klausen - Johns Hopkins University S011**

Innovation in building block structure for functional polymers

Day:1- 14:30:15:45	**Ms Celia Ziane - Luxembourg Institute of Science and Technology S011**

High-Performance Epoxy-Amine Vitrimers With Internally Catalyzed Bond Exchange

Vitrimers are a new class of cross-linked polymers that combine the benefits of thermosets (mechanical performance, dimensional stability) and thermoplastics (repairability, reprocessability, recyclability). Bond-exchange via reactions such as transesterification (TER), transcarbamoylation, transimination, etc. enable their reprocessability [1]. The potential to reuse and recycle such materials promises enhanced sustainability, new end-of-life options and reduced waste generation. That said, many TER-based vitrimers described in the literature depend on the presence of a separate catalyst for bond exchange. Not all possess the needed thermal and mechanical properties for structural applications, and the reworking temperatures for such systems tend to be quite high. The use of vitrimers in practice requires these characteristics to be improved. Prior to curing, an ideal vitrimer formulation should be an easy to handle liquid that can be cured at low T (h < 1000 mPa¬∑s at or near RT, crosslinking at T < 65¬∞C). Once crosslinked, the resulting materials should show sufficient thermal and mechanical performance (Tg > 60¬∞C, E > 1 GPa) for load-bearing applications as well as practical reworkability with substantial degradation (Íûá* < 30 min at T < 190¬∞C, Tonset >200¬∞C in air). This work focuses on a novel type of high performance vitrimer based on epoxy-amine chemistry [2]. Careful precursor selection yielded vitrimers with outstanding properties (Tonset to 260¬∞C, Tg to 145¬∞C, Íûá* of ~15-20 min at 180¬∞C, E to 3 GPa). Such high levels of performance make these materials attractive for use in the composite, automotive and energy sectors. Furthermore, the in situ generated tertiary amines act as internal catalysts for the TER reaction, thus avoiding the plasticization, properties loss and potential for leaching associated with the use of external catalysts. This work was supported by Luxembourg National Research Fund (FNR) via SusPoCo (PRIDE21/16748260) project. [1] Guerre M. et. al., Mat. Adv., 2022, 3, 8012 8029. [2] Daniel F. Schmidt, et al., LU505289, 2023.

Day:1- 14:45:15:00	**Assistant Professor Bas van Ravensteijn - Utrecht University S011**

Switchable Electrostatically Templated Polymerization

We report a switchable, templated polymerization system where the strength of the templating effect can be modulated by solution pH and/or ionic strength. The responsiveness to these cues is incorporated through a dendritic polyamidoamine-based template of which the charge density is pH dependent. The dendrimers act as template for the polymerization of oppositely charged monomers. We show that the rate of polymerization and maximum achievable monomer conversion are directly related to the charge density of the template, and hence the environmental pH. The polymerization could effectively be switched "ON" and "OFF" on demand, by cycling between acidic and alkaline reaction environments. These findings break ground for a novel concept, namely harnessing co-assembly of a template and growing polymer chains with tunable association strength to create and control coupled polymerization and self-assembly pathways of (charged) macromolecular building blocks.

Day:1-15:00:15:15

Mr Alasdair Rigby - The University of Birmingham
S011

Functional monomer design for aqueous PET-RAFT polymerisation

Photo electron/energy transfer-reversible addition-fragmentation chain-transfer (PET-RAFT) polymerisation has emerged as a powerful controlled radical polymerisation technique, enabling oxygen tolerant polymer synthesis with exquisite spatiotemporal control through irradiation of cytocompatible organo-photocatalysts with visible light within aqueous environment. Traditional monomers used for carrying out aqueous PET-RAFT polymerisation allow for precise structures to be synthesised, but often they lack the ability to undergo post-polymerisation modifications. In this work, we rationally design and synthesise a range of acrylamide-based monomers, capable of undergoing cytocompatible PET-RAFT polymerisations in aqueous environment. Additionally, such polymers can undergo biorthogonal modifications under cytocompatible conditions, allowing for efficient aqueous functionalisation.

Day:1-15:15:15:30

Mr Nicholas Starvaggi - Texas A&M University
S011

Non-Aqueous Emulsion ATRP for Microcapsule Fabrication

Encapsulation of phase change materials (PCMs) imparts thermal stability to the core and protection against undesired reaction. Soft-templated encapsulation methods commonly use interfacial polymerization for shell formation, with a multifunctional monomer added to the droplet phase, resulting in an impure core. Our hypothesis is that modification of colloidal silica with surface-immobilized initiators for ATRP will produce Pickering agents that stabilize emulsions of interest and serve as reactive handles for in situ capsule shell formation, eliminating the need for monomer addition to the core. To test this hypothesis, silica particles were modified to achieve surfactants with pendant ATRP initiators. Particles demonstrated dispersibility in nonpolar solvents and interfacial activity at the PCM-toluene interface. Microcapsule assembly was driven through grafting/crosslinking polymer chains from interfacial silica, producing a core-shell structure that is robust to thermal cycling.

Day:1-16:00:16:30

Associate Professor Jia Niu - Boston College
S011

Polymer Chemistry-Inspired Approaches to Polysaccharides and Glycomimetics

Polysaccharides are a major class of biomacromolecules that play important roles in both biology and material sciences. A long challenge for the characterization and utilization of polysaccharides is the heterogeneity of highly diverse natural polysaccharides. The efforts for chemically synthesizing complex polysaccharides have undergone rapid development in the past decade, but methods for the scalable preparation of polysaccharides remain elusive. Herein, I will present our efforts toward chemical synthesis of polysaccharides and glycomimetic polymers for biological and material applications by taking inspirations from polymer chemistry. Three specific examples involving various polymerization chemistries will be discussed.

Day:1-16:30:16:45

Ms Eleanor Trudinger Charnley - University of Bath
S011

Polymer from Sugars: Development of Novel Polymers and Investigation of their Impact on the Marine Environment

Day:1-16:45:17:00

Mr Florian Tobias Kaps - University of Helsinki
S011

New Functional Lipid-like Moieties enable Facile Synthesis of Lipopolymers

Lipopolymers (LPs), especially PEG-based LPs, find extensive use in the biomedical sector. Lipo-PEG has been used in liposomal formulations since the 1990s[1] and was recently also part of the lipid nanoparticle carriers used in the Covid-19 vaccines.[2] Actively investigated alternatives to Lipo-PEG are LPs based on other stealth polymers such as poly(2-oxazoline)s (POx).[1] The possible synthesis routes of LPs vary greatly depending on the chosen stealth polymer and applying the same method to different polymers is challenging. Here, a new functional lipid-like moiety is introduced which enables the synthesis of LPs based on a variety of stealth polymers via a highly efficient coupling procedure. Thus, comparable well-defined LPs, among them Lipo-PEG and Lipo-POx, with high functionalization efficiency are obtained and investigated regarding their pH-stability and ability to form liposomes. [1] Li et al., Asian J. Pharm. Sci. 2015 10, 81. [2] Xiao et al., Chem. Rev. 2021 121, 12109.

Day:1-
14:00:14:30

Associate Professor zhongqiang Yang - Tsinghua University
OC101

Smart responsive liquid crystal elastomer fibers

Liquid crystal elastomers (LCE) are cross-linked networks formed by coupling liquid crystal units with polymer chains. Due to the phase transition of liquid crystals under external stimuli, LCE exhibits anisotropic optical and mechanical properties, and have been attracted continuous attention as a smart responsive material. This talk will introduce the fabrication of LCE fibers developed by the research group, including dry spinning, melt spinning, template method and rotational 3D printing. It will also explicate how to obtain solid and hollow fibers, control their size, structure and liquid crystal orientation. Finally, several examples are demonstrated for the application of LCE fibers in the field of soft actuators, artificial muscles and soft robots.

Day:1-
14:30:15:00

Professor Maria Vamvakaki - University of Crete
OC101

Main Chain Degradable Polymers and Polymer Networks

Light degradable polymers are proposed for use in patterning, polymer recycling and biomedicine.1 Soft, transparent, hydrogels comprising dithioacetal cross-links, that undergo degradation upon exposure to light, are presented. Mechanistic studies revealed a chemical recycling process to the initial reagents as the main photoproducts, enlightening the network reformation upon heating at mild temperatures. Photo-/acid-degradable polyacylhydrazones synthesized via a step,Äìgrowth reaction of dicarbonyl and diacylhydrazide comonomers are also discussed.2 The amphiphilic copolymers, and the acylhydrazone groups in the polymer backbone, which promoted inter,Äì/intra,Äìchain hydrogen bonding, fostered the polymer self,Äìassembly into photodegradable nanostructures.

Day:1-
15:00:15:30

Dr Martin Greenall - University of Lincoln
OC101

Modelling polymer self-assembly: micelle shape transitions in solution and rod-coil molecules in the bulk

Mean-field theories can give insight into a new system and can also guide more computationally intensive simulation studies. In this talk, the results of mean-field models will be presented for two cases. Firstly, self-consistent field calculations will be shown for the transitions that occur between the different shapes of micelle formed in solution, with the main finding being the strong effect of the inter-block incompatibility on the temperature dependence of these transitions . Secondly, results will be presented that use simpler mean-field models developed for strongly segregated systems to fit recent experimental data on the structures formed by fluorinated rod-coil molecules in the bulk.

Day:1-
16:00:16:15

Professor Monika Gosecka - Centre of molecular and Macromolecular Studies of Polish Academy of Sciences
OC101

The role of hydrophobized hyperbranched polyglycidol in the formation of the aqueous formulations of clotrimazole

The internally hydrophobized hyperbranched polyglycidol with aryl groups such as phenyl, 1,4-biphenyl incorporated via a carbamate linker are prone to form non-Newtonian structured fluids with clotrimazole.

The series of formulations were applied to explain the mechanism of the formation of such constructs. Detailed analysis of the aqueous formulations with FTIR and DSC analyses revealed significantly enhanced solubility of clotrimazole in the presence of hydrophobized hyperbranched polyglycidol. Moreover, the Franz diffusion experiments showed a 5-fold increase of the permeability constant of clotrimazole in comparison to the drug-loaded in a commercially available disposable tablet. In addition, polymer-clotrimazole-based formulations showed enhanced and prolonged antifungal activity in respect to the tablet properties. Such simple formulation based only on clotrimazole and hydrophobized hyperbranched polyglycidol make these systems potential antifungal therapeutics for the gyneacological applications.

Day:1-16:15:16:30

Mr Maxime Hedou - HEIA and EPFL
OC101

Designing inherently degradable epoxy resins around a carbohydrate core

The development of high-performance bio-based epoxy resins has been limited by the lack of competitivity with the harmful bisphenol-A precursor (DGEBA). Here, we detail the synthesis of a bio-based epoxy building block from a novel tricyclic diester (DMGX) that can be produced directly from the hemicellulosic fraction of non-edible biomass. DMGX was reduced at high yield to a diol (XGDO) which was further reacted with epichlorohydrin to a resin precursor. Epoxy resins were made with commercial diamines and the properties of the resulting bio-based resins were compared to their DGEBA counterparts. All cured DGEXGDO epoxy resins had degradation temperatures above 300°C, high glass transition temperature (>120°C), and higher glassy storage moduli than DGEBA-cured epoxy resins. Furthermore, the unique acetal chemistry of the carbohydrate building blocks led to improved end-of-life as DGEXGDO-cured epoxy resins are more easily degradable compared to classical DGEBA-based epoxy resins.

Day:1-16:30:16:45

Dr Xuan Li - Institute of Chemistry, Chinese Academy of Sciences
OC101

Robust and Transparent Polyamide 1012 Membranes for Biogas Purification Controlled by the Degree of Hydrogen Bonding Order

This work aims to design thermal protocols to generate different crystal forms, which can tailor properties. We chose low Mn Polyamide 1012, because its crystal forms can be more easily controlled by changing cooling rates in comparison with high Mn PA1012. When the chosen PA1012 was slowly cooled after erasing thermal history to a temperature where it had crystallized until saturation, the standard α form could be obtained when the sample was further cooled to RT at any rate. However, if PA1012 was firstly cooled at faster cooling rates until saturation, two types of different crystal forms could be obtained upon subsequent cooling. The formation of locally ordered H-bonds at high temperatures directly affected the final crystal form. Lower crystallization degree and smaller crystal size of the less thermodynamically stable γ' form films possess not only good toughness but also excellent transparency, as well as higher gas permeability coefficient with better selection properties.

Day:1-14:00:14:15

Dr Roisin O'Connell - University of Leeds
OC102

Automated Production and Self Optimisation of Lipid Nanoparticles for Drug Delivery

Lipid nanoparticles (LNPs) have emerged as an exciting prospect for drug delivery systems due to their cell membrane transport properties and have gained traction in recent years as effective and stable delivery systems for mRNA. The success of mRNA treatment is dependent on their carrier reaching target cells without excessive loss of the drug payload, as such, complex LNPs consisting of 4 or 5 component molecules, with a specific size and structure, are generally favoured. This poses a problem in the material discovery stage for LNPs, limited by the large parameter space and very high cost of materials, meaning optimal production conditions are likely not met. This work uses a low-cost model lipid system, with a fluorescent dummy payload, to produce LNPs continuously in flow and monitor their size and loading online with DLS and UV-vis spectroscopy. The platform uses outputted data to self-optimise, targeting specific particle properties and loading in as few experiments as possible.

Day:1-
14:15:14:30

Mr WeiNian Wong - Monash University
OC102

Automated Continuous Flow Synthesizer for Rapid Diblock Copolymer Material Library Construction

The design and synthesis of diblock copolymers are often tedious, posing a significant hurdle in compound discovery. To overcome this, we developed a fully automated platform for diblock copolymer material library synthesis. Leveraging continuous flow chemistry and RAFT polymerization, versatility and precise control over polymer structures is achieved. The automated setup comprises peristatic pumps, oil baths, PFR, autodegasser, FITR, and an auto sampler, controlled by a Python program to minimize human intervention. Employing timesweep kinetic screening approach, monomer conversion is optimized in the first block using a ML model, facilitating subsequent chain extension without Interstage purification. A broad library of block copolymers is generated and the methods and algorithms for their generation will be presented. Further, we will discuss the scope of the platform to highlight the exciting avenues that are presented from fully automated feedback-enabled polymer synthesis.

Day:1-
14:30:14:45

Mr Owen Tooley - University of Warwick
OC102

MaDDOSY: Mass Determination Diffusion Ordered Spectroscopy on the Bench Top and its use in Reaction Monitoring

Control over molecular weight is one of the most important parameters in polymer synthesis, and yet often only once a reaction has finished is the molecular weight of the polymer determined. Here we present a universal, solvent-independent [1] calibration curve for the rapid determination of polymer molecular weight using a benchtop NMR spectrometer, which provides a system in which no external calibration is required prior to measurement.

We also present an automated sampling method for the monitoring of molecular weight as a reaction proceeds using rapid MaDDOSY measurements. We evidence the reaction monitoring capability of this system through the monitoring polymerizations in non-deuterated solvents using a range of mechanisms. We see the results are comparable to those obtained by offline GPC while providing a much shorter measurement time, and requiring the use of no additional solvent, whilst being able to return the sample to the reaction mixture following measurement.

Day:1-
14:45:15:00

Ms Ankita Meena - Polymer Institute of the Slovak Academy of Sciences
OC102

Propagation rate coefficient for sparingly water-soluble monomers in water and EtOH/water mixtures

The knowledge of radical polymerization kinetics in aqueous solutions is limited to sparingly water-soluble monomers, such as methyl acrylate, methyl methacrylate, styrene, and 2-methoxyethyl acrylate. Herein, we were interested in the propagation rate coefficient, kp, of these monomers determined in water and EtOH/water mixtures. The IUPAC-recommended pulsed laser polymerization coupled with the size exclusion chromatography was used to determine kp values as a function of monomer concentration, solvent composition and temperature. The results of this work complement the current understanding of the solvent effect on propagation rate for polymerization in aqueous solutions.

Day:1-
15:00:15:15

Mr Dominik Fuchs - JGU Mainz
OC102

Near infrared (NIR) spectroscopy: a versatile tool for in-situ monitoring the anionic (co)polymerization of styrene and dienes .

Thermoplastic elastomers (TPE) are based on ABA triblock copolymers that consist of at least two high Tg blocks and one highly flexible low Tg block that phase separate. In the statistical copolymerization of styrene with isoprene in cyclohexane, the reactivity ratios (rS=0.015 and rI=10.03) differ drastically, thus gradient block copolymers are formed. By adding polar modifiers like Lewis bases, these reactivity ratios can be adjusted and even reversed (rS=12.58 and rI=0.012)

In this work, the effect of various ether-based polar modifiers such as THF,DTHFP and MTBE as well as Li+ and K+ amylates on the copolymerization of different styrenes and dienes have been investigated, via NIR. Consequently, reactivity ratios changed from rS<<rI via rS≈rI to rS>>rI. Here, the chelating modifier DTHFP or K+ as an additional counterion showed the strongest impact. By adding minor amounts of these modifiers, a variety of different polymer architectures with tailored material properties is access.

Day:1- 15:15:15:30	**Mr James Barclay - Durham University OC102**

In Situ Monitoring of Soil Removal Using Flow FTIR

Removal of contaminating soils from clothing is an intensive process requiring large quantities of energy and water. Reducing this environmental impact through more effective detergent formulations is a fundamental challenge in the personal care industry. This will require a greater understanding of the interactions between soil, fabric, and surfactant. However, in situ monitoring of soil removal during the wash process is extremely challenging. We report a method to study these interactions on model polymer surfaces using FTIR spectroscopy in flow. Using labelled derivatives of lipids commonly found in soil, removal of individual components from the surface can be monitored, allowing us to identify culprits in difficult to remove stains at a chemical level. We anticipate this technique will allow us to probe the mechanisms of soil removal, enabling the development of more efficient and sustainable detergent formulations.

Day:1- 16:00:16:15	**Dr Wolfgang Radke - Agilent Technologies OC102**

Characterization of Complex Polymers by 2D-LC

Most modern polymeric materials are heterogeneous with respect to several molecular features, e.g. molar mass, chemical composition, end-group functionalization or architecture. Size exclusion chromatography (SEC) also named gel permeation chromatography (GPC), the most widely applied separation technique for polymers separates by molecular size. Thus, molecules of identical size, but differing in, e.g. chemical composition will not be separated, but coelute. Likewise, a separation based on chemical composition will render fractions homogeneous in composition, but containing different molar masses. Consequently, one dimensional separation methods do not allow revealing the complex distributions of modern polymeric materials.

2D-LC, however, allows separating by different structural features providing deep insight into the multidimensional distributions of modern polymeric materials.

The presentation will explain the potential of 2D-LC on selected applications.

Day:1- 16:15:16:30	**Ms Nawal Hassan - Aston University OC102**

Novel functionalised styrene-maleic acid block copolymers for protein extraction

By 2030 the UN aims to ensure that everyone has access to clean and affordable drinking water. To help achieve this goal, we are drawing inspiration from nature, notably aquaporin transmembrane proteins. We are developing novel styrene-maleic acid (SMA) block copolymers with additional functionality to afford both efficient protein solubilisation and immobilisation within artificial membranes for selective water separation. These amphiphilic SMA block copolymers stabilise nanoscale discs to encapsulate the aquaporin and surrounding lipids, retaining the stability and efficacy of the aquaporin transmembrane proteins. We use well-controlled RAFT polymerisation to determine the effect of the molecular weight distribution on protein solubilisation ability and assess whether the large polydispersity of the industry standard SMA2000 is critical to its success, or if a next generation of SMA copolymers can provide enhanced performance.

Day:1-16:30:16:45

Mr David Londoño - PhD student
OC102

CO2-responsive polymers containing an amine-modified pyrene dye for the rapid detection of CO2 at low concentrations.

The detection of carbon dioxide is a major challenge in both industrial and domestic environments. Detecting fluctuations in carbon dioxide by switching “on” or “off” fluorescence in aqueous environments has often been targeted for efficient monitoring. This switch needs to occur in a drastic way that is visually observable to be effective. To achieve this the chemical structure of a dye could be modified in response to CO2, switching “off” fluorescence. We, therefore, created a water-soluble polymer functionalized with a CO2-responsive pyrene-modified dye (DEAPyMA). This functional dye contains a tertiary amine conjugated to the aromatic pyrene, which can be protonated at pH ~ 6.5 or lower. After only 30s of CO2 bubbling a significant fluorescence "off" response was observed, where a drastic reduction in fluorescence at 480 nm was detected. We have incorporated this CO2-responsive dye into linear polymers, polymeric nanoparticles, and hydrogels to access its applicability.

Day:1-16:45:17:00

Ms Özge Özükanar - Istanbul Technical University
OC102

Synthesis of Novel Photocurable Bio-based Diallyl and Monoallyl Monomers for Flame Retardancy

In recent years, many scientific studies have been carried out aiming the development of new bio-based materials . The growing importance of the concept of "green chemistry" has led researchers to focus on this area. In this study, piperazine and eugenol from clove oil were used to form a diallyl monomer. Eugenol is particularly interesting for photocuring because it already contains an allyl group, thus shortening at least one reaction step to provide a monomer more suitable for the green chemistry concept. Secondly, we synthesized a new eugenol-based reactive phosphorus flame retardant monomer in a one-step . These two new bio-based monomers were then used to form thiol-ene photocured networks. In addition to several characterization methods, the thermal properties were studied. With photocuring, the networks showed high levels of gel content, and limiting oxygen index (LOI) values for thermoset materials increased as a result of the synergistic interaction between N and P atoms.

Day:1-14:00:14:15

Dr Eric Leclerc - CNRS (France)
OC103

Fluorine-Activated Hetero-Michael Reactions and Exchanges : A Way to Improve the Synthesis and the Dynamics of Vitrimers

The tremendous interest that have generated fluorinated molecules in the last decades finds its origin in the peculiar properties bestowed by F atoms and by the C–F bond. In particular, the electrophilicity of fluorinated acrylates is considerably enhanced and the Michael additions on such substrates particularly promoted.

Here we report our work on the use of various fluorinated groups as neighbouring activating groups in Covalent Adaptable Networks. Apart from our work on transesterification and transamidation exchanges, this presentation will unveil the same activating effect on hetero-Michael exchanges, that has been first demonstrated at the molecular level (kinetic studies, DFT calculations). These effects were also at work in materials and were exemplified by the characterization (rheology, reprocessing) of a broad range of fluorinated CANs. These studies demonstrate the potential and versatility of fluorinated groups as internal catalysts in CANs.

Day:1-14:15:14:30

Ms Megan Elliott - University of Birmingham
OC103

Crystallisation-Driven Self-Assembly of Polyester-Based Block Copolymer Materials

Nanoparticles formed through the self-assembly of block copolymers (BCP) have a wide range of applications, from drug delivery to friction modifiers (FM). When used as FMs, these nanoparticles are potentially able to mitigate problems associated with polymeric FMs, including degradation/scission from the high-shear environment of an engine. In this work, we use a semi-crystalline polymer (poly(caprolactone), PCL) to access high-order morphologies, such as rods and platelets, through crystallisation-driven self-assembly (CDSA). Here, we report the synthesis of a range of BCPs comprised of a PCL core and oil-soluble corona. Using RAFT polymerisation, different alkyl methacrylates were used to create different BCPs, investigating the effect of alkyl chain length and corona DP on self-assembly properties in non-polar solvents and, in turn, allowing us to improve their performance as friction modifiers.

Day:1-14:30:14:45

Ms Mariangela Rea - Department of Chemistry “Giacomo Ciamician”, University of Bologna, Via Selmi 2, 40126, Bologna, Italy
OC103

Frontal Polymerization for the Synthesis of Crosslinked Semi-Interpenetrating Networks: Tuning Properties for Versatile Hydrogel Applications

Frontal Polymerization (FP) is a self-sustaining process triggered by thermal or photo stimuli, leading to the formation of a polymerization front, with no need for continuous external heating, offering advantages in time, energy, and cost efficiencies over conventional polymerization methods. FP is particularly relevant in hydrogel synthesis, creating crosslinked polymeric networks, which find applications in drug delivery, chemical sensors, and self-healing materials. In this study, FP was utilized to obtain a copolymer from Acrylamide and GelMA intercalated with gelatin, forming semi-interpenetrating polymeric networks. Samples with different GelMA substitution degree (30%, 75%) and gelatin amounts were synthesized and characterized, resulting in tunable porosity, moduli, and high recovery upon cyclic load application. All the components are also biocompatible, thus encouraging the use of these systems in the field of drug delivery and tissue engineering.

Day:1-14:45:15:00

Mr Timo Sehn - Karlsruhe Institute of Technology (KIT)
OC103

Structure-Property Relationships of Short Chain (Mixed) Cellulose Esters Synthesized in a DMSO/TMG/CO2 Switchable Solvent System

Increasing environmental pollution and petroleum resource depletion are important indicators for the inevitable replacement of fossil-based polymeric materials with more sustainable counterparts. Hence, the development of bio-based materials from renewable resources, such as cellulose, is of great importance. Herein, we introduce a rapid and homogenous microwave assisted synthesis of high molecular weight short chain (mixed) cellulose esters with variable acyl side chain length ($2 \leq C \leq 8$) by using a DMSO/TMG/CO2 switchable solvent system. Accordingly, (mixed) CEs were synthesized by implementing tetramethylguanidine into a switchable solvent system and simple variation of reaction parameters, followed by in-depth structural characterization via IR, 1H NMR, 13C NMR and SEC. Examination of the structure-property relationships revealed a decrease in the glass transition temperature, an increase in surface hydrophobicity, and a decrease of Young´s modulus, with longer alkyl side chains.

Day:1-15:00:15:15

Mr Rikuto Kanno - Graduate School, Kyoto University
OC103

Self-Assembly of Amphiphilic Random Copolymer Micelles in Water: Self-Sorting Systems and Stimuli-Responsive Materials

Controlling selective and dynamic association of amphiphilic molecules in water is important to create self-assembled materials with stimuli-responsive properties and unique functions in complex media. In this presentation, we report design, controlled self-assembly, and stimuli-responsive materials of amphiphilic random copolymer micelles. Amphiphilic random copolymers bearing hydrophilic polyethylene glycol (PEG) or ionic groups, and hydrophobic alkyl groups as side chains form single- or multi-chain micelles in water via chain-folding by the association of the hydrophobic groups. Typically, we found that a cationic random copolymer co-self-assembled with a PEG-bearing copolymer to form a PEG/cation-fused micelle in pure water, whereas the fused micelle self-sorted into discrete cation- or PEG micelles in the presence of salts.

Day:1-
15:15:15:30

Mr Thomas Habets - University of Liege
OC103

Recyclable CO2-sourced Thermosets through Dynamic N,S-Acetal Chemistry

Finding promising chemistry platforms for designing easily recyclable polymers has become a key challenge to face up environmental concerns and the growing plastics demand. Recently, we reported a highly dynamic chemistry between CO2-sourced alkylidene oxazolidone and thiols to deliver circular poly(oxazolidone)s networks embedding N,S-acetal bonds in mild conditions. Oxazolidone monomers were easy to synthesize from cheap available reagents and valorize CO2 as building block. The polymer structure was easily tuned by virtue of monomer design, translating in a wide panel of mechanical properties similar to commodity plastics, ranging from PDMS-like elastomers to polystyrene-like rigid plastics. The highly dynamic chemistry allowed to access many closed- and open-loop recycling scenarios and various mechanical recycling approaches. The versatility of this chemistry shows great potential for the preparation of circular materials (including composites) of tunable structure and properties.

Day:1-
16:00:16:15

Ms Eunsong Jung - ETH Zurich
OC103

Ball-Mill Grinding Depolymerization of Vinyl Polymers: Poly(α-methylstyrene) and Polymethacrylates

Chemical recycling to monomer is crucial in our current Age of Plastics, and ball-mill grinding (BMG) is emerging as a promising candidate. Herein, we demonstrate that commercial vinyl polymers, such as poly(α-methyl styrene) (PMS) and polymethacrylates, can undergo appreciable depolymerization (up to 64 mol% of α-methyl styrene and 41 mol% of methylmethacrylate were produced) under mild conditions and without reactive end groups, using ball-mill grinding (BMG).

Constrained geometries simulate external force (CoGEF) simulations and radical trapping experiments supported that the depolymerization was initiated by mechanochemical chain scission. Control experiments suggested that the extent of depolymerization was equilibrium-controlled. However, polystyrene and poly(methyl methacrylate), having higher ceiling temperatures, underwent a lesser degree of depolymerization at room temperature (up to 4% monomer produced).

To achieve the depolymerization of polymethacrylates, we explored the factors that influence the depolymerization conversion and found temperature (heating to only 43 °C), the addition of a small amount of liquid (μL of tert-butyl alcohol), and ball number/size to be the most important parameters. We also applied this method to other polymethacrylates and found the pendent substituent to influence the extent of depolymerization. Notably, the molecular weight of the residual polymer is remarkably low, ca. 1 kDa, demonstrating the excellent degradation performance of BMG. Overall, this work provides important mechanistic insight into depolymerization reactions under ball-milling conditions and represents a significant step in expanding BMG as a tool for the chemical recycling of vinyl polymers.

Day:1-
16:15:16:30

Assistant Professor Thomas Vidil - CNRS, Université de Bordeaux
OC103

Synthesis of self-blown polyurethane foams with in situ generated isocyanates

Polyurethane (PU) foams are used in a wide range of applications, from thermal insulation to cushioning. They are classically produced from the polyaddition of polyisocyanates with polyols. However, the use of isocyanates is gradually restricted by international regulations. The in situ generation of isocyanates, on demand, is an acceptable strategy to mitigate their toxicity. Recently, we developed a metal-free process to access urethanes from the decarboxylation of oxamic acids (OA), a family of stable and non-toxic compounds. Building on this methodology, we investigated the possibility to synthesize PUs by using OA as the starting material. Thermoplastic and thermosetting PUs were successfully obtained by reacting bifunctional OA with diols and triols respectively. In the case of thermosetting PUs, the CO2 generated during the decarboxylation step stays entrapped to form cavities. Conveniently, this approach was used to fabricate PU foams with various thermo-mechanical properties.

Day:1- 16:30:16:45	**Dr nadia anter - phd student at USMS Morocco OC103**

Extraction and silylation of cellulose using a cyclotetrasiloxane

The complete dissolution of cellulose in a solvent system, more or less complex. a cyclotetra-siloxane was synthesized via hydrosilylation of 1, 3, 5, 7-tetramethylcyclotetrasiloxane (D4H) with Trimethoxyvinylsilane (TMVS). The structure of tetramethylcyclotetrasiloxane modified with Trimethoxyvinylsilane (D4H– TMVS) was characterized by Fourier transform infrared (FT-IR), 1H nuclear magnetic resonance (1H-NMR). This cyclotetrasiloxane was binding to cellulose then polymerizing it with an initiator in a second step. polysiloxane are useful for conferring chain flexibility, biointegrity, radiation resistance, thermal stability and hydropho-bicity. With an appropriate degree of silylation, cellulose will disperse efficiently in organic solvents such as acetone, chloroform and tetrahydrofuran.

Day:1- 14:00:14:15	**Dr Daulet Kaldybekov - Al-Farabi Kazakh National University OC107**

Advancing mucoadhesion: Boronate, catechol, and maleimide-functionalised chitosan for enhanced intravesical drug delivery

This study reports the synthesis of boronate and catechol-conjugated chitosans using a clickable mercaptoacetic acid locking imine reaction and functionalisation with maleimide groups through carbodiimide reaction chemistry. Physicochemical characteristics of the resulting chitosan derivatives were fully studied using techniques such as 1H NMR, FTIR spectroscopies, TGA, DSC, X-Ray diffraction, GPC, turbidity measurements at various pHs. Toxicological properties were assessed using in vivo slug mucosal irritation test, in vivo fluorescence planaria assay and in vitro cell viability MTT assay. Retention properties of these formulations on ex vivo porcine urinary bladder mucosa were evaluated using an established flow-through technique with fluorescent detection. Modified chitosan derivatives exhibited superior retention on freshly excised porcine bladder tissues compared to unmodified chitosan after periodic irrigation with artificial urine.

Day:1- 14:15:14:30	**Assistant Professor Shaista Taimur - University of Wah OC107**

Developing Polyamidoxime Polymer Brushes by Graft Polymerization for different Applications

Grafting is an attractive technique for the development of Polymer Brushes (PBs) in which polymers are covalently bonded onto a surface. It is an appealing process to transform the properties of a polymer according to specially made specifications formulated for target applications. This modus operandi has been considered the best to achieve hybrid materials with inorganic base and organic outer morphology. Three grafting approaches, Radiation Induced Graft Polymerization (RIGP), Emulsion Graft Polymerization (EGP) and Microwave-Assisted Graft Polymerization (MAGP) are utilized to develop PBs by modifying the surface properties of sepiolite nanoclay by integrating polymer chains onto the surface of nanoclay.Novel polyacrylonitrile grafted sepiolite nanohybrid PBs have been synthesized by Radiation Induced Graft Polymerization (RIGP), Emulsion Graft Polymerization (EGP) and Microwave-Assisted Graft Polymerization (MAGP) for different applications. The acrylonitrile group present in nanohybrid material was chemically modified into polyamidoxime. Both the grafting yield and degree of conversion of acrylonitrile to amidoxime was examined by gravimetric analyses. The structural and morphological investigations of these nanohybrid materials were performed by FTIR, XRD, FESEM, TEM, TGA and BET analyses. The grafting percentage of acrylonitrile achieved through Radiation-Induced Graft Polymerization was 280% and by Emulsion Graft Polymerization, it was 373% whereas Microwave-Assisted Graft Polymerization (MAGP) demonstrated the highest grafting percentage (449%). This comparison suggests that all these methods are effective, with MAGP showing superior efficiency by achieving the maximum grafting percentage among the three methods. PBs have wide ranging applications due to their versatile and unique characteristics. They include nanotechnology, separation and filtration, antifouling coatings, lubrication and surface protection, responsive materials and a lot more.

Day:1-14:30:14:45

Mr Albert Woodward-Rowe - University of Surrey
OC107

Unravelling capsule formation mechanisms in interfacially initiated PEGDA hydrogels

We produced covalent hydrogel capsules from a water-in-oil (W/O) emulsion of aqueous poly(ethylene glycol) diacrylate (PEGDA) in hexadecane, containing a UV-radical initiator. Upon initiation, PEGDA polymerisation begins at the W/O interface to produce hydrogel capsules. The 3D polymer microstructures were visualised using freeze-fracture cryo-SEM - in conjunction with qNMR reaction tracking to estimate internal polymer fractions with a range of processing parameters. Together, results show three distinct polymerisation regimes. For each regime, the water-holding capacity and network swelling were assessed via thermogravimetric analysis. When considering these results together, we propose a capsule formation mechanism based on diffusion-limited aggregation of PEGDA microbeads. The data further satisfies the theoretical volume fractions required for microbeads percolating throughout a sphere. This mechanistic understanding is paramount for designing or optimising any hydrogel capsule.

Day:1-14:45:15:00

Ms Caroline Coxwell Mohler - University of North Carolina at Chapel Hill
OC107

Using Data Science for Mechanistic Insights in Free Radical Copolymerization Reactivity Ratios

Copolymerization is a powerful tool for tuning the properties of synthetic polymers. In chain-growth polymerization, copolymer microstructure is controlled by the relative reactivity of comonomers, quantified by copolymer reactivity ratios(RR). Yet the complex macromolecular reactivity captured by RR preclude the prediction of the of the resultant microstructures by first principles. The established theory to predict RR has not been updated substantially since the development of quantum mechanics. To address this gap in copolymerization theory, my lecture will detail our work leveraging DFT and data science to derive mechanistic insights into copolymerization theory. We developed multivariate regression models using computationally derived parameters that reflect the electronic, energetic, and sterics of monomer reactivity ratios. Our models are the first to demonstrate the impact of sterics on reactivity in copolymers and enable the prediction of RR for a wide suite of vinyl monomers.

Day:1-15:00:15:15

Mr Tomoaki Kanazawa - Graduate School of Engineering, Kyoto University
OC107

Radical Polymerization of Alkenyl Boronate and Side Chain Replacement for Syntheses of Poly(vinyl alcohol) Derivatives

In this work, we have used alkenyl boronic esters where boron atom is directly attached to the vinyl group as monomers in radical (co)polymerization for syntheses of the boron-pendant polymers as well as the polymers transformed via side-chain replacement of the pendant group. Particularly, our interests are directed to the following: radical (co)polymerization behaviors depending on protecting group on boron; controlled radical polymerization(1); transformation into hydroxy pendant for syntheses of poly(vinyl alcohol) derivatives; combination of different transformation reactions, Suzuki-Miyaura coupling and oxidation(2); syntheses of polymers inaccessible via conventional polymerization and post-polymerization reaction.

(1) Kanazawa, T.; Nishikawa, T.; Ouchi, M. Polym. J., 2021, 53, 1167–1174. (2) Kanazawa, T.; Nishikawa, T.; Ouchi, M. ACS Macro Lett., 2022, 11, 706–710.

Day:1-15:15:15:15
Ms Clara Scheelje - Karlsruhe Institute of Technology
OC107

Non-Isocyanate Polyurethanes from Terpene and Erythritol Feedstock using Organocatalysis and Thiol-Ene Reaction

A synthesis route towards building blocks for non-isocyanate polyurethanes (NIPUs) using renewable starting materials is presented. Based on terpenes and erythritol, five-membered cyclic carbonates were synthesized and ring-opened by amines with terminal double bonds. In this way, a scope of monomers bearing one or two urethane moieties and two terminal double bonds was obtained. In case of terpene-based cyclic carbonates, the ring-opening was promoted by thiourea compounds as benign and efficient organocatalysts. The obtained AA monomers served as building blocks for NIPU synthesis via step-growth thiol-ene polyaddition. The reaction with different dithiols yielded linear NIPUs under mild conditions. Variation of the dithiol and amine led to polymers with different properties, with Mn of up to 31 kDa and Tg's ranging from 1 to 29 °C. Introduction of polyfunctional thiols enabled the implementation of these urethane building blocks into cross-linked NIPU materials.

Day:1-16:00:16:15
Mr boyu zhao - boyu.zhao@warwick.ac.uk
OC107

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Day:1-16:15:16:30
Ms Bige Bati - University of Birmingham
OC107

Harnessing the Sustainable Potential of Poly(ethylene succinate) through Ring-Opening Polymerization: A Step Towards Eco-Friendly Packaging Solutions

Aliphatic polyesters, particularly poly(ethylene succinate) (PES), hold immense promise as sustainable alternatives to conventional plastics due to their tunable mechanical properties, biodegradability, and compatibility with various applications. While polycondensation, the traditional synthesis route for PES, faces limitations in terms of energy consumption, byproduct formation, and molecular weight control, ring-opening polymerization (ROP) emerges as a viable solution. This study investigates the synthesis and ROP of PES cyclic oligomers, evaluating the impact of catalysts, reaction time, and temperature on the polymerization process. The optimized ROP conditions yield high molecular weight PES polymers, paving the way for investigations into their barrier and thermo-mechanical properties for environmentally friendly and sustainable packaging applications.

Day:1-16:30:16:45
Mr Tianlai Xia - University of Birmingham
OC107

Tuning the Functionality of Self-Assembled 2D Platelets in the Third Dimension

Controlled two-dimensional (2D) nanostructures, such as multi-layered platelets, have a broad range of applications, including drug delivery, information storage, catalysis, electronics, and as stabilizers. The ability to selectively functionalize the surface of 2D nanostructures could will allow the tailoring of these materials for specific applications. Here, we utilized living crystallization-driven self-assembly (CDSA) to synthesize poly(caprolactone) (PCL)-based 2D platelets with controlled sizes and dimensions. This allowed us to selectively functionalize 2D platelets with spatial-control. Furthermore, this method could be used to regulate height and alter the fluorescent properties in selective layers on the platelets. This approach provides a versatile method to precisely control complex 2D self-assemblies and surface functionalize these exciting nanomaterials.

Day:1-
16:45:17:00

Ms Beth Jordan - Loughborough University
OC107

Microplastic mimics produced using RAFT mediated PISA

Microplastics have gained more attention recently due to the increase in awareness of the effects of plastic pollution on the global environment and on human health. The increased use of synthetic textiles in the last decades, coupled with recent emphasis on the accumulation of microplastic in the environment, has garnered interest into the effects of microplastic fibres. The use of mimics is a popular way to study the effects of microplastics. The aim of this project is to create microplastic mimics with ‘worm- like’ morphologies produced via the synthetic method of RAFT-mediated PISA.

Day:1-
17:15:18:00

Professor Brent Sumerlin -
BUTTERWORTH HALL

Polymer Science Meets Mucosal Medicine: UHMW Synthetic Alternatives

We have developed a photopolymerization route to well-defined ultra-high molecular weight (UHMW) (co)polymers. This photoiniferter polymerization approach reaches molecular weights in excess of 10^7 g/mol with degrees of polymerization above 100,000. We have recently begun investigating these polymers as mucin-mimetic compounds. Aberrant mucin production is associated with various biological phenomena, including cancer, inflammation, and infection. While recent developments in polymer synthesis have shown promise for developing new macromolecules as mucin replacements, most of these reports rely on designing mucin-mimetic copolymers that resemble the intricate biomolecular structure of these heavily glycosylated UHMW proteins. We have instead developed polymers that differ significantly from mucins in their structure but behave similarly by a careful balance of UHMW backbones with mucoadhesive functionality and have begun their evaluation for the treatment of a variety of gastrointestinal diseases, including gut mucosal deficiencies.

Day:2-
09:00:09:45

Professor Xi Zhang -
BUTTERWORTH HALL

Supramonomers for Controllable Supramolecular Polymerization: Towards Fabrication of Renewable Materials

The interplay between polymer science and supramolecular chemistry leads to the formation of various supramolecular polymeric systems, with their functions determined by self-assembling supramolecular structures. In general, there are two main approaches to fabricate supramolecular polymeric systems. In approach A, covalently linked polymers are used as building blocks to self-assemble into supramolecular polymeric systems on the basis of noncovalent interactions. In approach B, bi-functional monomers are designed and synthesized on the basis of covalent bonds, which can then self-assemble into supramolecular assemblies exploiting noncovalent interactions. When these supramolecular assemblies exhibit macromolecular chain-like structures, they are defined as supramolecular polymers. In this presentation, I will introduce the concept of supramonomer, which refers to a monomer that is fabricated by noncovalent interactions and is able to undergo covalent polymerization. By the covalent polymerization of supramonomers in solutions or at interface, supramolecular polymeric materials with desired renewability and robust mechanical properties can be fabricated. This line of research enriches the methodology of supramolecular polymerization and opens new avenues for fabricating supramolecular polymeric materials with tailor-made properties.

Day:2-
09:45:10:30

Professor Geoff Coates -
BUTTERWORTH HALL

New Catalysts for the Synthesis of Sustainable Polymers

Society depends on polymeric materials now more than at any other time in history. Although synthetic polymers are indispensable in a wide array of applications, ranging from commodity packaging and structural materials to technologically complex biomedical and electronic devices, their synthesis and disposal pose important environmental challenges. This lecture will focus on our research using catalysis to: 1) mechanically recycle polymers; 2) create chemically recyclable polymers; and 3) develop sustainable routes to biodegradable plastics.

Day:2- 11:00:11:30	**Professor Emily Pentzer - Texas A&M University ARTS CENTRE THEATRE**

Architecting Polymers and Their Composites for Energy Management

This presentation will describe the use of emulsions as a platform to synthesize composites of disparate materials. We developed 2D particles as surfactants for different fluid-fluid interfaces, including oil-water, oil-oil, and ionic liquid-oil, and combine the high interfacial area with simple polymerization approaches to fabricate hybrid structures. These include capsules with core of ionic liquid or phase change material for CO2 uptake and thermal energy management, respectively, or porous monoliths coated with transition metal carbide nanosheets for electromagnetic interference shielding. This work helps establish structure-function-application relationships, en route to developing new technologies.

Day:2- 11:30:12:00	**Assistant Professor Eleftheria Roumeli - University of Washington ARTS CENTRE THEATRE**

Using carbon sequestering microorganisms to form strong biodegradable plastics

In recent years, sustainable polymers have emerged as a promising avenue for addressing environmental concerns linked to non-renewable sourcing, environmentally harmful production processes, and the persistence of non-degradable plastics. Bioplastics, originating from biological sources, have gained substantial attention as potential substitutes for traditional, non-degradable plastics. Nonetheless, many bioplastics lack both bio-origin and biodegradability, often requiring controlled aerobic environments for degradation rather than readily decomposing in common end-of-life settings like landfills or natural environments.

This study introduces an innovative approach to crafting bioplastics utilizing renewable and abundant photosynthetic microorganisms, such as chlorella and spirulina. The investigation encompasses bioplastics derived from harvested biomass in the form of intact cells, shedding light on the interplay between processing parameters and resulting mechanical as well as thermal properties. Additionally, we report the biodegradation assessments through soil burial tests to demonstrate backyard compostability.

Day:2- 12:00:12:15	**Professor Andrew Dove - University of Birmingham ARTS CENTRE THEATRE**

Designing Polymers with the End in Mind

One of the unresolved consequences of the massive global production of plastic is the lack of proper waste management. As a consequence of technological limitations as well as inefficient collection and sorting methods, current recycling schemes are underperforming. In part this is a result of the inherent linear design of our polymer systems, and lack of consideration of waste management and environmental impact of the waste that does escape into the environment, at the polymer design stage. We, among others, are focussing on creating tools that could be applied to design polymers 'with the end in mind' – i.e. to incorporate chemical bonding that can be easily processed to make polymers but readily reversed either 'on demand' for recycling, or upon exposure to environmental triggers. The presentation will focus on our latest work in this area.

Day:2- 12:15:12:30	**Professor Louis Pitet - Hasselt University ARTS CENTRE THEATRE**

Strategies for upcycling diverse polyester waste streams

Thermoplastic copolyesters (TPC) are found in countless products, from cable insulation to airducts to phone cases. The wide range of suitable products derives from the versatile chemical makeup employed to tailor the properties. Nearly all of these materials have one common ingredient – polybutylene terephthalate. In particular, the terephthalate unit has a relatively large carbon output associated with its production. Production of virgin terephthalic acid is an energy intensive process, and essentially all TPCs are manufactured from virgin raw materials. This continues despite the fact that millions of tons of terephthalates are discarded every year in the form of PET beverage bottles and polyester fabric. We have been investigating the possible routes to transform discarded polyesters into TPCs by chemically harvesting the terephthalate units. By repurposing discarded materials, we are working toward dramatic reduction in CO2 output, and contributing to a circular plastic economy.

Day:2- 12:30:12:45	**Assistant Professor Kevin Neumann - Radboud University ARTS CENTRE THEATRE**

Zwitterionic polymeric ylides open a new generation of biofilm preventing materials

Zwitterionic polymers are versatile hydrophilic building blocks for applications in biomedical science including as antifouling coatings. So far, zwitterionic polymers were classified as either polyampholytes or polybetaines. However, the scope of zwitterionic polymer compositions remains severely limited and new forms of zwitterionic polymers are essential when designing innovative, new materials.

Recently, we unveiled the potential of polymeric ylides - a largely overlooked class of polymers - in preventing bacterial biofilm formation. Structurally, polymeric ylides differ significantly from polyampholytes and polybetaines by having the positive directly adjacent to the negative charge. We show that the hydrogen-bond acceptor capabilities of poly(ylides) and its selective toxicity towards bacterial cells makes it a powerful addition to the available toolkit of antifouling polymers.

Day:2- 14:00:14:30	**Professor Rachel Evans - University of Cambridge ARTS CENTRE THEATRE**

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Day:2- 14:30:15:00	**Professor Matthew Becker - Duke University ARTS CENTRE THEATRE**

Resorbable barrier polymers for flexible bioelectronics

Resorbable, implantable bioelectronic devices are emerging as powerful tools to reliably monitor critical physiological parameters in real time over extended periods. While degradable magnesium-based electronics have pioneered this effort, relatively short functional lifetimes have slowed clinical translation. Barrier films that are both flexible and resorbable over predictable timelines would enable tunability in device lifetime and expand the viability of these devices. Herein, we present a library of stereocontrolled succinate-based copolyesters which leverage copolymer composition and processing method to afford tunability over thermomechanical, crystalline, and barrier properties. One copolymer composition within this library has extended the functional lifetime of transient bioelectronic prototypes over existing systems by several weeks–representing a considerable step towards translational devices.

Day:2- 15:00:15:15	**Dr Benjaporn Narupai - Chulalongkorn University ARTS CENTRE THEATRE**

Additive Manufacturing of Polymeric Materials for Conductive Sensors

Conductive sensors hold great potential for wearable electronics, biomedical devices, strain sensor, and soft robotic applications. However, the preparation of these materials relied on conventional fabrication methods which limit geometries of the materials. Additive manufacturing is a versatile platform for the on-demand fabrication of objects with excellent spatial control of composition and architectures. While 3D printing can generate sophisticated object geometries, the 3D printable materials with good conductivity, mechanical properties, and elastic recovery are still highly limited. Herein, we developed 3D printable polymeric materials for stretchable conductive strain sensors. A variety of 3D printed designs including complex architectures, auxetic structures and lattice structures are reported. To demonstrate the versatility of this system, 3D printed structures were tested as a strain sensor showing real-time electrical responses to stretching, bending, twisting and compression loads. In addition, these materials showed strong adhesive behavior to various substrate surfaces which is highly desirable for wearable devices.

Day:2-
15:15:15:30

Dr Lihui Yuan - Institute of Chemistry, Chinese Academy of Sciences
ARTS CENTRE THEATRE

Gas Transport Properties of Poly(ether-b-amide) Segmented Copolymers: The Role of the Degree of Microphase Separation in Amorphous Regions

Polyether-based crystalline multiblock copolymers have been employed as membrane materials for removing CO2 from light gases. However, the influence of crystalline and amorphous regions on gas permeability needs to be deeply explored. In this work, the effect of phase structure, especially the degree of microphase separation in amorphous regions, on gas transport properties of poly(ether-b-amide) has been studied. It was found that the amorphous domain consists of two partially mixed phases enriched either with PTMO or with PA1012. The effect of annealing on the microphase structure was also investigated. The DPS was found to be inversely correlated with the crystallinity of hard segments. Gas permeability measurements confirmed that for PEBA membranes with lower crystallinity, weak microphase separation favors gas permeability. Overall, this work revealed the synergistic effects on gas permeability, providing valuable guidance to enhance the performance of gas separation membranes.

Day:2-
16:00:16:30

Professor Molly Stevens - University of Oxford
ARTS CENTRE THEATRE

Designing and translating biomaterials for advanced therapeutics and biosensing

This talk will provide an overview of recent developments in biomaterials for applications in advanced therapeutics and biosensing. We are developing creative solutions for targeted and controlled delivery for example by using photo-responsive nanoreactors inspired by circadian rhythms. Our therapeutic delivery portfolio includes also high molecular weight polymer carriers for enhanced delivery of saRNA therapeutics and polymersome based nanomimics for malaria treatment. We are exploiting the sensing capabilities of functionalised nanoparticles to engineer nanoprobes for in vivo disease diagnostics that produce a colorimetric response ideal for naked eye read-out and for CRISPR-based preamplification free detection of ncRNAs (CrisprZyme) which we have validated with cardiovascular disease patient samples. Finally, I will explore how these versatile technologies can be applied to transformative biomedical innovations and will discuss our efforts in establishing effective translation

Day:2-
11:00:11:30

Professor Zi-Chen LI - Peking University
ARTS CENTRE WOODS SCAWEN

Day:2-
11:30:12:00

Dr Sandra Schlögl - Polymer Competence Center Leoben GmbH
ARTS CENTRE WOODS SCAWEN

Catalytically controlling bond exchange reactions in dynamic polymer networks

Latent catalysts are a versatile approach to temporally and locally control the rate of bond exchange reactions and the related material flow in dynamic polymer networks. Herein, we explored novel families of photolatent transesterification catalysts to equip dynamic covalent networks with creep resistance as well as high bond exchange rate (once activated). By ensuring wavelength-dependent orthogonality between the curing and the activation reaction, spatially resolved rearrangement of the network topology in 3D printable dynamic photopolymers was obtained. We further studied thermolatent catalysts, whose activation is not limited by sample geometry and optical transparency of the materials. As proof of principle, the selective activation of dynamic transesterification was shown in fiber-reinforced and highly filled magneto-active thiol-ene polymer composites giving rise to the wide range of potential future applications offered by this concept.

Day:2-12:00:12:15	**Assistant Professor Qiao Song - SUSTech** **ARTS CENTRE WOODS SCAWEN**
Photo-functional Supramolecular Dyes Based on Self-assembling Cyclic Peptides	
In life, dyes are ubiquitous, creating a colorful world. However, in the field of science and technology, the role of dyes is not limited to presenting different colors; they also have broader applications, including photocatalysis, sensing, bioimaging, and more. Starting from organic chemistry, scientists can rationally tune the properties of dyes by varying the structures. Utilizing supramolecular chemistry, it is also possible to control and optimize their properties. We use self-assembling cyclic peptides as supramolecular scaffolds, leveraging them to control the aggregation state of dyes and the surrounding microenvironment. This allows us to optimize the properties of the dyes and even impart new functions, successfully constructing a series of photo-functional materials known as supramolecular dyes. In this presentation, I will focus on introducing our research progress in 3 aspects: ultrabright fluorescent materials, aqueous RTP materials, and supramolecular photosensitizers.	

Day:2-12:15:12:30	**Dr Marc Guerre - CNRS/Toulouse University** **ARTS CENTRE WOODS SCAWEN**
New generation of thermoplastic elastomers from well-defined all-(meth)acrylic ABA triblock copolymers made by RAFT	
Styrenic block copolymers (e.g., polystyrene–polybutadiene–polystyrene, SBS) are a well-established class of TPEs, which suffer from limited upper service temperatures due to the relatively low Tg value of the hard domains and limited UV and oxidation resistance caused by their unsaturated nature. Therein, we report a new symmetrical trithiocarbonate (TTC-bCP) with the best leaving group ever reported for RAFT which is particularly suited for the synthesis of narrowly dispersed poly(meth)acrylates of controlled molar mass. It allowed the preparation of a high molar mass (Mn ~135 kg mol-1) methyl methacrylate-n-butyl acrylate-methyl methacrylate triblock copolymer with unprecedented control (Đ = 1.04) for RAFT. In addition, Tg range of (meth)acrylic monomers is very broad enabling high tunability with regards to soft and hard blocks. via the introduction of rigid co-monomers such as isobornyl methacrylate into the hard outer blocks.	

Day:2-12:30:12:45	**Assistant Professor Maciek Kopec - University of Bath** **ARTS CENTRE WOODS SCAWEN**
Understanding degradability of polymer networks synthesized by conventional radical polymerisation with cleavable strands or crosslinks	
Using divinyl crosslinkers with cleavable groups (e.g., disulfides) seems like a straightforward method to synthesize degradable thermosets, elastomers or (hydro)gels from vinyl polymers. However, when prepared by conventional free radical polymerization (FRP), the resulting networks/gels often cannot be degraded despite the presence of the cleavable crosslinks. In this talk I will present our recent work on the effect of network topology, location of the cleavable bonds and polymerisation kinetics on degradability of networks prepared by FRP from acrylates, methacrylates, styrene, and acrylamides. Dense microgel clusters formed during crosslinking under FRP conditions will be discussed to inhibit degradation by preventing some of the crosslinks to be cut. Finally, strand-cleaving comonomers (i.e., thionolactones) will be shown as an alternative, facile approach to fully degradable vinyl polymer networks by FRP.	

Day:2-14:00:14:30	**Professor Miao Hong - Shanghai Institute of Orangic Chemistry, Chinese Academy of Sciences** **ARTS CENTRE WOODS SCAWEN**
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-	

Day:2-14:30:15:00	**Professor Antoine Buchard - University of Bath** **ARTS CENTRE WOODS SCAWEN**

Synthetic carbohydrate polymers from monosaccharides and nucleosides and their applications as functional materials

The intensive use of polymers has brought challenges associated with their overwhelming reliance on fossil-fuel resources, limited end-of-life options and environmental persistence. The incorporation of carbohydrate units into synthetic polymer backbones can help to create renewable materials with attractive attributes, including degradability and advanced functionalities.

This talk will first describe the design of bio-derived monomers from natural monosaccharides such as xylose and glucose, as well as from deoxyribonucleosides, and their polymerisation using techniques such as ring-opening (co)-polymerisation (ROP and ROCOP), acyclic metathesis polymerisation (ADMET), and thiol-ene polymerisation.

The resulting sugar-based polymers form a promising, tuneable, bio-derived and degradable material platform, and the first steps taken towards their commodity and specialty applications will be presented (e.g., UV-degradable films, solid polymer electrolytes, hydrogels).

Day:2- 15:00:15:30	**Assistant Professor Hatice Mutlu - Université de Haute-Alsace ARTS CENTRE WOODS SCAWEN**

Harnessing the possibilities of sulfur-decorated polymers

Polymer chemistry has attained the sophistication necessity to produce macromolecules with diverse structure, composition, and properties by implementing manifold reactions that are both exceptionally versatile as well as tremendously useful. In this regard, sulfur and its functional groups have been major players in this area of exciting research, and further have been utilized for the design and preparation of polymeric materials that lead to a plethora of applications. Hence, it is in great urgency and highly desirable nowadays to find cost-effective reaction conditions to prepare those materials with unprecedented properties. Respectively, we have developed synthesis protocols which proceeds with the merits of mild conditions, broad substrate scope, operation simplicity, metal-free and ambient conditions. Aside, we are reporting promising methods for the (catalytic) re-/up-cycling of the developed sulfur decorated polymers to reduce their potential environmental impact

Day:2- 16:00:16:30	**Professor Christopher Barner-Kowollik - Queensland University of Technology, (Centre for Materials Science, School of Chemistry and Physics) ARTS CENTRE WOODS SCAWEN**

Orthogonal, Synergistic and Cooperative Precision Photochemistry for Multi-Wavelength Additive Manufacturing

Over the last decade, our laboratory has employed monochromatic tunable laser systems to reveal a fundamental mismatch between the absorptivity of a chromophore and its photochemical reactivity in the vast majority of covalent bond forming reaction as well as specific bond cleavage reactions. Our data overturns the long-held paradigm that effective photochemical reactions are obtained in situations where there is strong overlap between the absorption spectrum and the emission wavelength. The lecture will demonstrate how a detailed action-plot driven precision mapping of photochemical reactivity enables the design of advanced multi-colour network formation and 3D printing modes with never-before-seen precision, exploiting wavelength orthogonal, synergistic, cooperative, and antagonistic photochemical reaction systems.

Day:2- 11:00:11:30	**Professor John Matson - Virginia Tech ARTS CENTRE CINEMA**

Synthesis of complex polymer topologies using reversible-deactivation radical polymerization and ring-opening metathesis polymerization

Ring-opening metathesis polymerization (ROMP), often in combination with various reversible-deactivation radical polymerization (RDRP) methods, can allow for the construction of complex polymer topologies due to its high functional group tolerance and living characteristics. Of particular interest to us are densely grafted comb polymers, also referred to as bottlebrush polymers. Our overall aims are to utilize ROMP and RDRP methods to synthesize bottlebrush polymers with unusual asymmetric structures (e.g., cones) and to probe how structure affects the conformation and properties of bottlebrush polymers. We apply kinetics studies to evaluate how macromonomer factors influence the rate of ROMP, use this knowledge to synthesize new types of bottlebrush copolymers with low dispersity and a high degree of structural homogeneity, and employ advanced characterization methods including small-angle neutron scattering (SANS) to characterize these materials. Applications include polymeric surfac

Day:2-11:30:12:00

Dr Marcela Mihai - Petru Poni Institute of Macromolecular Chemistry
ARTS CENTRE CINEMA

Polymeric nanomaterials based on natural polysaccharides functionalized by synthetic polymers

The synthesis of novel polymeric nanomaterials based on natural polysaccharides covalently or non-covalently functionalized with synthetic, water soluble, responsive, and biorelevant polymers is presented. RAFT polymerization process is used to facilitate the covalent attachment of functional polymer chains on polysaccharides, by grafting from or grafting to synthetic schemes, creating hybrid synthetic-biological polymers of advanced functionality and properties. Self-assembly processes, following principles from synthetic polymers physical chemistry, provide self-organized nano-assemblies using the hybrid polymers obtained. Polymers prepared by RAFT co-assemble with natural polysaccharides using electrostatic and H-bond interactions. Physicochemical studies in aqueous media provide information on the structure and properties of the designed nanostructures. The nano-assemblies are expected to act as nanocarriers and/or nanocontainers for medical and environmental applications.

Day:2-12:00:12:15

Ms Yelin HOU - Univ. Bordeaux, CNRS, Bordeaux INP
ARTS CENTRE CINEMA

SI-ATRP grafting of polymers from polydopamine-modified cellulose nanocrystals

Cellulose nanocrystals (CNCs) are increasingly considered as valuable biosourced building blocks for the elaboration of innovative materials for high-value applications in biotechnology, electronics, optics… The efficient use of CNCs is however conditioned by a fine control of their dispersive, interfacial and self-assembling properties, which can be achieved by Surface Initiated Atom Transfer Radical Polymerization (SI-ATRP). Here, we developed an original method based on polydopamine (PDA) chemistry in water, to attach Br initiating sites at the CNCs surface and subsequently graft polymers from these sites. Dopamine was polymerized on the CNCs surface in alkaline water to produce an intermediary PDA layer that was further reacted with bromoisobutyryl bromide. The as-prepared brominated particles were subsequently tested as potential ATRP macroinitiators by using methyl methacrylate and styrene as model monomers. Polymer growth kinetics and surface grafting densities were discussed.

Day:2-12:15:12:30

Assistant Professor Izabela Zaborniak - Rzeszow University of Technology
ARTS CENTRE CINEMA

Synthesis of multifunctional wood-polymer materials through surface-initiated atom transfer radical polymerization

Wood stands out as a highly durable material well-suited for both residential and commercial constructions. Despite its appealing properties, wood is susceptible to degradation caused by moisture. Wet conditions create an ideal environment for organisms that degrade wood, impacting its physical and mechanical properties. Improving or introducing new features, such as through polymer functionalization, becomes crucial. One innovative technique for modifying surfaces with polymers is surface-initiated atom transfer radical polymerization (SI-ATRP). This method enables precise manufacturing of polymer brushes with excellent control over polymer molecular weight, composition, and architecture. Consequently, various modifications of wood were carried out by the covalent attachment of polymers to impart hydrophobic, antibacterial, and antifouling properties. The resulting wood-polymer composites underwent extensive analysis using various spectroscopic, spectrometric, and microscopic methods.

Day:2-12:30:12:45

Mr Gianluca Gazzola - University of Padova
ARTS CENTRE CINEMA

Oxygen Tolerance During Surface-Initiated Photo-ATRP: Tips and Tricks for Making Brushes Under Environmental Conditions

Surface-initiated reversible deactivation radical polymerization (SI-RDRP) enables the fabrication of polymer-brush coatings with fully tunable and technologically relevant properties. However, the presence of oxygen can hamper RDRP processes, and thus the development of SI-RDRP techniques tolerant to environmental conditions is critical for the scalability of these surface modification methods. In this work, we focus on surface-initiated photoinduced atom transfer radical polymerization (SI-photoATRP) and demonstrate how a fine adjustment of both composition of reaction mixtures and polymerization setup enable to grow thick polymer brushes over large areas and without the need for deoxygenation of reaction mixtures. Efficient oxygen consumption can be achieved by judiciously adjusting the concentrations of the Cu-based catalyst and the "free" alkyl halide initiator in solution, finally enabling to perform SI-photoATRP within scalable and more practical settings.

Day:2-14:00:14:30

Professor Jan van Hest - Eindhoven University of Technology
ARTS CENTRE CINEMA

Polymer-based coacervates: structural and functional mimics of living cells

Compartmentalization is one of the key prerequisites for life. To better understand the role of compartmentalization, there is a need for model systems in which life-like properties are installed. Polymer-based compartments are robust and chemically versatile, and useful for the development of artificial cells. Here we discuss a synthetic cell platform composed of a complex polymer coacervate stabilized by a terpolymer-based semi-permeable membrane. The coacervate structure resembles the crowded environment in the cytoplasm in which enzymes can be loaded. Using scaffolding proteins we can take up and release proteins from the artificial environment. We have reconstructed the cellular architecture of a eukaryotic cell by incorporating artificial organelles and an artificial cytoskeleton. Finally, we can incorporate life-like features such as motility and communication, making these artificial cells a versatile platform to study and mimic biological processes.

Day:2-14:30:15:00

Assistant Professor Olivier Colombani - Le Mans Université
ARTS CENTRE CINEMA

Supramolecular polymeric nanocylinders with tunable dimensions formed by hydrogen bonding in solution: use of chemistry, process or external stimuli (light, oxidation)

Polymer bottle-brushes consist of a long linear polymer backbone so densely grafted with polymer side-chains, typically on every monomer unit, that it becomes rigid and extended, affording a cylindrical (1D) morphology. Such particles have already found applications in various fields in anti-fouling, nanolithography, templates for the design of inorganic nanocylinders, design of supersoft thermoplastic elastomers or medicine (drug delivery, sensing, signaling, detection). Nature also uses polymer bottlebrushes for joints lubrication, cell protection and lung clearance. Being able to control the dimensions of these nanocylindrical particles is relevant as it has an impact on their properties for the targeted applications.

An attractive strategy to this respect is to prepare polymer bottle-brushes through supramolecular association via cooperative hydrogen bonding in solution. In this presentation, it will be shown that this strategy allows a fine control over the characteristics of the nanocylinders via multiple parameters: length and chemical composition of the polymer arms, strength of the hydrogen bonding units, solvent, process, temperature. Moreover, it affords the possibility to trigger the dissociation of the nanostructures using external stimuli such as light or redox systems, sometimes in a reversible way. This versatility makes supramolercular bottle-brushes potential candidates for new applications in the field of material science.

Day:2- 15:00:15:30	**Professor Bin Hua - Zhejiang University ARTS CENTRE CINEMA**

Macrocycle-Based Solid-State Supramolecular Polymers

Supramolecular polymers, generated by connecting monomers through noncovalent interactions, have received considerable attention over the past years, as they provide versatile platforms for developing diverse aesthetically pleasing polymeric structures with promising applications in a variety of fields such as medicine, catalysis, and sensing. In the development of supramolecular polymers, macrocyclic hosts play a very important role. Benefiting from their abundant host-guest chemistry and self-assembly characteristics, macrocycles themselves or their host-guest complexes can self-assemble to form well-ordered supramolecular polymeric architectures including pseudopolyrotaxanes and polyrotaxanes. The integration of these topological structures into supramolecular polymeric materials also imbues them with some unforeseen functions. Current interests in macrocycle-based supramolecular polymers are mostly focused on the development of supramolecular soft materials in solution or gel-state, in which the dynamic nature of noncovalent interactions endows supramolecular polymers with a wealth of ,Äúsmart,Äù properties such as multi-responsiveness and self-repair capabilities. While the preparation of macrocycle-derived supramolecular polymers in the solid state is a relatively challenging but intriguing prospect, they are an important part of the field of supramolecular polymers. On one hand, the construction of macrocycle-based solid-state supramolecular polymers enables us to obtain new materials with novel properties and functions such as mechano-responsiveness. On the other hand, the molecular structures and arrangements in these materials are well identified by X-ray crystallography techniques, offering a direct visual representation of the supramolecular polymerization process. The analysis of the role of noncovalent interactions in these architectures allows us to design more sophisticated and elegant supramolecular polymers in highly rationalized and controllable manners.

Day:2- 15:15:15:30	**Mr Sebastian Städter - Universität Bayreuth ARTS CENTRE CINEMA**

Synthetic approaches to create functional benzene trisureas as building blocks for supramolecular polymer bottlebrushes

In supramolecular chemistry various complex nanostructures can be fabricated via the self-assembly of functional building blocks. The synthesis of the building blocks might, however, induce some challenges, in particular if macromolecules are considered. We have recently introduced benzene trisureas (BTUs) as a versatile supramolecular unit, which enable the self-assembly of accordingly modified polymers into supramolecular bottlebrushes. Here, we present an overview of different synthetic approaches to prepare these asymmetrically substituted BTUs. The reported synthetic approaches to these are quite challenging and limit the opportunities to introduce further functionalities. Therefore, we tested various routes to introduce the required urea groups including reactive carbonates, isocyanate chemistry or rearrangements. The individual steps were analyzed in detail to enable an evaluation of the best synthetic approach circumventing costly purification steps and providing high yields.

Day:2- 16:00:16:30	**Professor Kohzo ITO - The University of Tokyo ARTS CENTRE CINEMA**

Slide-Ring Materials for Circular Economy

We have developed a novel type of polymeric materials such as slide-ring (SR) materials and pseudo-polyrotaxane (PPR) nanosheet with cyclodextrins for circulular economy. In the SR materials, polymer chains are topologically interlocked by figure-of-eight cross-links.1) Hence, these cross-links can pass along the polymer chains freely to equalize the tension of the threading polymer chains similarly to pulleys. Recently, we have just reported the stretch induced crystallization of the SR gel, which leads to extremely high toughness and recoverability. The concept of the slide-ring gel is not limited to cross-linked gels but also includes elastomer, cross-linked polymeric materials without solvent. Accordingly it can be applied to wide area such as paints, rubbers, soft actuator, resins and so on. The slide-ring materials were used as a key technology to create tough and sustainable polymers.

Day:2-16:30:17:00

Professor Jeroen Cornelissen - University of Twente
ARTS CENTRE CINEMA

Biomacromolecular Assembly towards Functional Materials

Hybrid materials between biological and synthetic macromolecules can have interesting properties, as these materials combine the function and precision of biomacromolecules with the versatility of their synthetic counterparts. In recent years we have studied the assembly of (virus capsid based) proteins on a variety of scaffolds with different shapes and functions, such as charged polymers, nanoparticles, and DNA origami. Next to virus-based protein assemblies, Encapsulins are protein cages found in bacteria that have interesting properties with respect to (thermal) stability and cargo loading.

I will highlight our studies towards functional materials by combining synthetic compounds with plant virus-based protein and the latest results on the modification of biomacromolecular cages based on Encapsulins with triggered responses will be discussed. This work paves the way for further design, engineering, and production of protein-polymer materials, for different applications.

Day:2-11:00:11:30

Professor Craig Hawker - UC Santa Barbara
OC105

Accelerated Polymer Synthesis and Discovery

New strategies for the synthesis of discrete and sequence-defined macromolecules will be presented. In addition, bio-derived building blocks for adding functionality and degradability to traditional polymer networks and backbones discussed.

Day:2-11:30:12:00

Professor Tanja Junkers - Monash University
OC105

The polymer synthesizer: Making (nano)particles

Digital chemistry and data driven synthesis approaches have rapidly moved from being an oddity in the synthetic chemistry space to drivers in research. Machines are ultimately faster and more accurate in providing screening, optimization or scaling of synthesis than even experienced researchers. Robotic synthesis is enabled by a plenitude of methods, from actual mobile robots over liquid handler platforms to flow chemistry. All provide high throughput experimentation and ideally possess online monitoring qualities in order to allow for feedback-controlled synthesis.

Synthesis of polymers of almost all facets have by now been demonstrated in robotic synthesis procedures. Also particles have routinely been synthesized in this way, most prominently via flow chemistry techniques. In this contribution we will briefly discuss the advantages of data driven high throughput experimentation, and then turn to formation of nanoaggregates form amphiphilic block copolymers.

Day:2-12:00:12:30

Professor Ben Zhong Tang - The Chinese University of Hong Kong, Shenzhen
OC105

Accelerated Polymerizations on/in Water and Functional Polymers from Water

Water, as an omnipresent substance, plays a vital role in many aspects of our lives, ranging from sustaining living organisms to driving technological advancements. The exploration of organic reactions in water or utilization of natural water as a reactant has attracted significant attention due to their advantages, including unique reaction performance, environmental friendliness, and reduction of harmful wastes. In this talk, the recent research progress on new polymerization approaches involving water and monomers containing triple-bond functionalities such as diyne, isocyanides, and bromoalkynes will be introduced. Furthermore, several click polymerization methods in aqueous media will be discussed. The "on water" effect facilitates polymerization in aqueous media more effectively than in conventional organic solvents. Additionally, many luminogens possessing aggregation-induced emission and natural characteristics (BioAIEgens) are developed in a water system. The synthesized polymers, small molecules, and

BioAIEgens show unique characteristics and functions such as aggregation-induced emission (AIE), clusteroluminescence, bio-imaging ability, and stimuli-responsive response. With the aim of exploring polymerizations on/in water, we hope this talk could provide insight into polymerizations of water and triple-bond based monomers, as well as the preparation of functional materials under mild reaction conditions or through the utilization of water.

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Day:2- 14:00:14:30	**Professor Steven Armes - University of Sheffield OC105**

Polymerisation-induced self-assembly

Polymerisation-induced self-assembly (PISA) is a powerful and versatile technique for the rational synthesis of concentrated dispersions of block copolymer nano-objects of controllable size, shape and surface chemistry. In essence, an insoluble block is grown from one end of a soluble block in a suitable solvent. Once the growing block reaches a certain critical degree of polymerisation, micellar nucleation occurs and the soluble block then acts as a steric stabiliser. Unreacted monomer diffuses into the copolymer cores, which leads to a relatively high local concentration and hence a significant rate acceleration. Depending on the target diblock copolymer composition, the final copolymer morphology can be spheres, worms or vesicles. The design rules for PISA are generic: such syntheses may be conducted in water, polar solvents or non-polar solvents using reversible addition-fragmentation chain transfer (RAFT) polymerisation. Various examples of PISA will be discussed in this lecture.

Day:2- 14:30:15:00	**Dr Helen Willcock - Loughborough University OC105**

Sensing and imaging using polymer particles

Polymer particles are a robust platform for functional groups, and as such have wide ranging applications spanning a variety of industries. They can be formed by reproducible techniques such as reversible addition fragmentation chain transfer (RAFT) polymerization1 (for small particles typically <100nm) and emulsion or dispersion polymerization (for larger particles up to ~ 1 micron)2, with their morphology and size being confirmed using scattering and microscopy techniques.

Some of our recent examples of the synthesis and application of polymer particles in Magnetic Resonance Imaging (MRI) and sensing will be described. A new strategy for the preparation of MRI agents from polymerizable Gd containing metal complexes is shown3. In this work the effect of varying the monomer functionality and therefore polymer architecture is studied, and relaxivities more than 8 times that of the commercial contrast agent Gd-DOTA are obtained.

Day:2- 15:00:15:30	**Professor Steve Rannard - University of Liverpool OC105**

Transfer dominated Branching Radical Telomerisation (TBRT) as a new route to novel macromolecules

Telomerisation was first reported in the 1940s and has been reported throughout the last 80 years as a route to very small structures with a degree of polymerisation less than approximately 5 units. TBRT utilises free radical chemistries to form high molecular weight materials using the telomerisation of polyunsaturated starting materials and avoids gelation despite reaching 100% consumption of vinyl groups. The mechanism, scope, and unique features of TBRT will be described within a summary lecture, providing a view of the opportunities for new macromolecular synthesis and design.

Day:2-16:00:16:30 | **Dr Clare Mahon - Durham University**
OC105

Glycopolymer sensor arrays to detect bacterial pathoadaptation

Bacterial pathogens can evolve and diversify within hosts, leading to persistent infections that are highly challenging to treat. These evolutionary transitions can be difficult to detect even with state-of-the-art omics techniques, as multiple genetic changes can lead to the same phenotypic outcome. I will describe an array of diagnostic molecular probes that can discriminate bacterial pathogens based on phenotypic variation in their surface properties linked to important pathoadaptations. This approach could provide the underpinning technology for new diagnostic tools to map the progress of persistent bacterial infections and inform treatment strategies.

Day:2-16:30:17:00 | **John Filip Anies - KAUST**
OC105

Carboranyl main chain polymers for organic electronics

Day:2-11:00:11:30 | **Professor Frank Leibfarth - University of North Carolina Chapel Hill**
OC003

New Approaches toward Stereoselective Polymerization

The stereochemistry of polymers is intimately linked to their resultant material properties. Despite the well-developed stereoselective methods for the polymerization of propylene and other nonpolar a-olefins, general approaches to the stereoselective polymerization of other monomers are less developed. In this lecture, I will discuss how our group uses principles of modern asymmetric catalysis to control the stereochemistry for a variety of polymers where stereocontrolled variants were previously challenging to access. First, I will describe our group's work demonstrating that asymmetric ion pairing catalysis as a general conceptual approach to control stereochemistry during cationic polymerization. Second, I will introduce our recent discovery of a stereoconvergent ring-opening polymerization, where a racemic mixture of monomers is transformed into an enantioenriched isotactic polymer. The structure–property relationships of the novel materials developed will be dedcribed.

Day:2-11:30:12:00 | **Dr Jennifer Garden - University of Edinburgh**
OC003

Multimetallic Cooperativity: From Catalysts to Copolymers

Mixed-metal (heterometallic) complexes often outperform their homometallic analogues, displaying activities and selectivities that are "greater than the sum of their parts". This lecture will describe strategies to harness mixed-metal cooperativity in cyclic ester ROP, which can enhance the catalytic efficiency by up to 10 times compared to the monometallic analogues. However, the choice of the heterometal is key; not all heterocombinations lead to enhanced catalyst performance. Multiple factors influence heterometallic cooperativity, including the metal coordination geometry, available monomer coordination sites and the ligand flexibility. This lecture will also demonstrate the powerful potential of heterometallic cooperativity in the synthesis of block copolymers tailored for recyclability, highlight trade-offs between activity and control, and reveal how the careful choice of the second metal is essential to generate well-defined block copolymer microstructures.

Day:2-
12:00:12:15

Professor Jeung Gon Kim - Jeonbuk National University
OC003

Mechanochemical Recycling of Polycarbonates and Polyesters

In our study, we introduce an environmentally friendly and cost-effective method for the chemical recycling of common polycarbonates and polyesters, including poly(bisphenol A carbonate), poly(ethylene terephthalate), and poly(lactic acid). This process uses mechanochemical ball-milling to treat a mixed plastic and methanol composition. This approach effectively breaks down these materials into their monomeric or useful chemical components, which are already in high demand. Our findings highlight that the main energy requirement lies in achieving physical contact among the reactants, rather than the methanolysis reaction itself. The mechanochemical ball-milling process ensures adequate contact and energy transfer between the plastics and methanol, thus removing the necessity for additional solvents and catalysts. This study presents a viable, low-input, and straightforward method for the sustainable chemical recycling of these plastics.

Day:2-
12:15:12:30

Dr Claire Seitzinger - Utrecht University
OC003

Elucidating the radical mechanism of mechanochemical recycling in polyolefins

Mechanochemistry, or causing chemical changes with mechanical energy, is an exciting opportunity for recycling plastics. It is known from mechanical recycling and melt processing that mechanically strained polymers decrease in molar mass. Initial studies have begun to harness this phenomenon to depolymerize polyolefins. However, the mechanism of depolymerization, which is proposed to proceed via a radical mechanism, is poorly understood. Our research focuses on polypropylene degradation to monomer and short-chain hydrocarbons via ball mill grinding. Here, I will discuss insights into the radical mechanism of mechanochemical breakdown by introducing spin traps and radical scavengers to quantify and identify radical species using spectroscopic techniques. ESR and IR spectroscopies were used ex situ for bulk measurements at discrete timepoints, and Raman spectroscopy preliminarily used with an in situ milling jar equipped with a transparent window to gain kinetic insights.

Day:2-
12:30:12:45

Assistant Professor Feng Li - Hokkaido University
OC003

Chemically Recyclable Unnatural Polysaccharides Synthesized from Cellulosic Biomass

Day:2-
14:00:14:30

Professor Megan Robertson - University of Houston
OC003

Enabling Polyolefin Circularity through Upcycling and Compatibilization of Plastic Waste

Day:2-
14:30:15:00

Professor Margaret Sobkowicz - UMass Lowell
OC003

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Day:2-
15:00:15:13

Professor Ema Žagar - National Institute of Chemistry, Slovenia
OC003

Insight into Chemical Recycling of Flexible Polyurethane Foams

The presentation focuses on the chemical recycling of flexible PU foams, which are bulky, thermoset materials for which incineration, landfilling or mechanical recycling are not suitable methods for treating this type of waste. We will present the advantages and disadvantages of different methods of degradation of flexible PU foams in terms of the type and amount of reagent used and other experimental conditions that influence the degree of degradation of the urethane and urea groups in the PU foam structure and the formation of unwanted side products. The influence of the end group types of recycled polyols on the quality of flexible PU foams synthesized from recycled polyols will also be discussed.

References
1. M. Grdadolnik, E. Žagar, et al. ACS Sustain. Chem. Eng. 2022, 10, 1323.
2. B. Zdovc, E. Žagar, et al. Macromolecules 2023, 56, 3374.
3. M. Grdadolnik, E. Žagar, et al. ACS Sustain. Chem. Eng. 2023, 11, 10864.

Day:2- 15:14:15:30	**Assistant Professor Tom McDonald - University of Manchester OC003**

A Data-Driven Analysis of HDPE Post-Consumer Recyclate for Sustainable Packaging

The packaging industry faces mounting demand to integrate post-consumer recyclate (PCR) and mitigate the environmental impact of plastics. However, the complex structure-property relationships of PCRs often obscure their performance compared to virgin equivalents, posing challenges in selecting suitable PCRs for applications. Focused on high-density polyethylene (HDPE), this study presents the most extensive characterisation of HDPE PCR to date, encompassing 23 resins (3 virgin, 20 PCR). Employing Fourier-transform infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), rheology, colour analysis, and mechanical testing, we established a feature-rich dataset with 56 distinctive characteristics. Utilising a data science approach, with the virgin samples as a benchmark, we identified that combining FTIR, TGA and mechanical testing provided effective identification of PCRs that closely match the properties of virgin HDPE. The pipeline create

Day:2- 16:00:16:30	**Professor Blair Brettmann - Georgia Institute of Technology OC003**

Informatics-Driven Design of Solvent Systems and Depolymerizable Polymer Materials for Improved Plastics Recycling

High thermomechanical stability is desirable for polymer applications, but this durability comes at the cost of insolubility and non-recyclability. To address this, we must overcome the fundamental disconnect between polymer stability and reprocessing, degradation and recycling. This requires simultaneous innovation in materials design to expand the range of compositions that display high performance and in polymer degradation to reprocess such materials on demand. We address these through research focused on predicting polymer solubility to expand the processability of polymers and through dual-tunable and reprocessable composites. We focus on improving methods for high throughput measurement of polymer solubility and integration with machine learning to enable selection of green solvents. Additionally, we expand the available plastics with desirable mechanical properties that are recyclable by designing composites with covalent adaptable networks that incorporate particles.

Day:2- 16:30:17:00	**Dr Scott Trenor - Association of Plastic Recyclers OC003**

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Day:2- 11:00:11:30	**Professor Joe Patterson - University of California, Irvine ARTS CENTRE STUDIO**

Understanding polymer self-assembly with Liquid and Cryo EM

Polymers are capable of self-assembling in solutions to create a diverse array of hierarchical structures. However, understanding the specific mechanisms behind these self-assembly processes poses significant challenges. In this study, we demonstrate that employing both liquid and cryo-electron microscopy together offers a highly effective method for unraveling the intricate details of polymer self-assembly pathways. This approach not only reveals the structural complexities but also provides insights into the dynamic aspects of hierarchical polymer organization.

Day:2- 11:30:11:45	**Dr Yujing Chang - University of Warwick** **ARTS CENTRE STUDIO**

Fluorescently labelled polymers synthesis via Cu-mediated RDRP

The "flat" initiator "Hostasol-bib" with fluorescent properties was synthesised and used for Cu mediated RDRP. A series of P(tert-butyl acrylate)s were produced then successfully hydrolysed into hydrophilic poly(acrylic acid)s. The fluorescent properties and self-assembly behaviour in water was characterised. Subsequently, a group of Hostasol-P(tBA)-co-P(PEGA) copolymers were synthesised. The dynamic surface wrinkling of block copolymer thin films induced by electron beam and gold sputtering were monitored under SEM.

Day:2- 11:45:12:00	**Ms Swarnali Neogi - University of Surrey** **ARTS CENTRE STUDIO**

Cationic Ring-opening Polymerisation of a Thionolactone to Produce Recyclable Materials

With rising concern over plastic waste accumulation worldwide, chemically recyclable polymers hold the potential to battle the challenge by leading towards a circular polymer economy. Thionolactones such as dibenzo[c,e]oxepine-5(7H)-thione (DOT) are known monomers to introduce labile linkages in the otherwise non-degradable backbone of vinyl polymers by ring-opening polymerisation. Here, the cationic ring-opening homopolymerisation (CROP) of DOT will be presented. Several cationic initiators have been found to successfully initiate CROP of DOT presumably generating a benzylic cation by ring-opening. This cation, when added to the thionolactone functional group of another DOT molecule, forms cleavable thioester groups in each repeat unit of the homopolymer (polyDOT). While both aminolysis and thiolysis produce successful degradation, the later causes polyDOT to depolymerise completely to the isomer of DOT dibenzo[c,e]thiepan-5(7H)-one (DTO) at room temperature promising for recycling.

Day:2- 12:00:12:15	**Associate Professor Jin Huang - Nanjing Tech University** **ARTS CENTRE STUDIO**

Ring-opening Polymerization of Macrocyclic Carbonate and Their Selective Depolymerization

Rapid growth in global plastic consumption in combination with fragile waste management systems has raised environmental concerns worldwide. To address these concerns, the process of deploymerization has been given due attention that helps in converting plastic waste into monomers which are reused for producing plastic polymers. In this regards, insights into the kinetics and thermodynamics of ring-opening polymerization (ROP) of the macrocyclic carbonates (MCs) are essential to develop fast and energy-efficient polymerization and subsequent recycling methods. Therefore, our endeavour to understand the kinetic behavior and alter thermodynamic polymerization of macrocyclic carbonate was made, where various catalytic strategies including carbene-mediated, alkaline cation-assisted, and anionic polymerization were developed. This study enables the synthesis of more advanced aliphatic polycarbonate structures and architectures and tune properties to replace petroleum-based plastics.

Day:2- 12:15:12:30	**Ms Irene De Franceschi - Ghent University** **ARTS CENTRE STUDIO**

Soluble Support for Sequence-defined Polymers: from design and platform development towards material applications

The incorporation of soluble supports in polymer synthesis provides a combination of solution and solid-phase benefits, offering a scalable and effective strategy. Through the utilization of a thiolactone-based protocol alongside a monodisperse support, the synthesis of sequence-defined oligomers becomes cost-effective but also easily purified. This versatile approach is further exemplified by a newly introduced Fmoc-based protocol, to synthesize sequence-defined oligoamides, with improved thermal stability in a one-pot synthesis. The protocol is optimized using amino γ butyric acid (GABA) and library of functionalized unnatural amino acids. Linear sequence-defined oligoamides are synthesized using these monomers. Moreover, a bidirectional growth approach is proposed as a greener alternative that reduces the number of synthetic steps to obtain telechelic sequence-defined oligoamides. The latter are finally used as macromers for the preparation of polymer networks.

Day:2-
12:30:12:45

Ms Emily Brogden - University of Wawick
ARTS CENTRE STUDIO

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Day:2-
14:00:14:15

Dr Anaïs Pitto-Barry - CNRS
ARTS CENTRE STUDIO

Block copolymers for the delivery of inorganics

Polymer assemblies have gained significant attention in nanotechnology owing to their capacity to encapsulate small molecules and protect them from early degradation.1 Recently, there has been a growing interest in exploiting polymer assemblies for the delivery of inorganic compounds.2 Inorganic complexes have unique properties that make them desirable but their incorporation into polymeric systems presents unique challenges owing to their inorganic nature.3

In this presentation, we will discuss strategies we work with for the delivery of inorganics (boron esters and ruthenium complexes) for anticancer therapy.4-6

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2. C. Yi, Y. Yang, B. Liu, J. He, Z. Nie Chem. Soc. Rev. 2019, 49, 465
3. N. P. E. Barry, P. J. Sadler ACS Nano 2013, 7, 5654
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Day:2-
14:15:14:30

Ms Anna Morrell - University of Leeds
ARTS CENTRE STUDIO

The Production of Polysarcosine-Containing Nanoparticles by N-Carboxyanhydride Ring-Opening Polymerization-Induced Self-Assembly (NCA ROPISA)

NCA ROPISA offers a convenient route for generating poly(amino acid)-based nanoparticles in a single step, crucially avoiding the need for post-polymerization self-assembly. Most examples of NCA ROPISA make use of a poly(ethylene glycol) (PEG) hydrophilic stabilizing block, however this non-biodegradable, oil-derived polymer may cause an immunological response in some individuals. Alternative water-soluble polymers are therefore highly sought. This work reports the synthesis of wholly poly(amino acid)-based nanoparticles, through the chain-extension of a polysarcosine macroinitiator with L-Phenylalanine-NCA (L-Phe-NCA) and Alanine-NCA (Ala-NCA), via aqueous NCA ROPISA. The resulting polymeric structures comprise of predominantly anisotropic, rod-like nanoparticles, with morphologies primarily influenced by the secondary structure of the hydrophobic poly(amino acid) that enables their formation.

Day:2-
14:30:14:45

Mr LAIHUI XIAO - University of Birmingham
ARTS CENTRE STUDIO

Enhancing the Scalability of Crystallization-Driven Self-Assembly Using Flow Reactors

Living crystallization-driven self-assembly (CDSA) has proven a versatile method to access uniform 2D platelets of various sizes, however its application has been constrained by low concentration and small-scale limitations. Flow reactors, offer advantages in heat and mass transfer, scalability, control, and safety over batch counterparts and present a promising method for enhancing platelet throughput. In this study, we initially transferred the epitaxial growth of platelets to flow reactors to explore optimal conditions. Subsequently, traditional living CDSA, utilizing conventional one-dimensional seeds, was conducted in flow to enhance scalability and uniformity. To further boost throughput and efficiency, all CDSA procedures were transitioned to flow reactors, enabling the direct formation of uniform platelets from polymers. We anticipate that this technology will be pivotal in realizing the commercial application potential of nanomaterials.

Day:2-
14:45:15:00

Mr Emiel Pattyn - Ghent University
ARTS CENTRE STUDIO

From scientific curiosity to real life applications? The living cationic ring-opening polymerization of 2-ethylthio-2-oxazopine

While the five-and six-membered 2-oxazoline and 2-oxazine cyclic imino ethers have been extensively used as monomers for living cationic ring-opening polymerization (CROP), their seven-membered ring counterparts, the 2-oxazopines, have virtually remained unexplored, both regarding their synthesis and CROP. In our previous work, we demonstrated for the first time that the synthesis and CROP of 2-phenyl-2-oxazopine is possible, albeit it showed very slow polymerization and only oligomers were formed. Encouraged by these initial results, we created a novel 2-ethylthio-2-oxazopine monomer in this work, which wsawas hypothesized to be more suitable for polymerization. To gain a better understanding into the polymerization behavior and the ring size effects kinetic studies were performed on the CROP of the 2-oxazopine and compared with the kinetics of the five-and six-membered analogues. Further mechanistic insides were elucidated through DFT calculations and MALDI-TOF spectra were used to g

Day:2-
15:00:15:15

Mr Matthew Farmer - University of Sheffield
ARTS CENTRE STUDIO

Efficient Synthesis of Hydrolytically Degradable Block Copolymer Nanoparticles via Reverse Sequence Polymerization-Induced Self- Assembly in Aqueous Media

Hydrolytically degradable block copolymer nanoparticles are prepared via reverse sequence polymerization-induced self-assembly (PISA) in aqueous media. This efficient protocol involves the reversible addition-fragmentation chain transfer (RAFT) polymerization of N,N'-dimethylacrylamide (DMAC) with a trithiocarbonate-capped poly(ε-caprolactone) (PCL) precursor. DMAC monomer is used as a co-solvent to solubilize the PCL. At an intermediate DMAC conversion, the homogeneous reaction mixture is diluted with water to 10-25% w/w solids and the growing amphiphilic block copolymer chains undergo nucleation to form PCL-core nanoparticles with PDMAC coronas. Hydrolytic degradation occurs in days at 37 °C in acidic or alkaline solution. Degradation is also observed in pH 7.4 solution at 37 °C. However, no degradation is seen over twelve weeks when these nanoparticles are stored at 20 °C in deionized water. Finally, these nanoparticles are evaluated as a dispersant for an agrochemical formulation.

Day:2-
15:15:15:30

Ms Erika Paola Fonseca Parra - Lorraine University
ARTS CENTRE STUDIO

Kinetic and morphological insights into photo-RAFT polymerization induced self-assembly

Polymer Induced Self Assembly (PISA) process has attracted a great deal of interest due to its ability to produce polymeric nano-objects (no) in situ, in water or in organic solvents, in a single step.In addition to its versatility, this process has the advantage of producing concentrated dispersions, which is an advantage for future large-scale production.The emulsion PISA process is of great potential value because it can be applied to a wide range of monomers, however, only nano-objects with kinetically trapped morphologies (spheres) are generally reported in the literature.The aim of this work is to further investigate the PISA process in emulsion by using photo-RAFT polymerization,to overcome its scientific and technological barriers and thus provide access to nano-objects with advanced morphologies such as vesicles.Our results show a significant influence of the composition of the reaction medium on the kinetic of the polymerization and the characteristics of the formulated no.

Day:2-
16:00:16:30

Professor Yohann Guillaneuf - Aix-Marseille University
ARTS CENTRE STUDIO

Radical Ring-Opening Polymerization as a Powerful Tool to Prepare Degradable Materials

Polymers' light weight, low cost, and, importantly, stability under thermal, chemical, and mechanical stress make them valuable for a range of demanding applications. This stability, on the other hand caused environmental pollution. Since it is very difficult but also very expensive to design brand-new materials that could both have the desired properties (mechanical, thermal, solvent resistance, etc.) and that are in the same time either recyclable and/or biodegradable, transforming already known materials to make them biodegradable/recyclable is more interesting. This approach relies on the introduction of labile bonds onto the polymer backbone. The degradation could thus occur from these weak bonds leading to oligomers that could be easily recyclable and/or bioassimilable.

A simple and useful method of incorporating weak bonds randomly onto the C−C polymer backbone is by radical copolymerization of vinyl monomers with cyclic monomers via radical ring-opening polymerization (rROP).

Day:2- 16:30:16:45	**Dr Richard Whitfield - ETH Zurich ARTS CENTRE STUDIO**

Solvent-Free Chemical Recycling of Polymethacrylates made by ATRP and RAFT polymerization: High-Yielding Depolymerization at Low Temperatures

Although controlled radical polymerization is an excellent tool to make precision polymeric materials, reversal of the process to retrieve the starting monomer is far less explored despite the significance of chemical recycling. Here, we investigate the bulk depolymerization of RAFT and ATRP-synthesized polymers under identical conditions. RAFT-synthesized polymers undergo a relatively low-temperature solvent-free depolymerization back to monomer thanks to the partial in situ transformation of the RAFT end-group to macromonomer. Instead, ATRP-synthesized polymers can only depolymerize at significantly higher temperatures (>350 °C) through random backbone scission. To aid a more complete depolymerization at even lower temperatures, we performed a facile and quantitative end-group modification strategy in which both ATRP and RAFT end-groups were successfully converted to macromonomers. The macromonomers triggered a lower temperature bulk depolymerization with an onset at 150 °C yielding

Day:2- 16:45:17:00	**Dr Nethmi De Alwis - ETH Zurich ARTS CENTRE STUDIO**

Comprehensive investigation into the depolymerization of bifunctional polymers synthesized through RAFT Polymerization

Reversibility in RAFT polymerization, explored under thermal and photothermal conditions, focuses on depolymerization studies of polymers synthesized with monofunctional CTAs. However, it's crucial not to overlook that multifunctional CTAs commonly synthesize polymers with distinct architectures. To date extending depolymerization studies to polymers with different functionalities remains a critical gap. As a pivotal step towards understanding the depolymerization dynamics of multifunctional polymers, this study investigates bifunctional polymers using specific CTAs: 1,4-phenylenebis(propane-2,2-diyl) dibenzodithioate (terminal bifunctional CTA) and bis(2-phenylpropan-2-yl) benzene-1,4-bis(carbodithioate) (mid-bifunctional CTA). Polymerization with these CTAs yields polymers featuring RAFT end groups at both ends and in the middle of the chains. Comparing the depolymerization behavior of these polymers with monofunctional ones enhances our understanding of their unique characteristics.

Day:2- 11:00:11:30	**Professor Devon Shipp - Clarkson University OC002**

Poly(Methacrylic Anhydride) and its Copolymers: Polymerization, Functionalization, and Properties

Cyclopolymerization of methacrylic anhydride (MAA) by conventional radical polymerization using cobaloxime boron fluoride (CoBF) as a chain transfer agent allows high conversion synthesis of fully soluble cyclo-poly(methacrylic anhydride) (PMAA). Specifically, soluble PMAA was attainable even at moderate MAA concentrations with no crosslinking in the presence of CoBF. This was achieved by studying various MAA concentrations and temperatures with and without CoBF and examining the impact these parameters have on the PMAA microstructure, including the acyclic, cyclic, and crosslinked forms. Furthermore, one intriguing property of these polymers is the ability of the anhydride moiety to undergo dynamic covalent exchange, thus allowing PMAA to form the basis of potential covalent adaptable network (CAN) systems.

Day:2-11:30:11:45	**Dr Luke Broadbent - Aston University** **OC002**

Synthesis of Styrene-Maleic Acid Copolymers for the Extraction of Membrane Proteins

Styrene-maleic acid (SMA) copolymers are used to extract membrane proteins from biological membranes, keeping the surrounding lipids, unlike when extracting with detergents, benefitting the stability of the protein. SMA is the hydrolysed form of styrene-maleic anhydride (SMAnh). Commercial SMA polymers, such as SMA2000, exhibit broad molecular weight distributions and do not possess the advertised 2:1 molar ratio of styrene-to-maleic anhydride.

We have synthesised a range of SMAnh copolymers targeting a 2:1 styrene-to-maleic anhydride molar ratio using reversible addition-fragmentation chain-transfer (RAFT) polymerisation. SMAnh copolymers of varying chain lengths were synthesised with molar ratios of 1.87-2.45:1, compared to 4.23:1 for SMA2000. Novel SMAnh based polymers comprising SMAnh and monomers with either amide, carboxylic acid or hydroxyl functionality will be synthesised with the aim of incorporating membrane proteins into a polymeric membrane to be used as a filter.

Day:2-11:45:12:00	**Mr Oluwaseyi Ajala - Hiroshima University** **OC002**

The Origin of the Two Major Types of Double Bond Containing structures in poly(β-pinene) obtained by Cationic Polymerization of β-pinene with Lewis/Brønsted Acid Catalysts

Generally, poly(β-pinene) gave absorptions of the endo-olefin in the cyclohexene unit at 5.2 – 5.5 ppm containing two olefinic protons. The signal around 5.3 ppm containing 1,4-cyclohexenyl sequences has been fully characterized by previous studies. However, the possibility of differently substituted cyclohexenyl sequences in poly(β-pinene) by assigning the signal around 5.2 ppm has not been investigated. Therefore, this study introduces the possibility of significant amount of the 1,3-cyclohexenyl sequences in the poly(β-pinene) microstructure and also introduces the use of a new boron-based catalyst in achieving moderate control of stereospecificity in the cationic polymerization of β-pinene.

Day:2-12:00:12:15	**Ms Solène LE ROUX - Institut Parisien de Chimie Moléculaire - UMR 8232** **OC002**

Cationic Reversible Addition-Fragmentation chain Transfer applied to oxazolines polymerization

Oxazolines are usually polymerized via a cationic ring-opening polymerization (CROP) mechanism. Cationic RAFT polymerization has recently been applied to the polymerization of vinyl ethers or styrene derivatives in the presence of transfer agent. While cationic RAFT polymerization of olefins is drawing large attention, no comparable investigation has been undertaken for heterocycles such as oxazolines. In the present study, polymerization of oxazolines was conducted in the presence of various CTA and a small amount of cationogen. Demonstration of reaction of CTA with oxazolinium growing chains was first assessed. Then polymerizations in the presence of CTA were carried out. The relationship between CTA concentration and Mn was established. Kinetic studies were performed to demonstrate the expected CRAFT-ROP mechanism. Final structures were characterized by 1D/2D NMR, and DOSY, chain ends assessments were achieved by MALDI-ToF. Molar masses were evaluated by SEC.

Day:2- 12:15:12:30	**Dr Philippa Jacob - University of Nottingham OC002**

Poly(glycerol adipate) variants as enhanced nanocarrier replacements in drug delivery systems

Poly(glycerol adipate) (PGA) is a bioderived polyester with great potential for use in drug delivery applications as a result of its biocompatibility, ability to self-assemble into nanoparticles (NPs), and pendant hydroxyl groups facilitating post-polymerisation functionalisation. However, limitations including poor NP stability and weak drug-polymer interactions limit the applicability of this polymer. This work investigates the one-pot synthesis of modified PGAs, introducing new functionalities into the polymer backbone. The newly incorporated functional groups were accessible in post-polymerisation modifications and rebalanced the amphiphilicity of the polymers resulting in improved self-assembly and small molecule encapsulation. The polymer NPs were proven to be non-toxic in in vitro tests, and in vivo screening in C. elegans demonstrated good biocompatibility. These findings highlight the potential of modified PGAs in overcoming the drawbacks of PGA in the drug delivery field.

Day:2- 12:30:12:45	**Mr Aitor Hernandez Toribio - Ghent University - Polymer Chemistry Research Group OC002**

From commercial copolymers to thermally resilient and reprocessable polymer networks

Dissociative Covalent Adaptable Networks (CANs) are crosslinked materials that exhibit flow properties due to the reversible loss and exchange of crosslinks when subjected to triggers, such as elevated temperatures. In this study, we developed CANs derived from industrially available styrene-maleic anhydride copolymers including monoester or monoamide functionalities. In stark contrast to previous monoester and other cyclic anhydride-based materials, these versatile and scalable curing procedures allowed the preparation of CANs with remarkably high thermal resilience, good retention of their rheological, mechanical, and thermal properties, without any indication of previously observed elevated temperature induced side reactions (i.e. T > 210°C). This is attributed to a specific macromolecular architecture, which changes the thermodynamic and kinetic landscape of the reactive monoester/monoamide moieties, reaching flow rates adequate for continuous processing methods such as extrusion.

Day:2- 14:00:14:30	**Professor Bruno Ameduri - Institute Charles Gerhardt, Montpellier France OC002**

On the Overall situation of Poly- or perfluoroalkyl substances (PFASs) and Recycling of Fluoropolymers

PFASs are divided into two main families, differentiated by their molecular weights (MWs). The first one encompass non-polymers and oligomers. They display major issues of bioaccumulation, persistency, toxicity and mobility, because of their low MW-structure or after some degradation. These PFASs are under severe restricted and drastic regulations are currently proceeding. In contrast, fluoropolymers (FPs), endowed with outstanding properties and involved in High Tech applications are not prone to face such hazardous limitations. They have high molar-masses, are non- bioaccumulative and non-toxic, fulfilling the PLC criteria. Though the global production of FPs is less than 0.1% of plastics, its growth rate is 8%. Progress has been made in the last decade where several FP manufacturers have modified their production using non-fluorinated surfactants. They have also found solutions to depolymerize, recycle ("close the loop" on pilot plant) or reuse FPs also covered in that presentation.

Day:2- 14:30:14:45	**Professor Wolfgang Binder - Martin-Luther University Halle Wittenberg OC002**

Designed nano-compartimentized single chain nanoparticles: resonsive and functional

Single-chain nanoparticles (SCNPs) are polymeric nanoparticles generated by intramolecular collapse and crosslinking of single polymer chains. They can mimic natural enzymes, making them perfect candidates for numerous applications, such as for imaging, drug delivery and catalysis. We previously have designed amphiphilic, core-shell structured SCNPs (sized ~ 5 ,Äì 8 nm) for the covalent encapsulation of fluorescence and EPR labels. Spectroscopic methods prove the formation internal compartmentalized structures (~ 1 nm) with multiple labels inside the hydrophobic core of the SCNP. Those nanosized compartments can be applied for photoacoustic imaging and as nanosized reactors. We here report on the precise tuning of such internal compartments by embedding functional and responsive reactive sites, such as N heterocyclic carbenes (NHC) for mechanochemical activation and photoacoustic imaging. References : Hoffmann, Binder et. al.; Angew. Chemie 2021, 60,7820,Äì7827. (b) Th√ºmmler, Binder et. al.; Chem. Commun. 2023, 59, 11373. (c) Alqaisi, Binder et. al.; Polym. Chem. 2024, accepted. (d) Th√ºmmler, Binder et. al. MRC 2023, 44, 2200618.

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<tr><td>Day:2-
14:45:15:00</td><td>Professor Zhongbao Jian - Changchun Institute of Applied Chemistry, Chinese Academy of Sciences
OC002</td></tr>
<tr><td colspan="2">Diverse Polyolefins Synthesis</td></tr>
<tr><td colspan="2">As the most important polymer by scale, polyolefins like polyethylene (PE) possess various architectures to form versatile products. Branching, functional group, polar group, or cleavage group etc are of great importance in these PEs to tune microstructures and thus determine material properties. However, how to precisely install these functions into the microstructure of PE is greatly challenging. In this presentation, we develop transition metal catalysts and show diverse polyolefins synthesis including selective branched PE, polar functional PE, UHMWPE/PP, degradable PE, high refractive COC.</td></tr>
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<tr><td>Day:2-
15:00:15:15</td><td>Mr Florian Pieringer - TU Wien
OC002</td></tr>
<tr><td colspan="2">GROUP TRANSFER POLYMERIZATION IN BULK METHACRYLATES</td></tr>
<tr><td colspan="2">The limitations of solution polymerization prompted exploration into bulk GTP using methacrylic monomers in this study. We aimed to produce low polydispersity polymers with high conversion rates. Various catalyst/initiator (C/I) systems, each with distinct mechanistic characteristics, were evaluated for their impact on molecular weight, polydispersity, and double bond conversion in the resulting bulk polymers.
Carefully selected C/I combinations were employed to offer a comprehensive overview, encompassing both previously developed and recently investigated systems. Moreover, photochemical initiation via GTP was implemented alongside the 2K experiments. This involved employing a photoacid generator in combination with a GTP initiator to initiate polymerization through UV light exposure. This approach led to the development of a highly controlled photopolymerization method in bulk, yielding low polydispersity polymers with high double bond conversion rates.
10.1002/pol.20230132</td></tr>
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<tr><td>Day:2-
15:15:15:30</td><td>Ms Ana Carolina FERNANDEZ RODAS - CEA Grenoble
OC002</td></tr>
<tr><td colspan="2">Recycling of Nafion(TM) membranes used in Proton Exchange Membrane Fuel Cells (PEMFCs) by ionic liquids</td></tr>
<tr><td colspan="2">To ensure the economic sustainability of PEMFCs in the industrial market, the recycling of the membrane used as electrolyte is primordial (2,000 € for a Toyota MIRAI stack). The most frequently used are perfluorosulfonic acid polymer (PFSA) membranes such as Nafion(TM), which cannot be recycled like usual thermoplastics while the current processes are energy intensive and/or not eco-friendly. It is therefore essential to explore and establish alternative processes.
A new attractive approach is the recovery of the membrane in ionic liquids (ILs). ILs are known for their remarkable and tuneable properties. We have evidenced that selected ILs can interact with different phases of Nafion(TM) according to their physicochemical properties. Thanks to an in-depth multiscale</td></tr>
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structural characterization with X-rays and neutron scattering, we studied their incorporation into Nafion(TM) to select the most efficient ILs for Nafion(TM) recovery. This developed methodology is intended to be generic.

Day:2- 16:00:16:30	**Professor Neil Ayres - The University of Cincinnati OC002**

Synthesis of emulsion-templated polymers for acoustic materials

Porous elastomeric polymers have been used in a wide range of applications because of their unique characteristics. Poly(dimethyl siloxane) (PDMS), a commercially available elastomer, has been shown to exhibit specific acoustic properties. However, the material properties were limited because of a lack of control over the chemistry used to prepare the cross-linked PDMS elastomer. We have prepared PDMS polyHIPEs using simple, room-temperature one-step reactions. The total porosity, pore size, and surface area of the prepared polyHIPEs are controlled by varying the volume of aqueous dispersed phase in the emulsion, while materials properties including the moduli of the polyHIPEs are controlled by the chemistry of the polymer network and the morphology of the porous materials. Acoustic analysis showed these materials achieved sound speed values of 40 m/s, which is close to the predicted minimum of ~ 25 m/s attainable in some models.

Day:2- 16:30:16:45	**Associate Professor Thomas Swift - University of Bradford OC002**

Functional Responsive Polymer Additives to Control Bulk Material Behaviour - Breathable Silicones, Grafting Hydrogel Sheets and Polyurethanes for Rapid Diagnosis of Disease

Polymer materials can be modified to impart responsive functionality to their behaviour. We show how responsive polymer components alter their responsive depending on molecular weight, comonomer distribution, degree of branching or interactions with additives / environmental factors. These responses can be controlled to make useful, stimuli responsive materials, and even a small weight % inclusion of a responsive copolymer can impart bulk material functionality and fundamentally change material properties.

This is demonstrated through three case studies:

The inclusion of lipophilic polymer additives that can modulate vapour transmission through a hydrophobic silicone adhesive non-porous sheet.

Newly developed methods for chemically bonding additional pH responsive polymer functionalities to hydrogel sheets using successive branching RAFT reactions in the polymer gel.

Branched polymers with antimicrobial chain ends function as binding ligands for rapid diagnostics for infection.

Day:2- 16:45:17:00	**Dr Jean RAYNAUD - CP2M lab - UMR5128 - CNRS - Univ. Lyon - CPE Lyon OC002**

Catalysis to Construct, Deconstruct and Reconstruct Polyolefins and Silicones

Polyolefins and Silicones are ubiquitous materials, owing to their versatile properties than can be finely adjusted throughout the course of their respective synthetic processes. They find applications in many everyday life applications (infrastructure, packaging, transport, energy, health...) under many forms (pipes, containers, coatings, elastomers, foams...). Advantageously utilizing catalysis for the tailored synthesis of Polyolefin & Silicone materials has been a workhorse of the corresponding industries of these versatile polymers. By appropriately selecting the catalyst or catalyst combination, one can finely tune the properties of the corresponding polymers and networks. It is possible to map a catalyst/architecture/properties relationship for these high-performance polymers. These “turnkey” solutions allow for a rational design of materials, perfectly adapted to the application. Similar solutions are necessary for the recycling of said polymers, at any stage of their lifespan.

Day:2-
11:00:11:30

Assistant Professor Angelika Neitzel - University of Florida
OC004

Charge density mismatch-driven demixing in multicomponent polyelectrolyte complex coacervates

Multiphase complex coacervates are experiencing a surge in popularity as simple models for biomolecular condensates. However, given the vast structural and chemical diversity of commonly studied polycation/polyanion combinations, deeper insights into the fundamental physics governing the phase behavior of these interesting structures have proven largely elusive. Here we show that aqueous multicomponent mixtures of homologous polyelectrolytes undergo demixing due to a mismatch in their linear charge densities. Our observations are consistent with predictions by the random phase approximation which introduces an electrostatic contribution to the Flory-Huggins interaction parameter.

Day:2-
11:30:11:45

Assistant Professor Klaus Bretterbauer - Johannes Kepler University Linz
OC004

Polyelectrolytes in sensor and energy technologies

Polyelectrolytes with tailored properties are obtained from radical (co)polymerization of specially synthesized monomers and commercially available comonomers. The crosslinked polyelectrolyte organogels show high ionic conductivity, flexibility, and mechanical stability. The transparent materials support a broad temperature operation window and enable artificial signal transmission through pressure- and strain-sensitive properties. Sensor devices and a transparent touchpad highlight the versatility of the developed polyelectrolyte organogels. In contrast, analogous linear polyelectrolytes show great potential in the field of energy materials. The tailored polymers are a viable fluorine-free, water-processable alternative to commercially used N-methyl-2-pyrrolidone-processed polyvinylidene fluoride. Furthermore, a highly efficient water-based recycling process is demonstrated for these innovative materials.

Day:2-
11:45:12:00

Professor Sook-Wai Phang - Tunku Abdul Rahman University of Management and Technology (TAR UMT)
OC004

DEVELOPMENT OF POLYANILINE SENSOR IN ETHYLENEDIAMINE (EDA) DETECTION AND ITS COMPUTATIONAL STUDY

In this research study, a simple and effective ethylenediamine (EDA) sensor is successfully developed by using polyaniline (PAni). The incorporation of computational chemistry toward the assessment of PAni performance as EDA sensor is first explored in this study. PAni is synthesized at different temperatures through chemical oxidation process and applied as chemical sensor for EDA detection. PAni(0¬∞C) exhibits higher electrical conductivity (1.486,Äâ√ó,Äâ10,àí2S/cm) and better sensitivity (0.0529) with R2 of 0.8419 compared to PAni(25¬∞C). The presence of branches in PAni(25¬∞C) hinders EDA from approaching the reactive sites of PAni and hence resulted in low sensitivity of 0.0022. Besides, 0.5,Äâppm limit of detection was obtained by using 3 layers of PAni(0¬∞C). PAni(0¬∞C) showed good recyclability of up to 10,Äâcycles with 7,Äâs short response time and 5,Äâs fast recovery time. Meanwhile, good recoveries of 110% and 95% were obtained for real sample analysis for PAni(0¬∞C). The high electrical conductivity of PAni(0¬∞C) is supported by its low band gap energy of ,àí0.2803,ÄâeV that was obtained by computational data. Based on the computational data, PAni(0¬∞C) possesses the highest sensitivity in EDA detection with the short response time of 7,Äâs which shows good agreement with the high interaction energy of 294,Äâkcal/mol.

Keywords: Polyaniline, Ethylenediamine, Sensor, Computational.

Day:2-
12:00:12:15

Dr Thiago Guimaraes - University of Bordeaux
OC004

Organic conjugated trimer nanoparticles stabilized by amphiphilic block copolymers for photocatalytic generation of H2

Climate emergency, resulting from contemporary human lifestyles, require joint efforts from our society to curtail CO2 emission. Nations worldwide are prioritizing renewable energy sources to reshape their energy matrix. In this context, photocatalytic generation of H2 via water splitting emerges as a promising solar fuel due to its low carbon footprint. Herein, a versatile platform is designed to the preparation of functional π-conjugated organic nanoparticles dispersed in aqueous phase via miniemulsification method. Such particles are composed of Donor-Acceptor trimers prepared via Stille coupling and they are stabilized by amphiphilic block copolymers, synthesized by RAFT polymerization. The hydrophilic segment from the block copolymers will not only provide colloidal stability, but also allow for precise control of the surface functionalization. Photocatalytic tests of the resulting particles for H2 production resulted in excellent photocatalytic activity (> 1 mmol g-1 h-1).

Day:2-
12:15:13:30

Professor Mohamed Abu Saied - Polymeric Materials Research Department, Advanced Technology and New Materials Research Institute (ATNMRI), City of Scientific Research and Technological Applications (SRTA-City), New Borg El-Arab City, Alexandria, Egypt.
OC004

Highly Conductive Polymer Electrolyte Membrane Impervious to Methanol for Direct Methanol Fuel Cell Applications

DMFC is attracting much interest as an energy source for transport and other portable applications. The Nafion®) is commonly used as PEM in DMFCs, owing to their good chemical and thermal resistance and ionic conductivity. However, it has been found out that: over 40% of the methanol can be wasted in DMFCs through leaks across such membranes, Rapid dehydration above 100 oC, leads to a drastic impairment of its performance and the production cost is extremely high, which makes it difficult for industrialization of DMFC. This abstract will concentrate on overcoming these drawbacks through preparation of SGMA - PVC membrane by using Electrospinning technique as a new membrane forming material. The prepared PEMs will be evaluated and compared with Nafion for their physicochemical, electrochemical properties, thermal, mechanical, dimensional and oxidative stabilities and methanol permeability, to assess their suitability for DMFC applications.

Day:2-
12:30:12:45

Dr laurent bernard - UGA Grenoble alpes - Liten
OC004

Charge-Transfer Complexes and new polymers for electrolyte in solid-state lithium battery

The mass production of portable electronic devices and electric vehicles led to new obligations. To fulfill them, lithium batteries are now being developed with new type of organic materials. Following this strategy, alternative polymer-based electrolytes were developed based on poly(ethylene oxide). However, those technologies show limitations especially regarding the ionic conductivity at low temperatures. Recently, a new family of materials is attracting lot of attention: charge-transfer complexes. They are showing great ionic conduction properties up to 10-3-10-4 S.cm-1 at room temperature when associated with a lithium salt pointing out their strong potential as organic solid electrolyte. In this work, different polymers and organic molecules are synthesized and studied as electrons donor and/or acceptor associated with a lithium salt to synthesize a solid electrolyte. Ionic conductivities up to 10-5 S.cm-1 were obtained at room temperature and are currently being improved.

Day:2-
14:00:14:30

Professor Sagrario Pascual - Le Mans Université
OC004

3D-polymer architectures decorated with multi-functional handles

Hyperbranched polymers (HBP) and copolymer self-assemblies (PSA) are 3D-polymer architectures that provide spatially versatile platforms decorated with a high density of functional groups. Despite such a high density and their easy synthesis thanks to reversible-deactivation radical polymerizations including RAFT polymerization, they are most often limited to one kind of functional terminal groups. To tackle this limitation, two strategies have been developed and will be discussed. The first one combines RAFT self-condensing vinyl polymerization and the powerful azlactone chemical handle to target HBP with multiple chemoselective reactive functions. The second one relies on RAFT polymerization induced self-assembly from a mixture of telechelic polymer precursors to target PSA decorated with multiple reactive groups. Final 3D-polymer nanostructures featuring multi-reactive handles provide spatially defined platforms for subsequent functionalization necessary for advanced materials.

Day:2-14:30:14:45	**Dr Ilaria Grimaldi - University of Salerno** **OC004**

Stereoregular Polymerization of Molecules of Natural Origin Promoted by Titanium Complexes With OSSO-Type Ligands

The global push towards sustainability has led to significant progress on the use of monomers from renewable sources for the synthesis of polyolefins, historically derived from petroleum-based monomers. An innovative approach involves two titanium complexes with OSSO-type ligands for the stereoselective polymerization of 1-phenyl-1,3-butadiene (1PB) synthesized through a Wittig reaction starting from cinnamaldehyde extracted from cinnamon essential oil. The resulting isotactic polymer from 1PB is copolymerized with linear terpenes such as myrcene and ocimene which show promise as eco-friendly raw materials. The study extends to the stereoselective polymerization of (R)-4-isopropenyl-1-vinyl-1-cyclohexene (IVC), synthesized from perillaldehyde, found in the perilla herb. A previous study on 1-vinylcyclohexene (VCH) as a model monomer was done, sharing a similar structure with IVC, except for the isopropenyl substituent.

Day:2-14:45:15:00	**Samantha Liu - University of Warwick** **OC004**

Synthesis of Novel Dicationic Ionic Liquids and Investigation into Redox Mediator for Biosensor applications

A novel family of polyether-based DILs through the mixing of terminal diamines with organic acids were synthesis. DILs were thoroughly characterised in terms of physical, thermal, and electrochemical properties. In addition, their cytotoxicity against HeLa cells was evaluated. The novel character of these DILs, both in terms of their synthesis and structure, as well as the evaluation of their properties, contributed to expanding the literature available on DILs. The main objective of the second part is to develop a library of new synthetic, cheap, fast electron transfer, water soluble, stable, redox probes which can be readily available to a variety of end users. A ferrocene scaffold will be used with the redox potential systematically adjusted using ligand engineering to alter the electron density on the Fe centre.

Day:2-15:00:15:15	**Mr Fabian Mehner - Insutitute of Polymer Research Dresden e.V.** **OC004**

Exploring the preparation and application of (bio)degradable polymers from Radical ring-opening polymerization (RROP) of cyclic ketene acetals (CKAs)

Microplastics and environmental pollution caused by vinylic polymers are known to be a threat to public health and environment. Following the need for (bio)degradable alternatives, radical ring-opening polymerization (RROP) of cyclic ketene acetals (CKAs) offers a method to synthesize branched polyesters with tunable properties like melting behavior and viscosity. However, gaining control over the branching reaction and the polymerization itself remains challenging. In the work presented, kinetic studies, the use of supercritical CO2 as a green solvent and methods of controlled radical polymerisations including the resulting polymers of each will be discussed. By implementing nanoprecipitation for the hydrophilic P(2-Methyl-1,3,5-tioxocane) the potential of fully degradable nanoparticles without implemented vinylenes will be presented. With that, the use of P(CKAs) as fully degradable materials for drug delivery and potential applications is cosmetics will be shown.

Day:2- 16:00:16:30	**Assistant Professor Gulzar Ahmad Bhat - University of Kashmir, Srinagar J&K India OC004**

Making Polycarbonate Polymers from Sustainable Resources: Applications in 3D Printing and Micellar Catalysis

Recent years have witnessed tremendous efforts by chemists around the globe for synthesizing sustainable polymers from renewable resources. This transition is strongly motivated by the continuous accumulation of non-biodegradable oil-based polymers in the ecosystem, along with long-term goals such as economic and exhaustion of these non-renewable feedstocks. In this direction, we have recently synthesized terpolymers via the catalytic coupling of renewable epoxides and CO2 in presence of different chain transfer agents. We have further used thiol-ene click chemistry to functionalize these terpolymers to achieve amphiphilic polycarbonates. These amphiphilic polycarbonate were shown to self-assemble in water to provide uniform and spherical micelles. The resulting micelles was demonstrated to effectively catalyze carbon-carbon coupling reactions at very low catalyst loadings in water. We have also formulated thixotropic by dispersing NaCl particles in these terpolymer solutions.

Day:2- 16:30:16:45	**Dr Bo Li - Royal College of Surgeons in Ireland OC004**

Digital Light Processing 3D Printing of Caprolactone Copolymers with Tailored Properties through Crystallinity

Digital light processing (DLP) 3D printing has shown great advantages in the fabrication of 3D objects towards various applications. As a biocompatible material, post-functionalised PCL has been demonstrated as a promising candidate for DLP printing, while the mechanical properties mainly relied on molecular weight and crosslinking density. Herein, we introduced a copolymerisation of caprolactones offering built-in functionality for photochemistry. By altering the monomer feeding, a crystalline block copolymer and an amorphous random copolymer were obtained. DLP printed scaffolds from these copolymers have inherited their thermal properties, leading to dramatic different mechanical properties. Moreover, the crystalline scaffold displayed a shape memory property as the first example of PCL polymer in DLP printing. This work has offered the simplicity of achieving photo reactivity, tailored mechanical properties and shape memory for DLP printing from two straightforward copolymerisations

Day:2- 16:45:17:00	**Mr Quinten Thijssen - Ghent University OC004**

Volumetric 3D-Printing of Cell-Adhesive Shape-Memory Scaffolds

Volumetric 3D printing is revolutionizing tissue engineering, offering the ability to create highly complex, patient-specific, and degradable implants within a surgery's timeframe. This capability is highlighted in our previous work (Thijssen et al., Advanced Materials, 2023; Thijssen et al., Progress in Polymer Science, 2023).

Building on these advances, we report the integration of cell adhesiveness and shape-memory behavior into volumetric 3D-printed patient-specific scaffolds. We demonstrate homogeneous incorporation of the cell-binding motif RGD throughout these 3D-printed objects, ensuring cell adhesion on their surfaces. Moreover, the shape-memory design of these scaffolds, inspired by the ancient Japanese art of Origami, incorporates folding lines, allowing the structures to transition to preprogrammed designs at body temperature.

Day:2- 11:00:11:30	**Professor Nadav Amdursky - University of Sheffield OC104**

From charge transfer processes in biopolymers to functional protein-based polymers

Day:2- 11:30:11:45	**Dr Elisabeth GARANGER - University of Bordeaux OC104**

Post-modifications of recombinant elastin-like polypeptides towards bioactive (nano)materials and self-assemblies

Elastin-like polypeptides (ELPs) are thermo-responsive biopolymers whose primary sequence is derived from a natural extracellular matrix protein (elastin). Genetically-engineered and produced recombinantly in heterologous hosts (typically Escherichia coli bacteria to ensure reasonable production yields), they are perfectly monodisperse macromolecules. Although powerful to yield ELPs with exact primary structures and lengths, protein engineering techniques present however some limitations, in particular lengthy bacterial cloning steps and limited chemical diversity due to few possible post-translational modifications in E. coli bacteria.

My research activities are therefore dedicated to exploring a dual biotechnological and chemical approach, combining recombinant biosynthesis of ELPs with orthogonal chemical bioconjugation methods to enlarge the diversity of relevant ELP-based macromolecules and self-assemblies thereof for biomimetic, biological and/or biomedical applications.

Day:2- 11:45:12:00	**Associate Professor Meryem Kalkan Erdoğan - Department of Chemistry Faculty of Science, Ankara University OC104**

Surface Functionalization of Cotton Fabrics with Modified Bamboo Cellulose-Based Biopolymers Through Electrospinning Technique

In this work, we aimed to develop a surface-modified textile material from environmentally friendly and biocompatible polymeric sources, such as cotton, selectively oxidized cellulose from bamboo pulp, gelatin, and polyethylene imine, that can be used as an alternative reusable mask fabric and not cause infection due to bacterial/fungal growth and have a soothing effect on the skin. For this purpose, a modified fabric surface was prepared by electrospinning biocompatible polymer mixtures onto the cotton. A skin-compatible allantoin molecule was introduced onto the nanofibrous webs through chemical cross-linking using the EDC/NHS. The experimental studies were conducted to determine the polymer compositions that give the desired properties. The breaking strength, air permeability, and wettability were investigated. ATR-FTIR and SEM techniques evaluated the samples' structural and morphological characterization. The antimicrobial activity and biocompatibility were also determined.

Day:2- 12:00:12:15	**Dr Jan Lauko - The University of Queensland OC104**

(Bio)mechanical control of hybrid polymer networks

Biopolymers, such as collagen are widely used across fields of tissue engineering. One of the main challenges remaining, is the ability to consistently control their biochemical and mechanical properties such as bulk stiffness, stress relaxation/stiffening and matrix geometry.

To specifically address the mechanical reproducibility of collagen networks, we implemented a well-defined synthetic biopolymer analogue – polyisocyanopeptide (PIC), to provide mechanically controlled interpenetrating networks (IPNs) of collagen and the PIC polymer. Using a customised confocal microscope–rheometer setup, we observe, in situ, the formation of collagen networks in PIC on a microscopic scale, while simultaneously recording the mechanical synergy between both materials. Using these IPNs, we then assessed the cellular morphology and behaviour of metastatic melanoma cells, and showed that alterations in cellular motility and adhesion are responsive to changes in the mechanics of these materials.

Day:2-12:15:12:30
Mr Askican Hacioglu - University of Helsinki
OC104

Amidine Containing Gels Obtained from Thionated Poly(2-ethyl-2-oxazoline)

Askican Hacioglu*, Andrew Kerr, Robert Luxenhofer
University of Helsinki, Department of Chemistry, Helsinki, Finland

Thioamides are single atom substitutes of amides where the carbonyl oxygen atoms are replaced with sulfur. One of the little-known coupling reactions is the coupling between thioamides and sulfonyl azides, which yields amidine moieties. Polymers containing amidine functional groups are pH and CO2 responsive and could be promising for use in biological settings.

Here, we will discuss for the first time using thionated poly(2-ethyl-2-oxazoline) to build covalently crosslinked polymer gels with amidine moieties via thioamide/sulfonyl azide ligation. Thionated polymers of PEtOx were synthesized by reaction with Lawesson's reagent. Gels were subsequently produced by reaction of the thionated PEtOx with the crosslinker bis(4-azidosulfonyl) phenyl ether under heating. Structure-property studies were conducted and response to stimuli of the formed gels was investigated.

Day:2-12:30:12:45
Ms Anne Fernando Pulle - Queensland University of Technology
OC104

Thioketones as a simple route towards thioester-based materials

Multicomponent reactions have been an essential synthetic tool for polymer chemists in recent years. Among various MCRs, Passerini chemistry stands out as a robust chemistry for synthesizing esters using an isocyanide, carboxylic acid, and an aldehyde. However, due to greater stability and steric bulk, ketones are more sluggish in Passerini reactions. To overcome this challenge, we have introduced thioketones as simple, easy to use Passerini polymerization monomers for the generation of polythioesters. Additionally, we highlight that the polythioesters generated from this methodology have tunable degradation pathways as a function of either temperature or nucleophile used. Finally, we highlight that these low Tg polythioesters can be rapidly transformed into processable thermosets via synergistic combination of thiols and maleimides. With the ever-increasing need for recyclable, reprocessable, and functional materials we feel Passerini chemistry and thioketones will provide a powerful tool for soft matter materials scientists.

Day:2-14:00:14:30
Assistant Professor Peter Wich - University of New South Wales
OC104

Polysaccharides and Proteins as Biopolymer Nanomaterials in Drug Delivery and Biocatalysis

Nature's polymers, such as polysaccharides and proteins show remarkable versatility as multifunctional materials. They can be easily modified with the toolkit of bioorganic chemistry and are attractive because of their degradability and biocompatibility.

The presentation will feature our latest results on different nanoparticle systems that contain modified polysaccharides and enzymes. Examples will include dextrans as versatile biopolymer starting materials. Conjugation with synthetic and bio-derived polymers results in biohybrid materials that are responsive and show triggered disassembly and payload release. Similarly, we explore proteins and enzyme conjugates as materials for nanoparticles in order to obtain active materials that show high efficiencies in biotransformations and catalytic applications.

The presented multifunctional biopolymer nanosystems exemplify that function and structure of the particle material itself are as important as the transported payloads.

Day:2-14:30:14:45
Dr Panagiotis Georgiou - University of California Los Angeles (UCLA)
OC104

New Nanomaterial Design Principles of Biomacromolecular Antifreezes

Nature has been a source of inspiration for advanced material synthesis through the mimicry of biological functions and natural materials/structures. The aim of this work is to identify the design principles for nanomaterial biomimetics applied in the growing field of cryobiology. In particular this work explores a variety of polymer nanomaterial architectures capable of mimicking ice binding proteins (IBP)s' ice recrystallisation inhibition and ice nucleation functions. Polymerisation-induced self-assembly, an easily scalable method attracting significant interest, offered a practical approach to generating a platform of ice growth controlling colloidal dispersions. A synthetic framework for probing heterogeneous ice nucleation is developed through a library of molecular bottlebrushes with varying grafting densities. Findings emerge from this work are expected to set the groundwork which links structural biological-derived understanding of ice growth to nanomaterial synthesis.

Day:2-14:45:15:00

Ms Claire Wang - University of North Carolina at Chapel Hill
OC104

Tissue-mimetic hydrogels with architecturally controlled swelling and mechanical properties

Hydrogels possess a distinct combination of properties including softness, high water retention, and biocompatibility, which are vital for biomedical applications. However, they are limited in their fragility at high swelling and their mechanical mismatch to tissue when deformed. Many studies have been done to improve gel mechanics, but often compromise swelling ratio and softness. We address this problem using the bottlebrush architecture, which enables concurrent enhancement of softness and firmness from crosslink dilution and backbone stiffening by the densely grafted side chains. We report a facile one-pot synthesis of single-network polyoxazoline bottlebrush hydrogels with softness down to <1kPa and swelling ratio up to 125 that withstand up to 10-fold extension. Understanding the interplay between brush monomers, backbone spacers, and solvent types provides insight into new hidden-length mechanisms for gel property control for more extensive applications.

Day:2-15:00:15:15

Ms Dongxu Zhou - University of Bordeaux
OC104

Artificial Cell Membranes from Synthetic Biomimetic Lipoproteins

The goal of this study is to mimic the biological structures and natural self-assembly processes of natural lipoproteins by designing amphiphilic lipid-grafted copolymers able to self-assemble into polymersomes as drug delivery (nano)carriers or biomimetic cell membranes. Elastin-like polypeptides (ELPs), thermo-responsive polymers derived from tropoelastin, are here used as precise protein polymer backbones, where different kinds of lipid chains can be grafted onto specific amino acid residues (i.e., methionine). Two generations of ELP-g-lipid bioconjugates were synthesized. ELP-g-butyl was unable to yield stable vesicles most likely due to the short alkyl segments. Then squalene, a natural triterpenoid and an important precursor in the biosynthesis of sterols, was used as a longer and more hydrophobic lipid chain. ELP-g-squalene self-assembled into vesicles whose morphology evolved with temperature as evidenced by different scattering and microscopy techniques.

Day:2-15:15:15:30

Professor Hassan Said Bazzi - Texas A&M University at Qatar
OC104

One pot synthesis of copolymers of poly(acetylene)s and PEG-modified poly(olefin)s using ring-opening metathesis copolymerization (ROMCP)

Amphiphilic copolymers of highly conjugated poly(acetylene)s and poly(ethylene glycol)-functionalized perylene diimide poly(olefin)s have been synthesized via tandem cyclopolymerization and ring-opening metathesis copolymerization (ROMCP) methodologies. The relative atomic weight percentages of both di- and tri-block copolymers were estimated using XPS analysis. Photophysical properties of both copolymers have been explained based on both UV-Vis and fluorescence spectroscopic analysis shedding more light on their different stages of organization as well as the π–π stacking interactions of the PEG750-incorporating perylene cores in aqueous solutions. Copolymeric surface analysis, segmental patterns and film morphology were examined by AFM revealing globular or spherical morphological features enhanced by various functional groups present in the polymer bulk. In addition, the formation of these spherical morphologies was further visualized in the thin film cross-sections of both di-and tri-block polymers by SEM to confirm the surface morphologies determined by AFM analysis of both polymeric materials.

Day:2- 16:00:16:30	**Professor Jin Geng - Shenzhen Institute of Advanced Technology,Chinese Academy of Sciences OC104**
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Day:2- 16:30:16:46	**Assistant Professor Francesca Lorandi - University of Padua OC104**

Unraveling the role of structural dispersity in polymer electrolytes

Solid electrolytes for rechargeable Li batteries are safer alternatives to currently used flammable liquid electrolytes, and ideal candidates for high energy density devices that can meet the urgency of decarbonizing transportation. Polymers comprising ethylene oxide (EO) repeating units are the most studied and arguably the most promising polymer electrolytes for Li batteries. In this work, graft polymers bearing EO units in the side chains will be synthesized with precise control over polymer dispersity, through a combination of chromatographic methods and controlled radical polymerization techniques. The graft polymers will be rationally

designed to present backbones with different flexibility and side chains with tailored heterogeneity. The influence of these parameters on the mobility of Li-ions will be determined by studying thermomechanical and structural properties, as well as electrochemical properties and Li-ion conductivity.

Day:2- 16:45:17:00	**Ms JIHAD OUMERRI - Lorraine University OC104**

The influence of the polysaccharide charge on the morphology of the assemblies produced by PISA

Nano-objects (NOs) obtained by self-assembly of amphiphilic copolymers derived from polysaccharides (e.g. dextran, alginate and chitosan) present advantages related to the biodegradability/biocompatibility of these biopolymers. The latter is particularly interesting due to its antioxidant, antimicrobial, antifungal and bioadhesive properties. Recently, our team had demonstrated the efficiency of the "Polymerization Induced Self Assembly" (PISA) process in the production of NOs based on polysaccharide derivatives and with advanced morphologies.

The aim of this study is to investigate the effect of the polysaccharide charge on the morphology of the NOs produced by PISA. Chitosan, a positively charged biosourced polysaccharide, was involved in the association with the 2-hydroxypropyl methacrylate (HPMA) monomer to prepare NOs by PISA under UV irradiation in water. Light scattering and transmission electron microscopy showed the formation of spherical NOs of different size.

Day:2- 11:00:11:30	**Professor HAKAN DURMAZ - Istanbul Technical University OC106**

Extremely Rapid Polythioether Synthesis in the Presence of TBD

A straightforward, novel and extremely rapid method is developed for the synthesis of polythioether based on the reaction of dimethyl acetylenedicarboxylate (DMADC) with electron deficient triple bond and 1,6-hexanedithiol (HDT) in CHCl3 using an organobase 1,5,7-triazabicyclo [4.4.0] dec-5-ene (TBD) at room temperature. The influence of various parameters, such as concentration of monomers, solvent, catalyst, and reaction time, on the polymerization were investigated through kinetic studies. Polythioether with molecular weight up to ~50 kDa was quantitatively achieved in 1 min, under the optimum experimental conditions. Various dithiol compounds were then reacted with dimethyl acetylenedicarboxylate to enhance polymer diversity. Following, three propiolate compounds were reacted with 1,6-hexanedithiol to explore their ability for polythioether synthesis, but low to moderate molecular weights were achieved compared to those with dimethyl acetylenedicarboxylate. This work was supported by the Research Fund of the Istanbul Technical University (Project number:TGA-2022-43943).

Day:2- 11:30:11:45	**Dr Jonathan Gregg - University of Sheffield** **OC106**

Using thiol-Michael addition to create covalent adaptable networks from unsaturated polyesters

Unsaturated polyesters (UPEs) containing fumarate groups were functionalised via the thiol-Michael addition of furfuryl mercaptan. This “click” reaction occurs rapidly in ambient conditions in the presence of an organic catalyst. The partial addition of a diene moiety allows the polyester chain to participate in Diels-Alder cycloaddition reactions with the remaining fumarate groups to form a crosslinked network. Such crosslinks dissociate at 130 °C through the retro-Diels-Alder (rDA) reaction and reform upon cooling to ambient temperature, highlighting the reprocessability of these networks. The unsaturated groups in poly(propylene fumarate) were functionalised to varying extents and it was shown via differential scanning calorimetry that 50% functionalisation produced the highest degree of crosslinking, confirmed by Soxhlet extraction.

Day:2- 11:45:12:00	**Mr Kam Poon - University of Oxford & Duke University** **OC106**

Thiol-ene Based 3D Printing of CO2-Derived Copolymer Elastomers

Producing polycarbonates through the ring-opening copolymerization of CO2 and epoxides valorizes and recycles CO2 while reducing polymer manufacturing pollution. Recent developments in catalysis provide access to polycarbonates with well-defined structures and allow for copolymerization with biomass-derived monomers. Here, 200 g of a low molar mass poly(carbonate-ester-carbonate) triblock copolymer was synthesised. The polymer was formulated to produce a novel resin which was successfully 3D printed through digital light processing (DLP) with a thiol-ene-based crosslinking system. A series of elastomeric and degradable thermosets were produced with varying cross-linker length and PEG content to form complex geometries at high resolutions. Thermomechanical characterization of the novel materials revealed printing induced phase separation and tuneable hydrophilicity. These materials may be utilized for applications in regenerative medicine, impact absorption, and acoustic management.

Day:2- 12:00:12:15	**Ms Sidonie LAVIEVILLE - ICGM CNRS UM ENSCM** **OC106**

Trifluoromethylated N,S-acetals: a new reversible function for vitrimer applications

Vitrimers (or CANs), introduced by L. Leibler in 2011, are a new class of polymers combining the reshaping and recyclability properties of thermoplastics with the mechanical and chemical properties inherent to thermosets, thanks to exchangeable/reversible crosslinking bonds. The incorporation of fluorinated groups provides hydrolytic stability, activates functional groups and promotes exchange reactions without the need for a catalyst. This work presents the exploitation of these fluorine benefits to synthesize unprecedented trifluoromethylated N,S-acetal CANs, based on thiol exchange reactions. These materials exhibit short relaxation times, high activation energies, low creep, and require mild reprocessing conditions. One of them was synthesized from melamine, the common aminoplast resins monomer, and thus represents the very first Formica®-like covalent adaptable network.

Day:2- 12:15:12:30	**Mr Matthias Steiner - Graz University of Technology** **OC106**

Using the phospha-Michael reaction for making phosphonium phenolate zwitterions

The reactions of 2,4-di-tert-butyl-6-(diphenylphosphino)phenol and various Michael acceptors yield the respective phosphonium phenolate zwitterions at room temperature. Nine different zwitterions were synthesized and fully characterized. The solid-state structures of two phosphonium phenolate molecules were determined by single-crystal X-ray crystallography. The bonding situation in the solid state together with NMR data suggests an important contribution of an ylidic resonance structure in these molecules. An analysis of the kinetics of the zwitterion formation was performed for three Michael acceptors (acrylonitrile, methyl acrylate and acrylamide) in chloroform and methanol. Results revealed the proton transfer step necessary to stabilize the initially formed carbanion as the rate determining step. The zwitterion formation kinetics have substantial impact on the understanding of nucleophilic catalysis for oxa-Michael and epoxy polymerization.

Day:2-12:30:12:45 | **Ms Lea-Sophie Hornberger - University of Stuttgart**
OC106

Synthesis and Functionalization of Bio-derived Polyesters via Metal-catalyzed Polymerizations

The interest in polymerization techniques generating polymers from renewable resources grows notably due to a limitation of fossil resources. Yttrium catalysts bearing dianionic ligands are promising candidates for a controlled ring-opening polymerization of lactones leading to biobased polyesters. Successful polymerization was proven for differently-sized monomers, such as the macrocyclic musk-derived ω-pentadecalactone or lactones from cyclic terpenoids. Carvone, naturally occurring in spearmint and caraway oil, was transferred by Baeyer-Villiger oxidation to its corresponding lactone. Due to the persistence of double bonds in the side group of these monomers, introduction of functionality (e.g. initiators for radical polymerization) via thiol-ene reactions was possible. Cu(0)-catalyzed living-radical polymerization was carried out as a grafting-from method in a one-pot or two-pot reaction to generate amphiphilic polymers by attachment of different hydrophilic side chains.

Day:2-14:00:14:15 | **Professor Xia Dong - Institute of Chemistry, Chinese Academy of Sciences**
OC106

Structural and Morphological Evolution Upon Heating of Quenched Polyamide 1012

The crystal form transition and morphology evolution of quenched polyamide 1012 during heating were investigated in the present study. Quenched PA1012 displayed a pseudo-hexagonal γ' form at room temperature, in which the methylene segments adopted a trans conformation, but the methylene group that directly attached to the amide group was twisted, and the hydrogen bonding pointed in all directions. During heating, the γ' form was gradually transformed into the γ form as the trans methylene sequences which away from the amide group further twisted and the value of dihedral angle between amide and methylene plane narrowly distributed. The transition onset temperature was near the Tg of quenched PA1012. The morphology of quenched PA1012 was a loose network consisting of a disordered arrangement of thin lamellae with poorly defined boundaries. As the annealing temperature increased, the lamellae became more perfect and thicker, while the morphological type remained the same.

Day:2-14:15:14:30 | **Professor DEZ isabelle - LCMT - Université de CAEN Normandie**
OC106

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Day:2-14:30:14:45 | **Mr Rakine Mouhoubi - ICGM, Univ Montpellier, CNRS, ENSCM, Montpellier, France**
OC106

Toward DLP 3D Printing of Tailorable Liquid Crystal Elastomers

Liquid Crystal Elastomers (LCEs) are stimuli responsive polymers that undergo reversible anisotropic macroscopic deformation above their nematic-isotropic transition temperature (Tni). Digital Light Processing (DLP), which is not yet widely used for making LCEs, enables the creation of complex high-resolution LCE structures. However, these LCEs generally have a high Tni, and cannot change shape due to the alignment limitations of DLP. To address these challenges, we engineered different DLP 3D printable LCEs by varying the network nature, incorporating non-mesogenic linkers (e.g. PEGDA...), and controlling the orientation of the mesogens after printing. The impact on the thermo-mechanical properties, shape changing behavior, and liquid crystalline order was assessed using tensile testing, DMA, and WAXS. The 3D-printed LCEs exhibited Tni values between 100 and 36 °C and showed one-way shape memory effect and reversible shape change.

Day:2- 14:45:15:00	**Ms Sofie Eriksen - The Danish Polymer Centre, DTU OC106**

Photo-responsive fibers as artificial hairs in an in-vitro model for transdermal drug delivery

Transdermal drug delivery offers local delivery compared to oral drug delivery while circumventing the first pass metabolism. Compared to injection, the transdermal route induces less trauma.

Current screening of new formulations is done on an artificial membrane, animal, or human skin. The artificial membrane tends to overestimate permeation and do not consider hair follicles and sweat glands. Testing on biological skin results in large variability between samples and between laboratories.

This work focus on creating an artificial skin membrane including hair follicles as an in vitro model. The model will provide a better estimate of permeation with less variability than current models. The membrane is made of PES and the hair fibers consists of liquid crystal elastomer network. The fibers can bend up to 40° when exposed to light at 365 nm and will bend back when exposed to light at 455 nm. The permeation of the membrane is investigated with drugs varying in size and lipophilicity.

Day:2- 15:00:15:15	**Assistant Professor Xavier Montané - University Rovira i Virgili OC106**

Assembly of biomimetic hybrid membranes for selective proton transport based on liquid crystalline polymers and delignified wood

Humankind has always used wood for all types of applications: buildings, energy production, furniture, weapons, toys, etc. Nowadays, the total or partial removal of lignin broadens the applications of wood, being able to obtain transparent wood, high-performance structural wood materials or high-performance thermal insulators. Furthermore, delignified wood (DW) could be used as a natural support in proton transport membranes due to its well-defined hierarchical structure.

In this work, we present the delignification of beech wood using sodium chlorite (NaClO2) and the subsequent chemical modification of DW using dodecanoyl chloride to obtain highly hydrophobic delignified wood (HHDW). Moreover, the assembling of hybrid membranes based on side chain liquid crystalline poly(epichlorohydrin) (PECH) supported on both wood supports (DW and HHDW) and the evaluation of the cationic transport of the resulting membranes have been investigated.

Day:2- 15:15:15:30	**Ms Sara Beldarrain - UPV/EHU - POLYMAT OC106**

Synthesis of Snowman particles by two-step semibatch emulsion polymerization

Amphiphilic random copolymers exhibit hydrophobic interactions that may result in the formation of unimer micelles in water, through a single-chain folding mechanism. Through tailored synthesis and comprehensive characterization of their size, shape, and conformation, these materials show promise for applications in environmental chemistry, industrial catalysis, biomedicine, and drug delivery.1,2 PEGMAx-co-FAy copolymers were synthesized using ARGET-ATRP and were analyzed in water using a combination of small angle X-ray scattering (SAXS), dynamic light scattering, and diffusion-ordered NMR spectroscopy. In particular, the SAXS studies confirmed the formation of compact-globular, self-folded unimer micelles.3 The hydrophobic nanocavities formed were utilized to encapsulate Combretastatin A-4 (CA-4), an active but poorly water-soluble anticancer drug.4 The loaded unimer micelles cytotoxicity against different cancerous cell lines was tested and fluorescein-labeled copolymers were prepared and used for biodistribution assays. Funding: MIUR, project PRIN 2022 BIOCOMMON, CUP I53D23004120006, E. Martinelli. References 1. Single-Chain Polymer Nanoparticles; Pomposo, J.A., Ed.; Wiley-VCH , Germany,

2017; 2. Terashima, T. et al, J. Oleo Sci. 2020, 2020, 1,Äì10; 3. Guazzelli E., et al., Macromol Chem Phys, 2023, 224, 220036; 4. Calosi M., et al., Polymers, 2022, 14 (4), 774.

Day:2-16:00:16:30

Assistant Professor Benoit Couturaud - ICMPE - CNRS
OC106

Polymer Metal-Organic Framework Self-Assembly (PMOFSA) to generate well-dispersed polymer-MOF hybrid nanoparticles in water

The combination of polymer and metal-organic frameworks (MOFs) has garnered significant attention in the fields of chemistry and materials science due to their unique properties. Polymer compounds offer several advantages, such as processability, sustainability, and various properties like water solubility, low toxicity, and biocompatibility, owing to their soft nature. Meanwhile, MOFs possess a high surface area, exhibit selective adsorption, making them an important new class of material. The hybridization of MOFs and polymers through polymer-grafted methodologies provides unprecedented functions and unexplored properties that are challenging to achieve using individual components. We here developed a new method called Polymer-Metal-Organic Frameworks Self-Assembly (PMOFSA) to generate well-dispersed hybrid nanoparticles in water in a one pot process.

Day:2-16:30:16:45

Ms Pragti Saini - Indian Institute of Technology Roorkee
OC106

Presence of volatile organic compounds and odorous compounds in recycled plastics.

Nowadays, packaging materials used in food, cosmetic and pharmaceutical industris are single use plastic. 50 % of worldwide debris is currently from this kind of litter in marine ecosystem. While advancements have been made in waste management and the plastics recycling industry is expanding, there remains an opportunity for further improvement in safeguarding the environment against plastic pollution. Currently, recycled materials produced through mechanical recycling face challenges in matching the quality of virgin polymers, making it more challenging to achieve a closed-loop system for plastic production. One contributing factor is the presence of contaminants or unwanted substances in recycled polymers, which can emit strong odors, volatile organic compounds (VOCs) thereby compromising the resin's quality. Consequently, the use of recycled polymers is often limited to lower quality applications than the source material. This study aims to assess the disparity in

Day:2-16:45:17:00

Assistant Professor Stefano Gazzotti - Università degli Studi di Milano
OC106

Covalent Organic Frameworks: from non-processable powders to plastic materials through a polymer-supporting strategy

Covalent Organic Frameworks (COFs) are defined as 2 or 3D networks based on covalent bonds and fully organic structures. COFs are applicable in many different fields that go from catalysis to electrochemical applications, through gas and energy storage, to name a few. The industrial applicability of COFs has been hindered by some drawbacks, amongst which an inherent lack of processability is one of the most significant. This work aims at solving this shortcoming through a polymer-supporting strategy. Different 2D-COFs have been synthesized and then exploited as active components in the synthesis of different polymers to grow polymeric chains directly on the COF backbone. These polymeric chains confer plastic behavior to the COFs resulting in an improved processability. The covalent bond between the COFs and the polymeric chains has been demonstrated. Processability tests were also carried out, with the successful preparation of films through solvent casting and 3D-printed scaffolds.

Day:2-11:00:11:30

Dr Friederike Adams - University of Stuttgart
OC109

Designing functional block copolymers for nanomedicine using metal-catalyzed polymerization techniques

With the shift from standard plastics to high-performance polymers, precise tuning of these materials is a key requirement. Optimization of polymerization catalysts plays an important role in modern polymer chemistry to efficiently fabricate tailor-made polymer architectures and microstructures to fine-tune material properties. Rare-earth metal complexes can act as highly active catalysts in two different types of coordination polymerization: ring-opening polymerization of lactones and group transfer polymerization of Michael-type vinyl monomers. Modifications of the complexes were performed to improve catalyst activity and stereoselectivity and to enable the synthesis of functional block copolymers with versatile end groups. Complemented by the implementation of new, functional monomers, various aspects of polymer chemistry are targeted: bio-based, metal-functionalized and stimuli-responsive, amphiphilic polymers for drug and nucleic acid delivery.

Day:2-
11:30:11:45

Professor Ana Clotilde Fonseca - University of Coimbra
OC109

The potential of α-amino acid poly(ester amide)s in the development of useful materials for the biomedical and pharmaceutical field

In recent years, α-amino acid based poly(ester amide)s (AAA-PEAs) have gained renewed interest for applications in the biomedical and pharmaceutical fields. This is due to the fact that these materials combine the good biodegradability of polyesters with the good mechanical properties of polyamides. These materials can be obtained with a wide variety of structures, which allows fine-tuning of their physicochemical properties (e.g., hydrophilicity, stiffness, degradability). In addition, the presence of α-amino acids enables the enhancement of cell-material interactions, thereby increasing cell adhesion and proliferation. This presentation will make an overview about the developments in the field of AAA-PEAs in the PolySyc Group, at the University of Coimbra, with particular emphasis on the different processing techniques used to prepare materials with interest in the biomedical/pharmaceutical field.

Day:2-
11:45:12:00

Mr Kudakwashe Chingono - University of Leeds
OC109

Continuous synthesis of PEG - based nanoparticles with nanoscale precision

In this work, an automated modular platform is presented for an industry 4.0 approach in the development and production of PEG based nanoparticles via continuous flash nanoprecipitation. Integration of real-time monitoring using Dynamic Light Scattering and Small Angle X-Ray scattering with inline workup using tangential flow filtration ensured control over the reaction parameters, resulting in consistently sized nanoparticles with enhanced stability. Furthermore, the automated operation of pumps can facilitate high-throughput exploration of the parameter space which brings about opportunities for the implementation of self-optimisation algorithms for the identification of optimal materials. Ultimately, control of physical parameters in processing will streamline the ability to link performance of biomedical formulations for example, to their process conditions, and eventually the optimisation of their manufacture.

Day:2-
12:00:12:15

Dr Jungyeon Kim - University of Manchester
OC109

Well-Defined Polymers for Biotechnology

Well-defined polymers synthesised by ionic and controlled radical polymerisation are a powerful source for developing novel materials for biotechnology. There has been much focus on neutral polymers, for e.g biomedical or coating applications, but here I will discuss biotechnological applications of highly charged polymers. Anionic polymers from controlled radical polymerisation have shown to inhibit the viral replication process, demonstrating a promising route towards in vivo broad-spectrum antivirals. Secondly poly(ampholytes), bearing mixed cationic/anionic groups have been shown to enable cellular cryopreservation, with the potential to make cell based therapies more potent and more widely available. In this talk, i will discuss recent results in deploying well-defined polymers in both of these applications.

Day:2-12:15:12:30

Ms Chaimaà EL KOUALI - Laboratory LIMAT, Faculty of sciences Ben M'Sick, Hassan II University of Casablanca, Morocco
OC109

Synthesis of recycled bio-polymer and the elaboration of intelligent antibacterial and antifungal films for biomedical applications

Recycled cellulose triacetate (rCTA), synthesized from waste cotton fibers by acetylation, is used as a base polymer to form a bioplastic film for biomedical applications. The films were prepared by the solution casting method. Ionic liquids and antibacterial agents are added to functionalize the films and give them new characteristics. Different analytical techniques, such as scanning electron microscopy (SEM), Fourier Transform Infrared (FT-IR), thermogravimetric analysis (TGA), and tensile and elongation tests, are used to characterize the films and evaluate their mechanical, physical, and chemical performances. Antibacterial and antifungal activities are tested to ensure the possibility of using these films as intelligent antibacterial films. The resulting films have been distinguished by their flexibility, transparency, and excellent antibacterial activity. These results offered opportunities for the production of new anti-bacterial film alternatives for biomedical applications

Day:2-12:30:12:45

Dr Julia Rho - University of Birmingham
OC109

Controlling the polymer self-assembly on multiple length scales for biotherapeutics

Polymeric nanoparticles have a key part to play in improving the delivery of biological cargo (drugs, genes, and antibodies) for biotherapeutics. Notably, the direct delivery of these cargos into our cells or bodies often leads to high toxicity and low efficacy. Many nanoparticles have been developed to address these challenges. Recently, we reported the selective surface modification, using photo-induced radical polymerisation, of 2D platelets formed by crystallisation-driven self-assembly. This work highlights not only the exquisite control we have in forming platelets but also our ability to modify specific regions on the self-assembled surface. Herein, I will discuss several polymer self-assembly methodologies (crystallisation, hydrogen bonding and coacervates) to yield nanoparticles with various sizes, compositions, and stability. This presentation will also highlight recent results applying these highly tunable and functional nanoparticles for drug and gene delivery.

Day:2-14:00:14:30

Professor Huaping Xu - Tsinghua University
OC109

Non-carbon Main Chain Polytelluoxane

In contrast to other main group elements, group VI elements are rarely observed to form long linear polymer main chains. We reported the synthesis and characterizations of polytelluoxane (PTeO), a polymer with an inorganic main chain constituted of tellurium and oxygen, which may bridge the gap between inorganic oxides and macromolecules. PTeO has a flexible Te-O backbone and can be facilely synthesized and further processed into macroscopic materials. Because of its unique molecular structure, PTeO is a transparency ultraviolet protection optical material and reveals a photocatalytic activity comparable with commercial catalysts. Moreover, PTeO exhibited effective closed-loop recyclability with a recycle efficiency around 90% and a recycle number over 10. In addition, PTeO can be synthesized in living cells via oxidative polymerization and selectively kill cancer cells by disrupting the intracellular redox balance.

Day:2-14:30:14:45

Professor Jan Merna - University of Chemistry and Technology, Prague
OC109

Functional branched polyolefins by chain walking catalytic polymerizations

Introduction of functional group to non-polar polyolefins may expand the scope of their application. Chain walking catalysts provide branched polyolefins with unique dendritic topology. Combining their ability for living olefin polymerization and higher tolerance to polar functionality makes these catalysts superior to deliver novel materials based on branched polyolefins with defined molar mass and bearing polar groups.

This contribution will describe methods of preparation of end-functionalized and in-chain functionalized polyolefins and their utilization to prepare block and grafted copolymers.

Acknowledgements: This work was supported by Czech Science Foundation (GAČR GF22 09470L).

References:

1. Kotyza, O., Kočková O., and Merna J., Chain-end functionalization of polyolefins prepared by α-diimine nickel catalysts using transfer to organometallic compounds. Polymer 2023, 285, 126314.
2. Nunvářová, K., et al., Eur. Polym. J. 2019 115, 193.

Day:2- 14:45:15:00	**Professor Markus Retsch - University of Bayreuth OC109**

Polymers-enabled heat management

Controlling heat and cold across various scales is a key prerequisite to mitigating the severe effects of global warming. Polymers are typically considered poorly conducting materials in this context. In this contribution, I will comprehensively demonstrate that polymers can play a vital role in high-end heat management applications along three examples: Firstly, engineered molar mass distributions of PE blends lead to highly anisotropic microstructures and concomitant thermal conductivities. 3D printing can then program areas of high and low heat dissipation. Secondly, many biogenic polymers have great potential for passive daytime cooling applications. I will outline strategies to use polymers such as chitosan for zero-emission cooling. Thirdly, autonomous temperature measurements are essential for battery safety assessments. Combining dry sintering kinetics of colloidal crystals with a gradient composition paves the way towards a time- and temperature-integrating sensor.

Day:2- 15:00:15:15	**Dr Nicholas Chan - Commonwealth Scientific and Industrial Research Organisation, Australia OC109**

Insect Digestible by Design: Plastics for a Circular Economy

Polymer and materials scientists have taken the forefront on alternative plastics design, utilizing different bio-based monomers and polymers and studied their environmental degradation. However, none have investigated these alternatives against insects – recently discovered to be effective bio-transformers for commercial plastics including poly(ethylene) and poly(styrene) despite their molecular robustness.

Herein, we present the design, processing and subsequent insect-based degradation of biobased plastics and assess their viability as a substitute for commercial plastics. To fully ascertain their viability as an insect-digestible plastic substitute, we have characterized the physical and thermal properties of various materials and the impact of both enzyme and insect exposure. This includes comparison of the crystallinity and molecular structure of the material both before and after degradation

Day:2- 15:15:15:30	**Ms Hsin-Chen Chen - KTH Royal Institute of Technology OC109**

Cellulose nanocrystals-stabilized Waterborne NIPU Latexes and Composites

Non-isocyanate polyurethanes (NIPUs) have emerged as one of the top candidates for more sustainable and less hazardous PUs. Waterborne NIPUs (WNIPUs), free of volatile organic compounds, have opened up versatile applications where low viscosity is essential. Herein, cellulose nanocrystals (CNCs) are used as stabilizers to form WNIPU latexes. Through emulsification, cyclic carbonate and amine monomers are dispersed in the water phase with CNCs, and polyaddition reaction is triggered at 60 °C for 24 h to produce the final WNIPU latexes. A limited coalescence process is recorded: below 0.03 wt% of CNCs, there is a linear correlation between the CNC amounts and the droplet sizes of emulsions, while above 0.04 wt% of CNCs, the droplet sizes hit a plateau. A 90% conversion of the reactive functions has been achieved after optimizing the monomer ratios against partial hydrolysis of carbonate in water. Adhesive properties of the CNC/WNIPU composites are characterized by tack tests.

Day:2- 16:00:16:30	**Assistant Professor Herdeline Ann Ardoña - UC Irvine OC109**

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Day:2- 16:30:16:45	**Dr Amanda Pearce - Loughborough University OC109**

Understanding structure-activity relationships of polymeric nanoparticles in biological applications

Polymer nanomedicines have emerged as a strategy for overcoming the limitations of traditional small molecule drugs, many of which suffer poor solubility and rapid clearance after administration in the body. This in turn limits the dose that can be administered and the amount that reaches disease sites to exert a therapeutic effect. However, to date less than 10% of nanomedicine formulations have reached commercialisation due to critical insufficiencies hindering widespread adoption in the clinic, such as an inadequate understanding of bio-nano interactions in the body. This talk explores the influence of nanoparticle properties including size, chemistry, and topology on drug delivery performance in anticancer and antimicrobial applications. The development of accessible LC-MS lab-based assays for studying fundamental interactions between polymer nanoparticles and key biological molecules such as proteins to improve reproducibility in nanomedicine reports will be presented.

Day:2- 16:45:17:00	**Assistant Professor Richard d'Arcy - Arizona State University OC109**

Tailoring Polymer-Drug Interactions for Ultrahigh-Loading, ROS-Triggered Release, and Tumor Elimination

Nanomedicine presents a promising modality for enhanced cancer therapy, particularly through maximum tolerated dose (MTD) enhancement. Recent studies have revealed that MTD is proportional to loading capacity (LC), with higher LCs resulting in superior MTDs and better therapeutic outcomes. Herein, by tailoring drug-polymer interactions through π–π, hydrogen bonding, and ionic interactions, we have developed nanocarriers capable of ultrahigh loading (LC > 35 wt. %) a wide-range of drugs with field-leading MTDs in mice. Employing a polysulfide-backbone further enabled temporal control over release, with reactive oxygen specie(ROS)-responsive kinetics accelerating with the increasing polarity of the polymer chain. In a comparative study between Fast and Slow-release formulations of paclitaxel (150 mg/kg, q10d), the Slow-release formulation demonstrated superiority, with sustained tumor regression/remission for up to 100 days in 4/8 tumors and complete tumor elimination in 3/8 tumors.

Day:2- 11:00:11:30	**Professor Andrew Slark - University of Sheffield FAB003**

Dissociative Covalent Adaptable Networks and Hybrids with Non-Covalent Interactions

Thermally reversible networks have been designed using Diels-Alder reactions and non-covalent interactions via facile, industrially scalable techniques. The combination of reversible covalent bonds and non-covalent bonds enables higher mechanical and thermal performance while maintaining facile reprocessability. A range of properties can be obtained, potentially suitable for different applications including adhesives, elastomers and composites.

Semi-crystalline prepolymers can be readily designed with varying melting points. The resulting networks produce remarkably high mechanical properties since crystalline regions do not prevent the formation of covalent bonds. Amorphous prepolymers with different polarity have also been copolymerized with multifunctional crosslinkers capable of different degrees of hydrogen bonding. The synergy between reversible covalent and non-covalent interactions provides improved mechanical performance at higher temperatures.

Day:2- 11:30:12:00	**Dr Vincent Ladmiral - CNRS FAB003**

Fluorine-activated transesterification and transamidation vitrimers

Vitrimers are polymer networks possessing dynamic crosslinks via exchange reactions. These materials thus combine properties of thermoplastics and of thermosets: resistance to solvant, good mechanical properties, reprocessability, self-healing and improved recyclability. This talk will show how the high electron-withdrawing effects of fluorinated groups can be harnessed to activate transesterification and transamidation to produce vitrimer materials. Indeed, fluorine atoms located on the alpha, or beta position of an ester or an amide are shown to significantly accelerate transesterification and transamidation on molecular model reactions and by DFT calculations. This acceleration is even more pronunced in crosslinked polyesters and polyamides. These materials featured typical vitrimer behaviours with complete stress-relaxation and topological reorganisation via fluorine-activated transesterification or transamidation, in the absence of any catalysts.

Day:2- 12:00:12:15	**Mr Vincent Scholiers - Ghent University** **FAB003**

Transalkylation Chemistry for Recycling Thermosetting Materials

Thermoset materials, while integral to modern society, pose significant environmental challenges in terms of recycling due to their permanent network topology. Recent advancements in dynamic polymer networks offer an attractable solution to tackle this dilemma. The present work is focused on the synthesis of polymer networks containing trialkyl sulfonium bonds, derived from partial alkylation of thioether bonds. This allows dynamic exchange reactions at elevated temperatures via an SN2-type of nucleophilic substitution pathway. Unlike various other dynamic chemical platforms, such as transesterification and olefin metathesis, this chemical platform does not require an external catalyst. Moreover, by considering the spatial arrangement of thioether bonds and electronic environment, the viscoelastic behaviour can be highly customized, making it a very attractive platform for a wide range of applications, including flexible electronics, smart coatings and optical applications.

Day:2- 12:15:12:30	**Dr Matilde Concilio - University of Oxford** **FAB003**

Functional oxygenated polyesters for the synthesis of crosslinked reprocessable thermosets

Thermosets have gained prominence in various applications due to their exceptional dimensional stability, mechanical properties, and resistance to both creep and chemicals. Nevertheless, their permanent molecular structure poses limitations, preventing them from being reshaped, manipulated, or effectively recycled. An intriguing chemical approach to introduce flexibility into cross-linked polymer networks involves the incorporation of exchangeable chemical bonds, which results in the formation of dynamic cross-links. Here, ring-opening copolymerization (ROCOP) of unpurified epoxides and anhydrides is employed for the synthesis of well-defined sustainable polyesters with precise end-groups and functionalities. Polymer networks are then formed through the catalysed reaction of the copolymers with epoxy-containing crosslinkers. The role of the dynamic covalent bonds on the mechanical and physical properties of the polymer networks is investigated, along with vitrification-based repairs.

Day:2- 12:30:12:45	**Dr Thiago Ouriques Machado - University of Birmingham** **FAB003**

A Circular Photopolymer Resin for Light-Assisted 3D Printing

Light-assisted 3D printing allows the fabrication of complex objects with high precision. However, recycling the photopolymer from the printed parts remains a challenge, and while there have been efforts to foster circularity in 3D printing systems, no resin can be depolymerised and reprinted in a closed-loop process. We have designed a resin platform fully derived from renewable feedstock able to form inherently dynamic covalent networks, allowing resin recycling in a closed-loop manner. The modular monomer synthesis enables structural changes in the resin components, rendering a versatile platform with range of thermomechanical properties. 3D-printed objects can be swiftly depolymerised and reprinted into high-resolution parts without additional diluent or crosslinker. Our resin platform is an advancement to photopolymer resin technology, which improves circularity of 3D printing processes by enabling closed-loop recycling and is adjustable to a range of thermomechanical properties.

Day:2- 14:00:14:30	**Professor Joost Brancart - Vrije Universiteit Brussel FAB003**

Additive manufacturing of Diels-Alder-based polymer networks into self-healing soft robotic grippers

Dynamic covalent chemistries enable reversible network polymerization to combine the (re)processability of thermoplastics with the superior properties of chemically crosslinked networks. Dissociative networks based on the thermoreversible Diels-Alder cycloaddition show a decrease in crosslink density upon thermal activation leading to a drastic solid-liquid transition at the critical gel conversion. This gel transition temperature and the viscoelastic behaviour depend strongly on the monomer and network architectures. Several approaches have been investigated to tune the rheological behaviour to improve the extrudability, while retaining these advantageous properties: (1) fillers and additives, (2) adjusting the polymer network compositions and (3) the combination of dynamic covalent chemistries. Extrusion-based additive manufacturing enables creating self-healing soft robotic systems with integrated sensors that are able to recover their sensory performance after damage healing.

Day:2- 14:30:15:00	**Associate Professor Hans Heuts - TU Eindhoven FAB003**

Dynamic Polymer Networks via Trans-Reactions with Neighboring Group Participation

The study of dynamic covalent polymer networks has become a very active field of research over the past decade, with many efforts directed towards the development of novel dynamic chemistries and a better control of the material properties. Our recent efforts have focused on dynamic covalent networks using catalyst-free trans-reactions, in particular in systems based on pyromellitic dianhydride (PMDA) and phosphate esters. PMDA is a common commercial building block that can be used for dynamic linking in polyesters and was found to be an efficient dynamic cross-linker in diamine systems through an imide-diamide equilbrium, imparting additional stiffness to the networks via supramolecular interactions. Phosphate tri-esters have also been found to be very efficient dynamic linkers and cross-linkers and can undergo transesterification reactions via both associative and dissociative mechanisms, depending on the presence of beta-hydroxyl groups. In this presentation, our recent results obtained for these systems will be discussed.

Day:2- 15:00:15:15	**Assistant Professor Audrey LLEVOT - Bordeaux INP FAB003**

Self-healing and transparent poly(dimethyl)siloxane: toward enhanced ageing materials for space applications

On the geostationary orbit, polymeric materials tend to degrade on their surface resulting in the appearance of cracks. Implementation of the self-healing concept in polymers going to space can enhance the lifespan of materials that cannot be replaced once launched. In this work, PDMS were functionalized with various compositions of urea and imine moieties to form dynamic covalent and/or supramolecular networks. Hydrogen bonds induced by ureas ensure the formation of a supramolecular network, while dynamic covalent imine bonds undergo exchange reactions. As for coating applications, surface properties are essential, percentages of scratch recovery were determined by AFM, from which self-healing kinetics were extracted and rationalized based on the polymer structures. These data were in good agreement with the relaxation times assessed by rheology. The accelerated ageing under proton irradiation, revealed a limitation or disappearance of cracks while keeping transparency of the PDMS.

Day:2- 15:15:15:30	**Associate Professor Maarten Smulders - Wageningen University FAB003**

“You gotta keep 'em separated”: phase-separation in imine-based covalent adaptable networks

To achieve the full potential of covalent adaptable networks (CANs), it is essential to understand –and control– the underlying chemistry and physics of the dynamic covalent bonds that undergo exchange reactions in the network. In particular, understanding the network architecture that is assembled dynamically in a CAN is crucial, as exchange processes within the network will affect the material performance. In this context, the introduction of phase separation in different network hierarchies has recently been proposed as useful handle to control or improve the material properties of CANs.

We present how to induce and visualise –by various methods, including Raman confocal microscopy– phase separation in imine-based CANs, on micrometer scale. Also, by modifying the CAN architecture, we could either suppress or enhance the phase separation, with associated effect on dynamic-mechanical material properties, and we propose that phase separation is driven by favourable π–π interactions.

Day:2- 16:00:16:30	**Professor Jeremiah Johnson - MIT FAB003**

Antibody,ÄìBottlebrush Polymer Conjugates (ABCs)

Antibody drug conjugates (ADCs), which are composed of a monoclonal antibody for cell targeting linked to a cytotoxic payload, have emerged as a promising class of targeted chemotherapeutics. Despite their success in the clinic, ADCs suffer key drawbacks. For instance, the number and type of payload molecules conjugated to each ADC is limited due to the restricted number of conjugation sites as well as the deterioration of physical properties as the number of conjugated payloads increases. Moreover, extensive optimization of each drug payload and linker chemistry needs to be done to achieve a maximal therapeutic index for each ADC. To address these challenges, we have developed a new antibody-targeted prodrug platform, which we refer to as ,Äúantibody bottlebrush conjugates,Äù or ,ÄúABCs.,Äù ABCs feature an antibody conjugated to bottlebrush polymers of similar size and shape. The latter carry inactivated ,Äúprodrugs,Äù attached at each repeat unit along a bottlebrush backbone shielded by hydrophilic poly(ethylene glycol) (PEG) chains that protect the prodrugs from premature activation and release. The high density of PEGylation can improve the pharmacokinetics of ABCs, while the prodrug linker structure can be molecularly tuned to control the payload release rate and mechanism. Finally, different payloads and antibodies can be easily mixed-and-matched, enabling modular development of novel ABCs with predictable properties.

Day:2- 16:30:16:45	**Professor Nico Bruns - Technical University of Darmstadt FAB003**

Biocatalytic Radical Polymerizations to Create Artificial Cells and Engineer the Surface of Living Cells

Enzymatic polymerizations allow the implementation of controlled radical polymerizations into life-like and living systems. Here, we demonstrate biocatalytic atom transfer radical polymerizations (bioATRP) to drive polymerization-induced self-assembly (PISA) to create giant polymersomes with the ability to encapsulate the protein expression system of bacteria, thereby creating self-synthesizing artificial cells that can act as microreactors for enzymes and produce their own proteins within their lumen. Moreover, we demonstrate how enzymes displayed on the surface of yeast cells can graft polymers on the surface of the cells, thereby engineering their surface with synthetic polymers. These examples showcase how enzymatic polymerizations can be used to create synthetic biology systems and engineered living materials in which the polymers serve as in situ synthesized biorthogonal building blocks, opening up application opportunities at the interface of biology and polymer chemistry.

Day:2- 16:45:17:00	**Dr Chloé Grazon - CNRS FAB003**

Oligonucleotide-b-Protein nanoparticles as a promising platform for biosensing

Functional nanoparticles (NPs) are traditionally obtained in two steps: i) a hydrophobic core is synthesized and ii) a targeting agent is grafted on the surface. For some applications, such as fluorescence sensing or tracking, small NPs are required. We therefore need to develop NPs without bulky stabilizing shells around it. In addition, environmental concerns now requires the use of biodegradable materials. In that regard, we will present two approaches to obtain small stimuli-responsive NPs with a hydrophobic core of polypeptide, and using the bioreceptor as the water-solubilizing group. First, we will show a synthesis of thermoresponsive elastin-like polypeptide–block-oligonucleotide bioconjugates, and we will describe their capacity to assemble as NPs and to bind proteins, especially a transcription factor. Second, we will show synthetic peptides nucleic acids-block-poly(benzyl-L-glutamate), as fully peptidic amphiphilic polymers to process biocompatible NPs.

Day:2- 11:00:11:30	**Dr Muriel Lansalot - CNRS FAB008**

Dynamic covalent chemistry in polymer latexes for the formation of vitrimer films

Film-forming polymer latexes are key products in various applications, notably in the field of coatings. The properties of the polymer film obtained from the liquid latex can be strongly enhanced by the chemical crosslinking of the polymer chains, usually induced during film formation. Various strategies have been developed over the years, leading to permanently crosslinked films. However, introducing permanent yet dynamic crosslinks could significantly improve the film properties, as it is the case for vitrimers. In this context, the synthesis of surfactant-free vinyl polymer latexes incorporating dynamic covalent bonds, and their subsequent use in the production of vitrimer films, is of great interest. The present paper describes our recent investigation into the synthesis of film-forming latexes using RAFT-mediated emulsion polymerization-induced self-assembly (PISA) for creating dynamically cross-linked films with recyclable properties.

Day:2- 11:30:12:00	**Professor Robert Grubbs - Stony Brook University FAB008**

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Day:2- 12:00:12:15	**Professor Rachel O'Reilly - University of Birmingham FAB008**

Advances in crystallization driven self-assembly

Crystallization-driven self-assembly (CDSA) is a powerful tool in the solution polymer self-assembly toolbox and has been utilized to create an impressive range of hierarchical block copolymer structures. Unlike in conventional solution self-assembly, where the range of morphologies obtained are determined by varying the relative block composition of each block, in polymers assembled via CDSA, the formation of micelles with low interfacial curvature is favored. Our group has the CDSA of poly(ester) based block copolymers. In this work we present the CDSA of a range of polylactone block copolymers which form a range of self-assembled nanostructures including 2D nanostructures and also explore new methods for investigating the mechanism of self-assembly.

Day:2- 12:15:12:30	**Associate Professor Xiayun Huang - Fudan University FAB008**

Efficient Fabrication of Janus Particles and their Responsive Particle Assemblies

The versatile and efficient fabrication method of complex and highly regular polymeric structures is highly demanded but very limited. In the first work, we propose two effective pathways for fabricating Janus particles with sizes from ~50 nm to ~15 nm. In the following work, we are interested in the assembly of small-sized oligo-chain Janus particles. By the co-assembly of oligo-chain Janus particles and C-b-B block copolymer, a mixed-shell assembly with a large number of nanogels anchored on the core was developed. Under stimuli, the assemblies exhibited the unique fracturing behavior that was not observed in the co-assemblies of block copolymers did not have. Based on this observation, the system was extended to dandelion-shaped single-chain Janus particles and other types of Janus particles possessing nanogels on one side. As expected, all these structures displayed unique stimuli-response behavior that differs significantly from traditional assemblies made of block copolymers.

Day:2- 12:30:12:45

Assistant Professor Ondrej Sedlacek - Charles University Prague
FAB008

Synthesis of block-like copolymer nanoparticles directly from monomers by emulsion copolymerization-induced self-assembly

Amphiphilic gradient copolymers represent an emerging class of polymers owing to their straightforward synthesis by one-step statistical copolymerization of monomers showing different reactivity and hydrophilicity. In this work, we report the synthesis of copolymer nanoparticle latexes directly by RAFT/MADIX-mediated statistical emulsion copolymerization of N,N-dimethyl acrylamide (DMAM) and vinyl acetate (VAc) without any additional surfactant. The emulsion character of copolymerization led to a significant alteration in copolymerization kinetics. While the solution copolymerization in methanol led to expected gradient copolymers, the emulsion copolymerization-induced self-assembly led to block copolymer structure and significant acceleration of copolymerization due to simultaneous self-assembly. A series of PDMAM-grad-PVAc nanoparticles were synthesized, leading to different nanoparticle morphologies. Financial support from the Czech Science Foundation (22-03102S) is acknowledged.

Day:2- 14:00:14:30

Professor Jutta Rieger - CNRS - Sorbonne Université
FAB008

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Day:2- 14:30:15:00

Professor Michael Cunningham - Queen's University
FAB008

Block-Random Copolymers: Self-Assembly Behaviour and Role in Stabilizing Nanoparticle Dispersions

Polystyrene-b-[polystyrene-r-poly(acrylic acid)] block-random copolymers were synthesized at various molecular weights and compositions by nitroxide-mediated polymerization. These materials exhibit distinctly different solution behavior compared to conventional block copolymers. Alkaline aqueous dispersions of the block-random copolymers were prepared with ease up to concentrations of 300 g/L, whereas similar block copolymers are limited to ~1 g/L. Analysis of the dispersions via dynamic light scattering and atomic force microscopy indicated the presence of very small aggregates with hydrodynamic diameters as small as 5-10 nm. The block-random copolymers were used as stabilizers in semi-batch emulsion polymerization, yielding stable latexes with particle diameters as low as 45 nm. The nucleation mechanism was strongly dependent on the pH, attributable to changes in the conformation of the BRC chains, allowing generation of either unimodal or bimodal size distributions.

Day:2- 15:00:15:15

Professor Fawaz Aldabbagh - Kingston University
FAB008

RAFT Dispersion Polymerization Induced Self-Assembly (PISA): Direct Access to Glucose-Responsive Nano- and Micro-Objects

Incorporating the boronic acid (BA) moiety into polymers leads to stimuli-responsive (smart) properties. BA reversibly binds to Lewis bases, such as hydroxide, cis-diols, e.g., sugars, and α-hydroxy-carboxylic acid salts, e.g., lactate. The glucose-binding to the core-forming BA-containing block of amphiphilic block copolymers has attracted the most attention due to insulin replacement therapy for diabetics. The issue is current PISA of free (unprotected)-BA monomers cannot directly give amphiphilic nanoparticles (NPs), without boroxine formation [3]. Boroxine is the anhydride of BA. The formation of boroxine during aqueous dispersion polymerizations is due to the anhydrous environment at the core, where the hydrophobic block is made. In this presentation, the formation of high concentrations of glucose responsive of NPs directly from PISA is described.

Day:2- 15:15:15:30	**Ms Georgia Maitland - Aston University FAB008**

Block copolymer synthesis in ionic liquid via polymerisation-induced self-assembly: A convenient route to ionogels

Energy storage is vital in this day and age, particularly for storing clean energy produced from renewable resources. In order to meet this ever growing demand and enhance sustainability in this field, more efficient and cleaner materials must be generated. Ionic liquids (ILs), compared to many standard organic solvents, exhibit advantageous properties such as high ionic conductivity and thermal stability, and can be used to generate so-called ionogels, which are a class of materials that offer much promise in the way of improving energy storage for future generations. Herein, a reversible addition-fragmentation chain transfer polymerization-induced self-assembly (RAFT-PISA) formulation in ionic liquid that yields block copolymer nanoparticles is presented. Most importantly, this new IL PISA formulation facilitates the in situ formation of worm ionogel electrolyte materials at copolymer concentrations ≥5% w/w via efficient and convenient synthesis routes.

Day:2- 16:00:16:30	**Professor maud save - CNRS - University of Pau & Pays Adour FAB008**

Organic photocatalyst supported onto latex particles as versatile tool for green chemistry

Harvesting visible light to implement low energy processes fulfills some principles of green chemistry. Photosensitized singlet oxygen production involving light, oxygen from air and catalytic amount of photosensitizer is particularly attractive for producing fine chemical intermediates of interest, for air/water photo-decontamination, or for photodynamic inactivation of bacteria. Immobilizing photosensitizers on solid substrates improves their handling, recyclability and photostability. In order to achieve a sustainable photochemical process, various generations of submicronic photoactive latex particles were designed by miniemulsion polymerization or dispersion polymerization (PISA) to meet the challenge of continuous flow photo-oxidation of biobased molecule while paving the way for organic photocatalyst recycling. Core-shell film-forming latex particles synthesized by emulsion polymerization were efficient to produce photoactive polymer films with tunable mechanical properties.

Day:2- 16:30:17:00	**Professor Per Zetterlund - University of New South Wales FAB008**

Nanoengineered hybrid polymer materials: Exploitation of emulsions, polymer self-assembly and multiblock copolymers

The key to design and synthesis of advanced polymer materials lies in control of both the polymer chain structure itself as well as the way polymer chains can be self-assembled into polymer nanoparticles and materials with well-defined microstructure and microphase separation. We have recently explored a number of synthetic approaches towards such goals, focusing on linear multiblock copolymers as well as nanofibers (worms) prepared via aqueous RAFT emulsion polymerization. This presentation will summarize our recent efforts, also outlining various applications such as coatings and viscosity modification.

Day:2- 11:00:11:30	**Professor Dorina M. Opris - Empa S021**

Breaking Boundaries: Overcoming Glass Transition Challenges in Polar Elastomers for Unprecedented Dielectric Performance

Polar elastomers are emerging as a novel material class with immense promise for various applications, from actuators, sensors, generators, and light-emitting devices to solid-state Li-ion batteries. However, their synthesis poses a formidable challenge for chemists and materials scientists, given that the interaction between polar groups elevates the glass transition temperature (Tg) to levels approaching room temperature, restricting polymer chain mobility.

This presentation aims to demonstrate a breakthrough in overcoming this challenge. Despite the substantial dipole moment and high density of polar groups in polysiloxane, the resulting polymers exhibit remarkably low Tg and offer elastic materials with outstanding dielectric permittivity. These advancements impact the actuators and sensors and enhance the performance of Li-ion batteries and light-emitting capacitive devices.

Day:2- 11:30:12:00	**Professor Nikhil Singha - Indian Institute of Technology Kharagpur S021**

A New Class of Thermoplastic Elastomers Based on Bio-based ABA Triblock Copolymer via RAFT Polymerization in Emulsion

Thermoplastic elastomers (TPEs) are a unique class of polymer materials which exhibit rubber-like elasticity and thermoplastic processing characteristics. In recent years, there have been significant efforts on the development of environmentally friendly TPEs through the utilization of bio-resourced monomers. The Œ≤-myrcene is an interesting terpene monomer having a conjugated double bond with a pendant substituted vinyl group. In this case, block copolymers of Œ≤-myrcene with styrene as well as bio-based (meth)acrylate monomers were prepared via RAFT-mediated miniemulsion polymerization. The styrene or the (meth)acrylate monomers play the role of a hard block (A) and the terpene monomer (B) as a soft block for the prepared ABA-type triblock copolymers. This method ensures precise control over molecular characteristics, resulting in copolymers with a narrow dispersity range. Comprehensive analysis of mechanical properties highlights the remarkable performance and recyclability of these bio-based TPEs. Moreover, the material exhibits notable film-forming abilities and transparency. This not only demonstrates the feasibility of crafting bio-based TPEs derived from terpenes derivatives but also emphasizes the environmentally conscious approach facilitated by RAFT-mediated miniemulsion polymerization.

Day:2- 12:00:12:15	**Dr Xinyuhang Zhang - Tsinghua University S021**

Thermal Responsive Liquid Crystal Elastomer Foam-based Compressible and Omnidirectional Gripper

Liquid crystal elastomers (LCEs) are considered to be a promising material for the fabrication of soft grippers because of their large and reversible deformations, an LCE gripper with suitable compressibility and omnidirectionality has not yet been developed. To overcome these obstacles, this study utilizes salt template method to fabricate a rod-like LCE foam as gripper. The thickness of the compressible foam can be reduced by up to 77%, temporarily maintaining the deformation and enabling the gripper to pass through slits. The foam was aligned along the long axis and the length of the foam exhibits reversible thermal responsiveness and contract up to 57% along its alignment. Additionally, when the foam approaches a heat source, the generated temperature gradient results in a contraction gradient owing to the low thermal conductivity of the LCE foam. This in turn causes the foam to reversibly bend with a bending angle up to 93 °and follow the movement of a heat source omnidirectionall

Day:2- 12:15:12:30	**Professor Kwang Leong Choy - Duke Kunshan University S021**

Innovations and Applications of Engineered Nanocomposites

This contribution covers the design and innovation of multifunctional polymer nanocompo-sites, including the engineering of nanocomposite film surfaces. This involves tailoring the sur-face of the nanocomposite film, the interface between the substrate and the nanocomposite film, as well as the interfaces between the fillers and the polymer, to create robust multifunc-tional nanocomposite coatings. These coatings have diverse applications, from enhancing wear resistance and self-healing to withstanding extreme cold environments and serving as biosensors in healthcare. Additionally, the use of eco-friendly, non-vacuum aerosol-assisted deposition techniques and their process principles for creating nanocomposite coatings with well-controlled structure and composition, to realize the superior performance of these nanocomposites, will also be presented.

Day:2- 12:30:12:45	**Mr Tuhin Subhra Pal - IIT Kharagpur S021**

Mussel-inspired Catechol functionalized EVA Elastomers for Specialty Adhesive Application

Marine mussels secrete adhesive proteins enabling them to bind to various surfaces in wet environment. A main structural component in these adhesive proteins is the presence of a catechol-based amino acid, L-3,4-dihydroxyphenylalanine responsible for interfacial binding. Mimicking this functionality in synthetic polymers has led to high strength adhesives able to bind to both dry and wet surfaces. Here, an epoxy functionalized elastomer poly(ethylene-co-vinylacetate-co-glycidylmethacrylate) (EVA-GMA) was modified with dopamine via epoxy-amino click reaction to make it self-healable and recyclable. These functionalized elastomers can self-heal in both dry and underwater by forming H-bonding and coordination complexes with several metal ions. The tensile study showed improvement in mechanical strength upon H-bonding and coordination interactions. This catechol functionalized EVA-elastomer showed excellent adhesive strength, as analyzed via lap shear test in both dry and underwater.

Day:2- 14:00:14:30	**Professor Peter Halley - The University of Queensland S021**

Sustainable biopolymer films scale-up; examining sustainability across the entire life cycle

The usefulness and cost effectiveness of plastics packaging and products has led to their wide use, but unfortunately a global waste issue. The solution to using plastics sustainably is a complex issue and needs to be examined across the entire life cycle of the plastic from materials formulation, processing, transport, use and disposal/recycling. This talk will examine a summary of various ways to develop a more sustainable plastics, and then as a case study we will summarise the research and development and scale-up of high value bio-based starch based polymer films. This will include initial work on starch biopolymer blends, novel processing and life cycle sustainability assessments.

[1] Global plastic production 1950-2021, Published by Statista Research Department, Mar 24, 2023 (https://www.statista.com/statistics/282732/global-production-of-plastics-since-1950/)

Day:2- 15:00:15:30	**Professor Chaoying Wan - University of Warwick S021**

Characterisation of dynamic reversibility of elastomer-filler network via large amplitude oscillation shear (LAOS)

The introduction of self-healing and reprocessability to conventional vulcanised rubbers has been recognised as a promising strategy to promote elastomer circularity. However, there is no solid strategy to assess the reversibility and recovery of properties in crosslinked polymer networks. The most often used static mechanical testing is unable to illustrate the self-healing mechanism at the microscale. We have explored Fourier transform (FT) rheology coupled with large amplitude oscillation shear (LAOS) technology to study the network break and recovery across linear and non-linear regimes (0.01~500%). The self-healing process of the rubber composite networks is monitored by using programmed time-temperature oscillation shear measurement. By coupling FT-rheology and LAOS analysis, two distinct non-linear enhancement behaviours beyond the linear viscoelastic regime were detected in the rubber nanocomposites, which were ascribed to the filler network disruption followed by the polymer network deformation. The relationship of the nonlinearity parameter I3/1 as a function of strain amplitude was selected to quantify the non-linear rheological responses as a complementary tool to Lissajous-Bowditch mapping, where the role of the filler and polymer on the network recovery can, therefore, be differentiated. This work provides an efficient method to evaluate the self-healing and reprocessability of crosslinked rubbers and offers a fast-screening route for formulation development and sustainable rubber composite design.

Day:2- 16:00:16:30	**Professor Patrick Theato - Karlsruhe Institute of Technology (KIT) S021**

Functional Polymers: from new synthetic routes to applications in energy storage

Functional polymers are based on certain chemical functional groups. As such, the inspiration from organic chemistry has always been fruitful to the development of new synthetic routes to functional polymers. Further, the drive for structure-property relationships in polymer materials requires a precise control of polymer structures. As such, two different aspects will be discussed: (a) PEO-based block copolymers as solid polymer electrolytes for batteries, (b) sulfur polymers and their applications.

Day:2-16:30:17:00

Professor David Mecerreyes - University of the Basque Country
S021

Current Trends and Perspectives of Polymers in Batteries

This presentation will discuss the current status and future opportunities for polymer science in battery technologies. Polymers are playing a crucial role for improving the performance of the ubiquitous lithium ion battery. But they will be even more important for the development of sustainable and versatile post-lithium battery technologies, in particular solid-state batteries. Through a collection of our recent works, we will identify the trends in the design and development of polymers for battery applications including binders for electrodes, porous separators, solid electrolytes or redox active electrode materials. Finally, the future needs, opportunities and directions of the field will be highlighted.

Day:2-11:00:11:30

Professor Luke Connal - The Australian National University
S020

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Day:2-11:30:11:45

Dr David Pahovnik - National Institute of Chemistry
S020

Cross-linked synthetic polypeptides prepared by ring-opening polymerization of N-carboxyanhydrides

Synthetic polypeptides have a promising potential for various biomedical applications that often require a cross-linked structure. Due to the natural occurrence and availability of the L-cystine α-amino acid, we used its N-carboxyanhydride (NCA) as a cross-linker in the ring-opening polymerization of NCAs in oil-in-oil high internal phase emulsions (HIPEs) to prepare macroporous polypeptide scaffolds. Scaffolds with a well-defined morphology were obtained when good control over the rate of polymerization was achieved. By deprotecting the corresponding polypeptide scaffolds, the stimuli-responsive polypeptide hydrogels with fully preserved polyHIPE morphology were prepared. We discovered that the L-cystine NCA readily undergoes undesired decomposition side reactions, i.e., β-elimination and formation of 2,5-diketopiperazine, which can be completely avoided when the analogous L-homocystine NCA is used instead.

Day:2-11:45:12:00

Ms Eloïse Equy - Université de Bordeaux / CNRS / Bordeaux INP
S020

Self-propelled Janus polymersomes: mimicking biological motility for drug delivery applications

Scientists strive to replicate natural cell features in artificial protocells. Specifically, achieving motility and directional swimming holds vast potential for developing smart therapeutics with targeted drug delivery. Our project aims to design asymmetric Janus-like polymersomes capable of self-propulsion, either chemically powered by enzymatic glucose decomposition or light-driven through self-thermophoresis, with improved directional swimming efficiency due to their functionalization with filamentous bacteriophages. We will present the development of asymmetric Janus-like vesicles resulting from the phase separation within the membrane between two distinct block copolymers. We demonstrate that copolymers can be rationally selected to self-assemble into asymmetric polymersomes with tunable phase separation based on parameters like ratio, molecular weight, and temperature. Furthermore, we explore their asymmetric functionalization with enzymes and gold nanoparticles.

Day:2-
12:00:12:15

Associate Professor Takuya Matsumoto - Kobe University
S020

Modification of poly(vinyl alcohol)s under supercritical carbon dioxide and their functionalization

Herein, we performed various modification of poly(vinyl alcohol) (PVA) under supercritical carbon dioxide (sc-CO2) media and investigated not only on their structure and mechanical properties but also on surface properties and hygroscopicity. High permeability and high solubility of the sc-CO2 lead to selective modification of the amorphous regions in PVA. Therefore, the modified PVA under sc-CO2 possessed different structure and material properties, compared to PVA modified in solution states. The acetylated PVA under sc-CO2 remained crystallite structure and orientation of PVA and the hygroscopic behaviors of their films depended on the maintained crystallites of PVA. In addition, urethanization and butyalization under sc-CO2 also performed. The urethanization of PVA provided low hysteresis of dynamic contact angles of air bubbles and diiodomethane droplets underwater. The butyralization of PVA under sc-CO2 led to high adhesion strength even in high humid condition.

Day:2-
12:15:12:30

Rosanna Le Scouarnec - LCPO
S020

Synthesis of lipo-polypeptide backbone as tools to control liposome-membrane destabilization

Delivering a drug at the right time and in the right place remains a major challenge for drug delivery. Stimuli-responsive polymers have been studied to modulate membrane permeability and trigger drug delivery from vesicles in the presence of ions, light, temperature or redox conditions. This work developes lipopeptidic polymers which, when incorporated into a liposome formulation, disrupt membrane organization, inducing local defects when exposed to changes in pH, temperature or to zinc cations. We fully report here on the synthesis of such polymers and their destabilizing effect. Interestingly, such switching elements could be used to build of synthetic cells with controlled nutrient transport across their membranes.

Day:2-
12:30:12:45

Ms Hui Wen Yong - McGill University
S020

Reversible Morphological Transitions of UCST Polymers for Regulation of Drug Release

Defined polymer aggregates are of utmost importance in the progression of nanomedicine. Most polymeric formulations contain multiple functional groups that accelerate drug release under differing microenvironments. However, these nanocarriers lose their distinct structures as they undergo physical or chemical modifications in response to environmental changes. Subsequent drug release from these systems is poorly controlled, which hinders their progression towards personalized medicine. Herein, we designed a nanocarrier that undergoes reversible temperature-controlled morphological transitions between active and dormant states for drug delivery. We leveraged the UCST properties of P(AAm-co-AN), in addition to other water soluble/ insoluble polymers to achieve these stable transformations. We demonstrate the importance of structural design and balance of functional units in regulating temperature-dependent transformations for better spatiotemporal control of drug release.

Day:2-
14:00:14:30

Professor Philippe Guégan - Sorbonne Université
S020

Mixed Cationic Polymers and Neutral Amphiphilic Copolymers for Gene Delivery Applications

Complexes between cationic polymers and polynucleotides have been envisioned as potent nanoparticules for gene delivery applications. Despite promising in vitro transfection results, the toxicity of the cationic polymers remains a drawback that can be circumvented by modifying the architecture of the cationic polymer, or the design of new formulation processes. We describe here the synthesis of new PEI-based star polymer that will be formulated with pDNA by nanofluidic for gene delivery applications. These nanoparticles will be mixed with polymersomes to form entrapped polyplexes into polymersome. These new nanostructures will be used for gene delivery applications, and compared with pristine polyplexes.

Day:2- 14:30:14:45	**Ms Nicola Cusick - University of Siegen S020**

Photosensitiser-loaded amphiphilic block copolymer vesicles enable eradication of pathogenic bacteria

Photosensitisers present an alternative strategy to traditional antibiotics for infected wound treatment. In the presence of oxygen and light, photosensitisers produce reactive oxygen species, acting as broad-spectrum killing agents by causing oxidative stress to cells. In a smart wound dressing, an externally triggered antimicrobial strategy would enable on-demand infection eradication. In this work, amphiphilic block copolymers poly(ethylene glycol)-block-poly(lactic acid) and poly(ethylene glycol)-block-poly(caprolactone) were synthesised and self-assembled to afford vesicles and micelles encapsulating photosensitisers. Such systems enable high local delivery of photosensitiser, without associated "dark toxicity" effects. Localised illumination generates singlet oxygen, eradicating both Pseudomonas aeruginosa and Staphylococcus aureus. Incorporation of these carriers into a support matrix in combination with a reporter dye could provide a promising smart wound dressing.

Day:2- 14:45:15:00	**Dr SOMDEB JANA - Post doctoral researcher S020**

Non-viral and efficient transfection agents for RNA delivery

There is a growing demand for developing safe and efficient non-viral vectors for RNA transfection due to several drawbacks and risks associated with viral vectors. The most-established cationic polymers for gene transfection are linear polyethylenimines (PEI), albeit PEI has certain limitations such as high charge density that can damage the cells and poor transfection efficiency for RNA, especially compared to lipid nanoparticles (LNPs). Here, we will describe the synthesis of a library of PEI-co-polypropylenimine (PEI-co-PPI) copolymers and systematic investigation of their in-vitro and in vivo RNA transfection ability. PEI-co-PPI copolymers were found to be more efficient in vitro than the current state-of-the-art in vitro transfection agents while in vivo transfection was demonstrated to approach the performance of LNPs, but with much simpler and cheaper production of the RNA complexes.

Day:2- 15:00:15:15	**Assistant Professor Lucas Caire da Silva - McGill University S020**

Designing Cell-Like Microreactors through Bio-Inspired Compartmentalization

Biomimetic compartments consist of vesicles, colloidal particles, and droplets designed to mimic the structural, organizational, and catalytic principles of cells. Such compartments provide the framework for the design of microreactors, biosensors, and synthetic cells. Research in my group is dedicated to the development of biomimetic compartments and cell-like microreactors, micrometer-scale "chemical factories". Our lab is exploring stimuli-responsive copolymers and peptides as building blocks for creating compartments with adaptive permeability, controlled self-assembly, and dynamic morphology. By incorporating cellular strategies into biomimetic microreactors, we are paving the way for the development of the next generation of chemical systems that are more energy efficient, selective, and versatile. In this talk, I will discuss assembly methods and applications of biomimetic compartments and microreactors.

Day:2- 15:15:15:30	**Ms Caroline Holick - Friedrich Schiller University Jena S020**

Poly(2-ethyl-2-oxazoline) (POx) as poly(ethylene glycol) (PEG) lipid substitutes for lipid nanoparticle formulations

In the midst of the COVID-19 pandemic, a new class of vaccines entered the market: Lipid nanoparticles (LNPs) encapsulating genetic material (mRNA). The LNPs are composed of four components; among them poly(ethylene glycol) (PEG) lipids that stabilize the LNPs and improve their circulation. However, there are also concerns, known as the "PEG dilemma", that are associated with the increase in anti-PEG antibodies, which can cause hypersensitivity reactions such as allergies. To avoid this, poly(2-ethyl-2-oxazoline) (POx)-based lipids with varying degrees of polymerization were synthesized and characterized by means of NMR, SEC and MALDI-TOF MS. These POx-lipids were subsequently used to formulate mRNA-loaded LNPs and tested for their size and encapsulation efficiency, and compared to commercial LNPs utilizing PEG-lipids. The POx-lipids demonstrate potential to substitute PEG-lipids in current LNP formulations as alternatives, e.g., in terms of mitigating side effects.

Day:2- 16:00:16:15	**Assistant Professor Rachel Hand - University of Warwick S020**

Interactive Polymers for Improving Analytical Methodologies.

While recently 'plastics' have received a bad reputation in the global media, polymers can play a vital role towards sustainability. Where there has been an industrial status quo in formulations and packaging materials for decades, recently the need for change has become paramount in the race to ambitious 'net zero' decarbonisation targets. However, this also means that the requirement for robust and reliable analytical methodologies has become vitally important, not only to ensure product viability when replacing components with more sustainable options but also in areas such as biomedical/healthcare testing. This aligns with the United Nation's Sustainable Development Goal (SDG) 3 – Good Health and Well-being.[1] In this talk I will demonstrate examples of the interactive polymers (molecularly imprinted polymers/hydrogels etc.) that we have created in order to tackle some of these analytical challenges.

[1] The 17 Goals, United Nations, https://sdgs.un.org/goals (accessed Dec. 23)

Day:2- 16:30:16:45	**Professor Oliver Brueggemann - Johannes Kepler University Linz S020**

Bio3-polymers: Medical Applications of Biomimetic, Biocompatible and/or Biodegradable Functional Polymers

This paper displays our newest developments of functional polymers for medical applications. These functional polymers follow a biomimetic approach, are biocompatible and some of them are even biodegradable, so labeling them Bio3-polymers might be justified. The first part presents our concept of chameleomers: molecularly imprinted polymers mimicking the effects of the chameleon's skin, showing easily observable colour changes, here, upon highly selective recognition and binding of specific (bio)molecules like peptide nucleic acids. Such chameleomers are intended to be applied as sensors, e.g., in wound patches or for fast DNA/RNA recognition. The second part shows our efforts in applying biobased, biocompatible and biodegradable polymers as carriers of anti-cancer drugs for efficient future treatment of cancer. And last but not least, we demonstrate the development of a novel photocurable ink applicable in 3D-printing of biocompatible and biodegradable tissue engineering scaffolds.

Day:2- 11:00:11:30	**Professor Guillaume Delaittre - University of Wuppertal S019**

Oleanolic Acid-Based Polymers

Oleanolic acid (OA) is a triterpenoidic hydroxyacid found in more than 1600 plants and notably to an extent as high as 3.5 wt% in olive leaves. In addition to its known pharmacological properties, it therefore represents an interesting source of raw materials for specific applications, where rigid and/or chiral units may be of use.

The present contribution will detail the incorporation of OA as main-chain or side-chain component in various polymer types, obtained by either step or chain polymerization mechanisms, respectively.

Polyurethanes, polycarbonates, and polymethacrylates were investigated. Various parameters such as the nature of the catalyst or of the comonomer, the concentration of transfer agent, and the solvent were investigated. Typically, the obtained polymers possess excellent high heat stability and high glass-transition temperatures ranging from 165 to 220 °C.

Day:2- 11:30:11:45	**Professor Helen Tran - University of Toronto S019**

Macromolecular Bioelectronics

Next-generation electronics will autonomously respond to local stimuli and be seamlessly integrated with the human body, opening the doors for opportunities in environmental monitoring, advanced consumer products, and health diagnostics for personalized therapy. For example, biodegradable electronics promise to accelerate the integration of electronics with health care by obviating the need for costly device-recovery surgeries that increase infection risk. Moreover, the environmentally critical problem of discarded electronic waste would be relieved. The underpinning of such next-generation electronics is the development of new materials with a wide suite of functional properties beyond our current toolkit. Organic polymers are a natural bridge between electronics and soft matter, where the vast chemical design space allows tunability of electronic, mechanical, and transient properties. Our research group leverages the rich palette of polymer chemistry to design new materials encoded w

Day:2- 11:45:12:00	**Associate Professor Jiajia Li - College of Chemistry, Chemical Engineering and Materials Science, Soochow University S019**

RAFT 3D Printing by Xanthate

Reversible deactivation radical polymerization (RDRP), such as reversible addition-fragmentation chain transfer (RAFT) polymerization and atom transfer radical polymerization (ATRP), enable precise control over polymer molecular weights, molecular weight distribution (MWD), composition and topological structures. Recently, the application of RDRP techniques in photopolymerization-based 3D printing has become an attractive approach, providing avenues for fabricating stimuli-responsive and self-healing materials. In addition, this method facilitates advancements in 4D printing and allows for fine-tuning nanostructures within the printed objects. Photoinduced 3D printing based on RAFT process has emerged as a robust method for creating diverse functional materials. Here the presentation will show oxygen-tolerant and rapid 3D printing through photoiniferter RAFT polymerization/RAFT step-growth polymerization/cationic RAFT polymerization by using Xanthate.

Day:2- 12:00:12:15	**Ms Urska Cesarek - National Institute of Chemistry S019**

Carbamate protected amino alcohols as initiators for ring-opening polymerization of propylene oxide to facilitate hybrid block copolymer synthesis

The incorporation of amino end group into the polyether structure using heterofunctional initiators can be challenging, as the amino protecting groups must be compatible with anionic ring-opening polymerization (ROP) of epoxides. We have developed a synthetic approach for the preparation of α-amino-ω-hydroxyl poly(propylene oxide) (PPO) by ROP of propylene oxide using heterofunctional amino alcohol initiators with different carbamate-based protecting groups. The efficient and chemoselective ROP was achieved by using a combination of a metal-free phosphazene base t-BuP2 and a Lewis acid, which allowed us to avoid unwanted initiation by the carbamate as well as any side reactions. In this way, we were able to obtain α-amino-ω-hydroxyl functionalized PPO with controlled molar mass, low dispersity and high chain-end fidelity. Direct access to the protected amino end group facilitates selective post-polymerization modifications at both PPO chain ends.

Day:2-
12:15:12:30

Associate Professor Chongyu Zhu - Donghua University
S019

Functionalization of Polyurethane towards Biomedical Application

Polyurethane (PU) is an attractive polymeric material, which possesses excellent physical and chemical properties. Thanks to its mechanical performance and good biocompatibility, it can be used solely, or be incorporated with other conventional textiles, for biomedical applications, such as wound dressings, tissue engineering, medical implants, etc. Despite the choice of monomers for PU is abundant, to design a polyurethane with more functions while retaining its good mechanical properties remains difficult. Here, we present the design of a functionalized PU through a rapid multi-component reaction. Through the efficient post-modification method, we managed to prepare a PU with antioxidant activity, excellent mechanical property as well as good processability. We expect this polymer can be fabricated into medical textile and will accelerate the healing process of large-scale burn wound.

Day:2-
12:30:12:45

Ms Ghazaleh Azizi Saadatlou - Koc University
S019

Poly(2-ethyl-2-oxazoline) based layer-by-layer coatings

LbL coatings have gained significant attention for their facile development and precise thickness and property control. This study focuses on LbL multilayers of poly(2-ethyl-2-oxazoline) (PEOX) (as neutral, H-acceptor) or partially hydrolyzed PEOX (PEOX-co-PEI) (with additional cationic components) at acidic pH. The choice of LbL counterpart in these structures allows modification of the properties for specific applications. We have used heparin and poly(acrylic acid) (PAA) as polyanions. Physicochemical properties of PEOX-co-PEI/heparin multilayers are investigated to develop anticoagulant surfaces with controlled heparin surface density. When PAA is employed as polyanion, porous films are obtained after pH annealing for potential local gradual drug release, particularly targeting osteoporosis patients. Film growth and the pore formation mechanisms are studied in detail to provide a better understanding of the interactions involved and facilitate subsequent structural improvements.

Day:2-
14:00:14:30

Professor Derek Irvine - University of Nottingham
S019

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Day:2-
14:30:04:45

Professor Hongxia Guo - Institute of Chemistry, Chinese Academy of Sciences
S019

Nonequilibrium Behaviors of Entangled Diblock Copolymers at the Entangled Polymer-polymer Interface under Steady Shear Flow

Under fast and large deformation flow field common in polymer blend processing, the nonequilibrium dynamics of entangled diblock copolymers at the entangled polymer-polymer interface are not fully understood, especially the quantitative relationship between interfacial slip velocity and interfacial stress and the corresponding microscopic interface entanglement images as well as the distinctive molecular mechanisms for tumbling motion. In this work, we adopt a modified dissipative particle dynamics simulation method to investigate the slip phenomena and the individual configuration dynamics of entangled diblock copolymers at the homopolymer-homopolymer interface under fast steady shear flow. We observe two distinct power-law regions of slip velocity against interfacial shear stress and for the weak incompatibility the tumbling event is irregular and occasional and includes six processes: align & flip, collapse, tumble, stretch, re-flip, and re-coil & tumble.

Day:2-
14:45:15:00

Dr M. Ali Aboudzadeh - University of the Basque Country UPV/EHU
S019

Exploring Chain Entanglement and Melt Memory in Bioplastics (such as PCL) Through Molecular Weight Variation

The effect of the molecular weight on chain entanglement and melt memory of a bioplastic such as poly(ε-caprolactone) (PCL) was studied. Therefore, 12 PCL samples of synthetic origin with a same chain end, covering a number-average molecular weight (Mn) range between 0.5 and 10 kg/mol, were analyzed. Differential scanning calorimetry and small-angle X-ray scattering (SAXS) were employed for in-depth characterization. The melt viscosity, thermal transitions, morphology, structural parameters, and memory effects were evaluated as a function of Mn. Molecular weight of entanglement (Me) was determined. In addition, we observed that the melting temperature saturated at a particular Mn. Instead, the crystallization temperature and the degree of crystallinity display an optimum Mn at which the parameters reach a maximum, describing a bell-shaped behavior as a function of Mn. SAXS analysis, which includes the long period and lamellar thickness determination, revealed that at Mn < 2.0 kg/mol, PCL crystallizes in an extended-chain conformation, while at Mn ≥ 2.0 kg/mol, folded chains are already present. The observed increase in the melt memory phenomenon of PCL, as investigated through self-nucleation experiments, correlates with the rise in Mn, attributed to the simultaneous increase of entanglements and the quantity of chain folding within the constituent crystalline lamellae per chain.

Day:2-15:00:15:15	**Dr Haley Beech - University of California Santa Barbara** **S019**

Immiscible Polymer Blend Compatibilization through Pendant Ionic Interactions

Polymer recycling is critical for reducing plastic waste, but various challenges result in less than 10% of plastics actually being recycled. One issue that limits mechanical recycling is the immiscibility between dissimilar polymers that results in macrophase separation and poor material properties for the resulting blend. Here, we demonstrate that low levels of pendant ionic bonds formed via a sulfonic acid to imidazole base proton transfer mechanism results in the formation of optically clear and phase mixed blends in an otherwise incompatible poly(dimethylsiloxane) and poly(n-butyl acrylate) mixture. This approach is then extended to semi-crystalline polymers to demonstrate its broad utility for blending commodity plastics. Rheology and x-ray scattering reveal the unique blend viscoelastic and microstructural behavior at various ionic functionalization levels, highlighting the underlying rich physics of immiscible polymer blends with sparse incorporation of charged groups.

Day:2-15:15:15:30	**Dr Baohu Wu - Forschungszentrum Jülich** **S019**

Small Angle Scattering Investigation of Biopolymer-Based Nanocomposite Formation

We have reported an in-situ mineralization protocol designed for the preparation of magnetic nanocomposites consisting of biodegradable polymer gelatin and iron oxide NPS. The sophisticated control mechanisms underlying nanocomposite formation typically involve the interaction between an inorganic component and a biopolymer matrix interface. Our investigation focuses on the roles of gelatin hydrogels in bio-inspired magnetite mineralization mechanisms, employing Small Angle Neutron/X-ray scattering measurements. The contrast variation method, achieved through solvent exchange, enables the analysis of individual components of the structure. These results are expected to provide in-situ structural information, elucidating the mechanisms of magnetite mineralization and the interaction between the inorganic component and the biopolymer. Our ultimate goal is to offer novel insights, establishing a direct relationship between the gelatin matrix's confinement and molecular control.

Day:2-16:00:16:30	**Professor Nick Turner - University of Sheffield** **S019**

Nucleic Acid-Polymer Hybrids: Improvement of Molecular Imprinting using Aptamer Recognition

To improve the capabilities of molecularly imprinted polymers (MIPs), we have utilised aptamers (single-strand nucleic acid biorecognition elements) as pre-selected “macromonomers” to remove the randomness and heterogeneity of the imprinting process.

By functionalising the chemical structure of the oligo sequence making it polymerizable, we are able to incorporate it into a polymer scaffold creating an aptamer-MIP hybrid. These hybrids offer superior (orders of magnitude) binding affinity over conventional MIP nanoparticles (nanoMIPs). We also see a significant improvement compared to just the aptamer. We hypothesise that the aptamer is “locked” into its optimal binding conformation reducing entropic effects, while protecting the NA sequence from enzymatic, chemical and thermal degradation.

We have demonstrated this technique for both protein and small molecule recognition; and believe the hybridisation process will have applications not just in sensing, but in wider polymer field.

Day:2- 16:30:16:45	**Professor W en Li - Shanghai University S019**

Microconfinement from Stimuli-Responsive Dendronized Polymers

Constrained microenvironments in biomacromolecules account for their defined biofunctions. To mimic this, synthetic polymeric materials which can form confined microenvironments is of key scientific value. Here we report on a series of oligoethylene glycols (OEGs)-based thermoresponsive dendronized polymers, which can act as molecular boxes to provide constrained microenvironments to encapsulate guest molecules (dyes and proteins), and provide shielding to protect the guests. The microconfinement from the polymers is ascribed to the nano-buffering formed from the dense crowded OEG chains. All these can be switched on or off simply through thermally-induced collapse of dendritic OEGs. This efficient shielding effect even can protect the guest biomacromolecules from biodegradation. Furthermore, the switchable encapsulation and release of guests can be greatly enhanced through intermolecular cooperation when these dendronized polymers are used for fabricating hydrogels or microgels.

Day:2- 16:45:17:00	**Assistant Professor Yunyan Qiu - National University of Singapore S019**

The controlled synthesis of mechanically interlocked polymers using ring-opening metathesis polymerization

The intrinsic dynamic feature of mechanically interlocked molecules (MIMs) has attracted great interest from polymer chemists, allowing them to explore various types of mechanically interlocked polymers (MIPs), such as polyrotaxanes and polycatenanes. However, almost all the previously reported methods to afford polyrotaxanes are uncontrolled and therefore unable to deliver materials with well-defined structures and narrow dispersity. Our group has recently developed a new method to synthesize polyrotaxanes in a controlled manner. Through ring-opening metathesis polymerization (ROMP) using a catenane as the selected monomer, we can produce polyrotaxanes with controlled molecular weights and narrow dispersity. Most importantly, the ratio of the threaded rings can be regulated by the copolymerization of other norbornene-based monomers, on account of the broad substrate scope of ROMP. In this talk, recent advances from our group regarding the controlled synthesis of MIPs will be covered.

Day:2- 11:00:11:30	**Dr Jens Gaitzsch - Leibniz-Institut für Polymerforschung Dresden e.V. S018**

Functional and Biodegradable Polymers by Radical Ring-Opening Polymerisation

Radical ring-opening polymerisation (RROP) of cyclic ketene acetals (CKAs) presents a synthetic strategy to synthesise functional polyesters with a broad scope of accessible properties like semi-crystallinity, hydrophilicity and pH sensitivity. In polymerising the 2-methylene-1,3-dioxepane (MDO) towards poly-MDO, a branched version of poly(caprolactone) (PCL) showed that increasing branching density systematically decreased the melting temperature of the material. Polymerising 2-methylene-1,3,6-trioxacane (MTC) to poly-PMTC proofed that the degree of branching is solely dependent on the conversion and no other reaction parameter. It degraded faster than poly-MDO and was ideal to be converted into biodegradable and biocompatible nanoparticles. If copolymerised with amine-bearing CKAs (Alk-MACs), it produces a broad range of pH responsive polyesters. Hence, the polymer composition and polymer architecture can be varied well within RROP to yield a range of functional materials.

Day:2-11:30:11:45	**Dr Evelina Liarou - University of Warwick** **S018**

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Day:2-11:45:12:00	**Dr James Wilson - Aston University** **S018**

Temperature-controlled sequencing in ring-opening polymerisation of lactones

The ring-opening polymerisation (ROP) of lactones is a potentially sustainable, atom-economical method of producing polyesters as a consequence of many monomers occurring naturally. However, until the last decade it has proven difficult to control the repeat unit sequencing as a consequence of transesterification side reactions shuffling the repeat units to produce statistical copolymers. Current techniques for achieving block copolyesters revolve around careful selection of catalyst, comonomers and sequential injection, which still leaves some architectures unobtainable. The one-step copolymerisation of two δ-lactones through organocatalysed ROP was explored at different temperatures. Kinetic studies of the copolymerisations showed that at both temperatures δ-valerolactone polymerises to high conversion before the second monomer is incorporated, with transesterification side reactions only occurring at 80 °C causing the formation of statistical copolymers. For the first time, one-step polylactone block copolymers were synthesised from a diol initiator with the unsubstituted block polymerised first, allowing the production of ABA triblock copolymers, with a semi-crystalline middle block and post-polymerisation modifiable outer blocks for use in self-assembly micelles or elastomeric materials.

Day:2-12:00:12:15	**Mr Björn Grabbet - Utrecht University** **S018**

Biobased Polymers from Furan Diels-Alder Adducts

Creating sustainable plastics from renewable carbon sources poses a significant challenge in shifting from petrochemical materials. We used furanics to synthesize three distinct monomers, each offering the potential for varied polymerization routes. The monomers' architecture is built upon a tricyclic core, presenting bifunctionality through an unsaturated olefin and a lactone site. The former enables ROMP, while the latter allows for ROP, offering various materials from one bio-based building block. Our study explored the translation from micro- to macrostructures, through in-depth NMR studies. Utilizing ROMP, we achieved well-controlled polymerizations, yielding exceptionally high glass transition temperatures and excellent thermal stability. The derived polyesters show promising thermoproperties and can be depolymerized, with high conversions even under mild conditions. These novel polymers, with adjustable functionalities, offer sustainable alternatives to petrochemical polymers.

Day:2-12:15:12:30	**Ms Rosa Noemi Villanova - Ghent University** **S018**

Synthesis and self-assembly of amphiphilic copolymers based on a branched hydrophobic 2-oxazine monomer

Aiming to develop a flexible hydrophobic polymer with low glass transition temperature (Tg) as basis for the preparation of fully poly(2-oxazoline/2-oxazine) based polymersomes, the synthesis of a new branched hydrophobic 2-oxazine monomer, 2-(2-ethylpenthyl)-2-oxazine, is reported. Cationic ring-opening polymerization of this monomer was carried out via microwave reactor leading to well-defined homopolymers and copolymers with different hydrophilic 2-oxazolines and 2-oxazine monomers. The obtained homopolymer was investigated with regard to its thermal properties revealing a Tg of 2 °C. In addition, we report the preparation of well-defined amphiphilic copolymers with different block ratios and their self-assembly in aqueous solution revealing the formation of various structures, interesting for biomedical applications. We are furthermore investigating their binding properties after post-functionalization with saccharide units to eventually develop a targeted drug delivery system.

Day:2-
12:30:12:45

Mr BO ZHANG - Monash University
S018

Comprehensive Kinetic Study of the Ring-Opening Polymerization (ROP) of L-Lactide via a Programmable High-Throughput Flow Platform

Organocatalytic ring-opening polymerization (ROP) is pivotal for creating non-toxic, biodegradable materials. Despite its advantages and heavy use in sustainable polymer synthesis, the kinetic understanding of ROP is very limited. Efficient catalysts such as triazabicyclodecene (TBD) make any kinetic investigation challenging due to the high reaction rate and sensitivity to moisture. Here, we present a reproducible kinetic analysis method for TBD-catalyzed ROP of L-lactide, utilizing a high-throughput flow platform with inline FT-IR analysis. For the first time, catalyst and monomer concentration, temperature, initiator concentration, and residence time are explored for their impact on monomer conversion in high detail. The data collected serve as a kinetic library for machine learning, facilitating precise polymer synthesis. This in turn enhances our understanding of ROP kinetics and leading to more efficient and controlled material synthesis.

Day:2-
14:00:14:30

Professor Michael Silverstein - Technion
S018

Emulsion-templating: Porous polymers and beyond

Emulsion templating has been used to synthesize highly interconnected macroporous hydrophobic polymers via free radical polymerization within water-in-oil high internal phase emulsions (HIPEs) Emulsion templating now encompasses a wide variety of synthesis chemistries (controlled radical polymerization, step growth polymerization, ring opening polymerization) and a wide variety of emulsions. Biodegradable scaffolds based on polyesters, polysaccharides, and polyphenols were evaluated for tissue engineering applications. Shape memory polymers were generated by combining crystallization and crosslinking using an interplay between emulsion stabilization and crosslinking via silane-modified silica and miktoarm stars and brushes. Hierarchically porous polymers were generated using a variety of approaches including hypercrosslinking, selective degradation, and foaming. Closed-cell systems were used to encapsulate phase change materials for thermal energy storage and recovery.

Day:2-
14:30:14:45

Associate Professor Tara Schiller - University of Warwick
S018

To be added

Day:2-
14:45:15:00

Mr Jerzy Garbarek - Adam Mickiewicz University in Poznan
S018

Synthesis of new norbornene derivative materials containing p-block elements (B, Si, P) obtained by controlled ring-opening metathesis polymerisation (ROMP)

Recent investigations into olefin metathesis reactions still show unexplored potential in production of hybrid polymeric materials capable of exhibiting interesting properties that may find applications in various branches of industry, like, sensors, gas separation materials or biomedicine. Among these processes, ring-opening metathesis polymerisation (ROMP) is perceived as an excellent example of obtaining linear, unsaturated polymeric chains with different functional groups attached.

In this communication, we would like to present the first step of an effective synthesis procedure for acquiring new norbornene derived materials bearing p-block elements, through the use of condensation reactions. These compounds were found to be applicable in ROMP. Moreover, we would also like to present additional modifications of such moieties (e.g. Huisgen cycloaddition, silylative coupling), what in future might vastly broaden the possible applications of such polymers.

Day:2-
15:00:15:15

Ms Iris Lena Haug - University of Stuttgart
S018

Chiral Diboranes as Metal-Free and Functional Group-Tolerant Catalysts for the Preparation of Isotactic Polyethers

Stereoselective polymerization of epoxides has long been an exclusive domain of metal-based compounds. Here, we present the first metal-free strategy to prepare isotactic-enriched aliphatic polyethers, using racemic monomer feed of, e.g., propylene oxide (PO). The corresponding organocatalysts are based on well-available 1,1'-bi-2-naphthol (BINOL) and contain two borane functionalities. These chiral diboranes deliver isotactic diad contents of > 90% alongside semi-crystalline and well-defined PPO with high molar masses (1.1 < ĐM < 1.3 and Mn > 100 000 g/mol). Notably, it is also possible to exploit the inherent functional group tolerance of boranes to grow isotactic-enriched sequences of PPO on aliphatic polyester-type initiators (polycaprolactone, polylactide), thus enabling the incorporation of stereocontrolled polyether blocks in more complex polymer architectures.

Day:2-
15:15:15:30

Mr Harrison Young - University of Victoria
S018

Synthesis, Characterization, and Ring-Opening Polymerization of Antimony-bridged [1]ferrocenophanes

Polymers which are comprised of ferrocene moieties in the backbone have been thoroughly investigated since the early 1990s. The most well-explored example of these species has been polyferrocenylsilanes, where the ferrocene subunits are bound by silane linkers.1 These materials have been used in applications such as photonic crystals, plasma etch resists, and nanostructure fabrication. Analogues of polyferrocenes have been synthesized with a variety of main group elements, which impart not only unique physical and structural properties, but also open up new avenues for downstream linker-centered chemistry. To date, the heaviest element reported as a linking group in a polyferrocene is tin. Herein, we report the successful synthesis and subsequent ring-opening polymerization of an antimony-bridged [1]ferrocenophane. The properties of the resulting polymeric product will be discussed.

(1) Hailes, R. L. N.; Manners, I. et al. Chem. Soc. Rev. 2016, 45 (19), 5358-5407.

Day:2-
16:00:16:40

Dr Mona Semsarilar - CNRS
S018

Functional Material for Environmental Remediation

Severe pollution is causing irreversible damages to the environment and human health. There is an urgent need in finding solutions to reduce the pollution and controlling the damage caused so far. During the past decade, our team have been looking into making materials that could offer solutions for decontamination of water. We work at the interface of polymer, supramolecular, colloidal and inorganic chemistry to design functional performant material. These novel materials would then be used to make membranes and adsorbents that could offer immediate solutions to water purification. In this talk, the highlights of several different approaches taken in making such material for removal of pesticides, Per- and poly-fluoroalkyl substances (PFAS), radioactive elements and heavy metals would be presented.

Day:2-
16:30:16:45

Mr Mickael GUERREIRO GONCALVES - Université de Montpellier
S018

Phosphorus-based films for actinide decontamination

Actinides are carrying a large amount of energy that can induce health issues in case of contamination. Chelating materials appear as promising for actinide decorporation, but existing solutions are still rare and poorly efficient. Recent studies highlight functional polymeric materials as effective options due to their dense chelating sites along the polymer backbone.

This project aims to develop a skin-friendly cream using photosensitive phosphorus-based polymers. Those copolymers bearing photosensitive moieties can crosslink and form a removable film when exposed to UV light. Polymers were prepared by combining RAFT polymerization of OEGMA, MAA, and HEMA, and subsequent post-polymerization modifications to introduce methacrylate and bisphosphonic acid moieties.

The phosphorous-based polymers demonstrated effective Neodymium (actinide surrogate) complexation indicating promising candidates for actinide recovery. Finally, these UV-induced formed films effectively trap Nd in

Day:2-
16:45:17:00

Ms Anita Plumley - University of Bath
S018

Renewable cyclic monomers for ring-opening polymerisation and co-polymerisation with L-lactide.

Day:2-
11:00:11:30

Dr Christophe BOISSON - CNRS
S013

Design of Olefin Block Copolymers based on Ethylene Butadiene Rubber

Polyolefins are the most important class of polymers and account for almost half of the plastic production. This field is still growing, and new applications require novel or improved performances. While butadiene insertion is often limited with most catalyst systems designed for olefin polymerization, we have shown that neodymium metallocene catalysts insert butadiene with good efficiency. This led to the discovery of ethylene-butadiene rubber (EBR) as a new class of elastomer. Alkylmagnesium compounds are shown to be reversible chain transfer agents when associated with neodymium metallocene complexes. The copolymerization of ethylene and butadiene with metallocene/alkylmagnesium catalysts is thus controlled by a degenerative transfer mechanism known as coordinative chain transfer polymerization (CCTP). We will focus on the design of olefin block copolymers (OBC) incorporating EBR segments that are achievable by macromolecular engineering thanks to the controlled nature of the CCTP.

Day:2-
11:30:11:45

Dr Helena Henke - University of Nottingham
S013

Scale up: Transesterification and Oligomerisation of Methyl Methacrylates via CCTP

Catalytic chain transfer polymerization (CCTP) with a cobalt containing catalyst can be effectively used to synthesize oligomers, which, due to their size and viscosity are of interest for medical applications such as vaccine adjuvant formulations. These synthetic oligomers could reduce global overreliance on scarce natural resources used in vaccine products, such as squalene derived from shark liver oil which is present in most seasonal influenza vaccines. In this contribution the successful scale up of butyl methacrylate and lauryl methacrylate via CCTP with azobisisobutyronitrile (AIBN) as initiator and PhCoBF as catalyst in a bulk reaction will be presented. Initial reactions were carried out on a 15 mL scale with various amounts of catalyst using conventional heating. After finding optimum catalyst conditions resulting in a molecular weight (Mn) range of 500-3000 g/mol, reactions were scaled up to 250 mL using standard laboratory equipment. Following the observations and results, we were able to move onto a 5 L microwave reactor, where initial reactions showed an increase in viscosity and molecular weight, as can be expected with microwave reactions compared to conventional methods. Butyl methacrylate and methyl methacrylate were also used for the transesterification of hydroxy group bearing terpenes to generate terpenyl methacrylates for later oligomerization to provide sustainable alternatives to currently used natural sources. The scale up of these reactions will also be presented.

Day:2-
11:45:12:00

Dr Muhammad Naseem Akhtar - King Fahd University of Petroleum & Minerals
S013

Synthesis of functionalized polyolefins using alpha-olefins having functional groups as comonomer over mono and bimetallic catalysts

The dinuclear early and late transition metal catalysts have shown enhanced activity, incorporation of α-olefins, tolerance to functional groups, tacticity control etc. as compared to that of related mononuclear catalysts. In this study we have prepared mono- and dizirconium bisamine bisphenolate catalysts having C6Me5 and anthracene as spacer groups. These catalysts were used for copolymerization of ethylene with 10-undecen-1-ol and 10-undecnoic acid in the presence of MAO and TIBA. It was noticed that activity of all mono and bimetallic catalyst was increased with increase in the concentration of 10-undecen-1-ol and 10-undecenoic acid indicating that these catalysts are more tolerant to functional groups as compared to that of conventional metallocene catalysts. Bimetallic catalysts having either C6Me4 or anthracene spacer exhibited higher activity but lower incorporation of comonomers than that of monometallic catalysts.

Day:2- 12:00:12:15	**Mr Alexander Evans - Oxford University S013**

Applied Functional Polypropylenes

Despite being one of the most manufactured polymers worldwide, polypropylene is limited regarding the incorporation of polar functionality. Yet when endowed with functionality, polypropylene evidences potential applicability across diverse industries. The copolymerisation of olefins and polar comonomers appears a facile approach to incorporate polar functionalities, and has been largely successful for late transition metal catalysts. However, early transition metal catalysis widely used in commercial olefin polymerisation is poorly compatible with polar monomers. Development of a platform copolymer system for the synthesis of functional polypropylene via propylene copolymerisation with a long-chain bromo-alkene and subsequent polymer post-modification should enable targeted end-application modification, whilst using commercial metallocene catalysts. Here we present a methodology for the preparation of functional polypropylenes targeting shortcomings in flame-retardant applications.

Day:2- 12:15:12:30	**Ms Huidi SUN - ESPCI Paris - PSL S013**

Upcycling polyolefin blends into recyclable high-performance materials by reactive processing

The revalorization of incompatible polymer blends is crucial from economic, environmental, and societal point of view. Polyolefin waste remains particularly challenging because it is difficult to sort into its constituent components; untreated polyethylene (PE) and polypropylene (PP) typically exhibit poor mechanical properties due to the weak interface between the PE and PP domains. In this study, we developed new chemistry for use in a solvent-free reactive extrusion process to directly upcycle PE-PP blends into recyclable materials with superior chemical and thermomechanical properties. The resulting upcycled materials rely on unusual nitrogen-nitrogen bonds in the context of a hierarchically-structured polymer network, resulting in high dimensional stability at high temperature and impressive mechanical recyclability. Given the excellent properties of the resulting materials, we believe that this approach is an important step toward realizing a circular plastics economy.

Day:2- 12:30:12:45	**Ms Mia Hall - University of Warwick and Monash University S013**

Inline monitoring of photo-induced Cu-RDRP of (meth)acrylates in continuous flow

Interest in continuous flow polymerisation has been growing rapidly over the past decade, with increased research in a range of controlled and living polymerisation techniques with a variety of monomers, reactors, and conditions. A continuous plug flow reactor allows for better control through removal of the products upon formation and the removal of thermal and/or light gradients throughout the reaction. Inline monitoring and automated processes are also of great interest and allow for instant data collection and reduced human error. There is also particular interest in simplifying Cu-RDRP to offer more sustainable, efficient, and user-friendly routes. In this work, photo-induced copper-mediated reversible deactivation radical polymerisation (Cu-RDRP) of a wide range meth(acrylates) were achieved with varying degrees of polymerisation, flow rates (residence times), wavelengths and temperatures. Reactions were monitored in real-time using a benchtop NMR and online GPC.

Day:2- 14:00:14:30	**Professor Dongmei Cui - Changchun Institute of Applied Chemistry, Chinese Academy of Sciences S013**

New Strategy for Preparation of High Value-added Commonly Used Polymer Materials

Plastics and elastomers are two of the three pillar synthetic macromolecules, which are widely applied in our daily life, mobile, medial, electrical and electronics, aerospace, and transportation areas. These are attributed to their various structures that mainly determine their properties, which are controlled by the catalysts employed. Therefore, the development of catalysts and polymerization methods as well as polymerization mechanism will benefit for fabricating new plastics and rubbers from the commonly used monomers. Herein, we report the synthesis of new polymeric materials from the copolymerization of ethylene, dienes and styrene etc commonly used monomers using newly designed organolanthanide catalysts by means of the synergic effects, the mechanism compromise, switching of selectivity, and the polar monomer-activation etc strategies. These allow us to obtain recyclable thermoplastics elastomer, upcycling HDPE, topological rubber with high green-strength, the "plastic" rubber

Day:2- 14:30:14:45	**Professor Boris Gorelik - MOBIChem Scientific Engineering Ltd. S013**

Cross-linking and Destruction of Polyolefins by UV and Visible Light Induced by Different Photo-Initiators

in order to increase polyolefins thermal stability in solid state (cables insulation) and in melt (production of shrink films), polyolefins are subjected cross-linking XL by irradiation by accelerated electrons. An alternative way is irradiation By UV or Visible light. Polymers XL is only possible if photo-initiators (PI) are in molecular form , meaning compatible with polymers irradiated. In our work a few PI of Norrish II type were made of high compatibility in different polyolefins. These are derivatives of Benzophenone, Acetophenone, Coumarin and Curcumin. Radical formation in photo-initiators can be via n->p* and p->p* transitions. In PI used n->p* transition is forbidden from symmetry restriction as going from Group Theory. Bu transition is still possible as total spin does not change. This was realized in XL of polyolefins by LED source of 356nm. It was shown, depending on specimen thickness, concentration of PI, light intensity, PI leads to XL or destruction of polyolefins

Day:2- 14:45:15:00	**Assistant Professor Josh Worch - Virginia Tech S013**

Selective photodegradation of polyenone thermoplastics to benign small molecules

Incorporating ketone moieties into polymer backbones can furnish photodegradable surrogates for conventional polyolefin thermoplastics. However, these materials often exhibit incomplete and/or uncontrolled degradation which may exacerbate environmental concerns. Here we use an organocatalyzed click polymerization approach to access polyenones that selectively photodegrade into small molecules. The polyenones degraded into non-cytotoxic Œ≤-diketone products via a unique mechanism, which is distinct from typical polyketone photodegradation that follows non-selective Norrish reaction pathways to afford a mixture of products. The overall synthetic approach is modular and allows for the design of several polyenone compositions possessing a range of thermomechanical properties. Thermoplastic behavior (including high strength and ductility) was observed when the glass transition temperature of the polymer was greater than the operating temperature.

Day:2- 15:00:15:15	**Mr Arpan Patel - The University of Manchester S013**

Defining and controlling degradation pathways during mechanical recycling of HDPE

High density polyethylene (HDPE) is a versatile polymer. Its resistance to thermo-oxidative and thermo-mechanical degradation during processing makes them highly recyclable. However, inconsistency of feedstocks and processing conditions results in polymer variability, especially after mechanical recycling. Using rheology simulated and extrusion-based recycling experiments we explore these degradation pathways of HDPE. A characteristic degradation parameter related to the rate of structural evolution is defined for virgin HDPE and post-consumer recyclate (PCR). Chain scission dominates the initial degradation mechanism of polyolefins, with increasing time resulting in the shift of dominant mechanism to long-chain branching. The methods reported herein show potential for industrial application, providing analysis of recyclate “quality” to facilitate recirculation of higher value material.

Day:2-15:15:15:30	**Ms Anna Lykkeberg - University of Edinburgh** **S013**

Simple Bifunctional Alkali Metal Salts: Accessing Block Copolymers through ROCOP and RAFT Polymerisation

Block copolymers (BCPs) are widely utilised, and in light of the plastic pollution crisis, it has become crucial to develop new and more sustainable alternatives to existing BCPs. Many BCPs have been synthesised by copolymerising two types of monomers through the same polymerisation mechanism, for example different vinyl monomers through reversible addition-fragmentation chain transfer (RAFT) polymerisation, and polyester or polycarbonate BCPs through the ring-opening copolymerisation (ROCOP) of epoxides with cyclic anhydrides or CO2 respectively. In order to access a broader range of materials, recent attention has turned more toward the combination of such distinct polymerisation mechanisms.

Here we report novel alkali metal salts based on RAFT agents that can be utilised to access polyester-polyolefin BCPs through the ROCOP of cyclic anhydrides and epoxides, along with RAFT polymerisation of vinyl monomers. This simple system shows promise for accessing a wide range of BCPs.

Day:2-16:00:16:30	**Professor Shigeru Yamago - Kyoto University** **S013**

Synthesis of Structurally Controlled Hyperbranched Polymers by Radical Polymerization

Hyperbranched polymers (HBPs) have attracted significant attention due to their unique physical properties compared to linear polymers. Here, we report on the new one-step synthetic method of structurally controlled HBPs in terms of molecular weight, dispersity, number of branching points, branching density, and number of chain-end groups by radical polymerization. The synthetic scope and properties of the resulting HBPs will be discussed.

References

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Day:2-16:30:16:45	**Ms Elizabeth Bygott - Queen's University** **S013**

The Synthesis of Acrylate-Based Macromonomers and Structured Copolymers using High-Temperature Radical Polymerization

A high-temperature starved-feed semi-batch operating policy is shown to be an effective means to produce poly(acrylates) with high macromonomer content, taking advantage of side reactions inherent to acrylate radical polymerization. A significant increase in the macromonomer content is observed when the monomer is switched from n-butyl acrylate to isobornyl acrylate (iBoA) under identical operating conditions. This increase is of commercial interest as the reactive terminal double bond (TDB) units of macromonomers can further react to produce functionalized branched structures and multi-block copolymers for particle stabilization. This presentation will describe the operating conditions required to synthesize iBoA-based macromonomers and their subsequent use to produce acrylate-based blocky or comb copolymers without a mediating agent. Furthermore, characterization methods to estimate macromonomer chain incorporation and determine polymer structure are addressed.

Day:2- 16:45:17:00	**Mr Matthew Diable - University of Liverpool / Polymer Mimetics Ltd S013**

Industrial development of novel hyperbranched polymers via transfer-dominated branching radical telomerisation (TBRT)

A new synthetic strategy, termed transfer-dominated branching radical telomerisation (TBRT), has been devised for preparing novel hyperbranched polymers. The approach uses free radical chain-growth chemistry, under modified telomerisation conditions, to form polymers with chemistries conventionally formed under step-growth conditions – e.g., hyperbranched polyesters. The patented technology, developed at the University of Liverpool, has been exclusively licensed to Scott Bader Co. Ltd, who have established Polymer Mimetics Ltd to focus on its commercial exploitation. Ongoing R&D has demonstrated the applicability of this new generation of materials in many commercially important areas, from high performance additives in adhesives and composites to biodegradable polymers for personal care applications. The lecture aims to show the versatility of TBRT and how this pioneering technology can support the development of effective, sustainable products and solutions for real-world issues.

Day:2- 11:00:11:30	**Dr Fiona Hatton - Loughborough University S011**

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Day:2- 11:30:11:45	**Assistant Professor Tan Zhang - Duke Kunshan University S011**

Eco-Friendly Room-Temperature Polymerization and Beyond

Radical polymerization usually requires elevated temperatures. The annual energy consumption for plastic production in the USA is about 6% of all the energy used by USA industries. With Paris Agreement, a green chemical reaction should be conducted at ambient temperatures to increase energy efficiency whenever possible. We utilized the oil-water interfaces to decompose commercial radical initiators, such as AIBN, KPS, BPO, to initiate radical polymerization at room temperatures. The interface-initiated polymerization is independent of surfactant type and insensitive to oxygen. Without using controlled radical polymerization techniques, homo and copolymers with narrow molecular mass distribution (PDI < 1.3) and ultra high molecular mass (Mw > 1000 kg/mol) can be produced via interface-initiated room-temperature polymerizaiton. The resulting polymeric materials exhibit excellent mechanical and biocatalytic properties.

Day:2- 11:45:12:00	**Dr Zishan Li - University College Dublin S011**

Controlled Polymerization of Acrylamides via One-Pot and One-Step Aqueous Cu (0)-Mediated Reversible-Deactivation Radical Polymerization

Copper-catalyzed controlled polymerization of acrylamide (AM) has always been a challenge, often exhibiting low monomer conversion and broad molecular weight distribution (MWD) or requires complex/multistep reaction procedures due to the highly active nature of the AM radical and its side reactions. To overcome these challenges, we report the successful synthesis of well-defined polyacrylamide (PAM) via a facile one-pot and one-step aqueous Cu(0)-mediated reversible-deactivation radical polymerization (RDRP). The results of this strategy show that strong deactivation control is crucial for the controllability of AM RDRPs, which depends on the equilibria of polymerization and mutual conversion of different copper species. With the fast-propagating monomer AM, extra addition of CuII into the reaction system is an effective way to enhance deactivation. Based on this kinetically controlled strategy, well-defined PAMs with narrow MWDs and varied molecular weights were successfully achieved.

Day:2- 12:00:12:15	**Ms Emilie Rojtman - ICGM, Univ Montpellier, CNRS, ENSCM, Montpellier, France S011**

Original Cashew Nutshell Liquid (CNSL) Based Monomers for the Synthesis of Fully Biobased Aromatic Polyesters

With the aim of developing fully biobased aromatic polyesters, cashew nutshell liquid (CNSL) derivatives emerged as one of the most interesting sources of building blocks. Original monomers, such as polyols, were designed from cardanol and cardol in their unsaturated and hydrogenated forms. These syntheses were performed in one or two steps using cost effective and mildly toxic raw materials to ensure industrial viability and limit their ecological impact. Thus, polymers were synthesised and characterised by SEC and NMR analysis. A study was carried out on the resulting materials focusing on the structure-property relationship, with peculiar attention to the influence of the alkyl chain on the thermal and mechanical properties. The solubility of these aromatic polymers was also explored to assess their processability.

Day:2- 12:15:12:30	**Associate Professor Melahat Göktaş - Van Yuzuncu Yil University S011**

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Becer group

Day:2- 12:30:12:45	**Ms Pauline Salaun - University of Lille S011**

Association of polymers and covalent organic frameworks towards the spontaneous formation of hollow spheres

Covalent organic frameworks are crystalline materials with tunable porosity. Despite their various applications, the nano-to-meso scale organisation is often neglected. The importance of processability has recently emerged and the synthesis of well-defined COF particles is still a challenge. We report the first example of COF-polymer particles using polymers to lead the 2D COF growth along a specific direction. We investigated the impact of macromolecular grafts' nature on boronate COF (COF-5). Catechol-poly(N-butyl acrylate) produced quasi-spherical structures, while catechol-poly(N-isopropylacrylamide) favored raspberry-like particles with a radial grain orientation. Microscopic methods highlighted the single-crystal nature of these domains and kinetic studies revealed the modulating role of the catechol-PnBuA and the template effect of catechol-PNIPAm, conferring supramolecular self-assembly properties and creating complex morphologies beyond the framework. (Small, 2023).

Day:2- 14:00:14:30	**Professor Vitaliy Khutoryanskiy - University of Reading S011**

Amphoteric polymers in drug delivery

Amphoteric polymers (polyampholytes) are macromolecules containing both acidic and basic groups within their structure. This feature enables these polymers to exhibit amphoteric behavior, functioning as either acids or bases depending on the surrounding conditions. This talk will explore the synthesis and properties of polyampholytes, focusing on our investigations into their ability to adhere to mucosal surfaces in the human body and the potential applications in transmucosal drug delivery. Gelatin, a protein derived from collagen, stands out as one of the extensively used polyampholytes in pharmaceutics. Our research delved into the derivatization of gelatin through reactions with methacrylic and crotonic anhydrides [1]. Additionally, we assessed the impact of solution pH on the mucoadhesive properties of both synthetic and natural polyampholytes [2].

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Day:2- 14:30:14:45

Professor Rong Wang - Nanjing University
S011

Multimodal ON–OFF nanoswitches of DNA-functionalized nanoparticles directed by stimuli-responsive polymers

Highly reversible transitions between assemblies and the dispersion of biomacromolecule-functionalized nanoparticles (nanoswitches), which are usually triggered by external stimuli, have emerged as a versatile and programmable toolbox for use in nanobiotechnology, such as diagnosis, therapeutics, and imaging. But it is a challenging task to realize highly reversible ON-OFF nanoswitches over a wide range of temperatures, which emerge as a versatile toolbox for use in nanobiotechnology. Herein, nanoparticles (NPs) bifunctionalized by DNA strands and stimuli-responsive polymers are proposed to construct multimodal ON-OFF nanoswitches by the coarse-grained model. The successful achievement of multimodal ON-OFF nanoswitches for bifunctionalized NPs at lower temperatures is attributed to the synergistic effects of the contraction and expansion configurations of stimuli-responsive polymers, combined with the hybridization-dehybridization event of DNA strands.

Day:2- 14:45:15:00

Dr Thomas Leigh - RCSI
S011

The ABCs (applications, benefits and characteristics) of Poly(Amino Acid) Nanoparticles

Poly(Amino acid) Nanoparticles have recently been developed and have shown promise for use in the medical field due to their biological nature and resistance to external pressures. The novelty of the materials has led to an investigation to understand what makes these particles work and how we can use them to solve medical problems.

Herein we discuss how the internal amino acid affects the size and stability of the particles, showing trends and prediction tools to predict what we would expect from future amino acids both natural and unnatural. These predictors being shown to work with a preliminary set of test data.

The results from these characteristics tests has allowed us to design particles that can exploit the changes of skin pH within burns victims. Combined with hydrogel technology we are able to describe a system which can provide a specialised and directed drug release of a therapeutic to the damaged tissues of the skin

Day:2- 15:00:15:15

Mr Kwanghee Lee - Korea Advanced Institute of Science and Technology
S011

Influence of Polycation Chain Structure on Polyelectrolyte Complex Micelle Formation

DNA-poly(ethylene glycol) (DNA-PEG) represents a special class of block aniomers that can complex with polycations to form polyelectrolyte complex micelles (PCMs). When the DNA block is short, the complexation behavior substantially differs from that of long DNA and the resulting PCMs show different structure and stability. In this contribution, we prepare single-stranded (ss) oligoDNA-PEG block copolymers of different DNA and PEG chain lengths and then complex them with either linear or branched polyethylenimine (PEI). Gel retardation assay shows that both linear and branched PEI bind to (ss)oligoDNA-PEG block copolymers. However, while the branched PEI leads to PCM formation with sizes on the order of tenth nanometers, no such structures are seen when linear PEI is used. The length of the oligoDNA block also influences the complex morphology. While PCMs are observed in all scenarios examined, their size and compactness vary substantially with decreasing oligoDNA block length.

Day:2-
16:00:16:30

Assistant Professor Abigail Knight - University of North Carolina at Chapel Hill
S011

Biomimetic hierarchical structure in synthetic macromolecules

The remarkable functions of proteins, from refined binding profiles to efficient catalysis, are currently unrivaled by synthetic macromolecules due to complex hierarchical structure in natural systems. Inspired by this grand challenge, the Knight group is at the interface of chemical biology and polymer science, developing synthetic strategies to control hierarchical structure and high-throughput platforms to understand fundamental design principles underlying macromolecule conformation. These research efforts are motivated by the need for innovative strategies to address global health and environmental challenges, where our foundational work informs the de novo design and development of functional polymeric materials.

Day:2-
16:30:16:45

Dr Jiazhe Ma - Tsinghua University
S011

Functional Color-Changing Cholesteric Liquid Crystal Elastomer

Cholesteric liquid crystal elastomer (CLCE), a class of chiral soft photonic crystals, is uniquely suited for the development of biomimetic smart color-changing materials. We developed a functional color-changing CLCE by introducing dynamic covalent B-O bonds into main-chain CLCE by an anisotropic deswelling method, which endows them with shape/color programming and room-temperature self-repairing properties. We also combined CLCE with ionogels by using silane coupling agents, to prepare CLCE with both mechanochromism and ionic conductivity and applied them in human-machine interactions. Based on the color-changing property of CLCE, this study develops their self-healing and ionic conductive functions and promotes their practical applications in the fields of bio-inspired camouflage, soft actuators and flexible electronics.

Day:2-
16:45:17:00

Dr Gaëlle Le Fer - Unité Matériaux et Transformations (UMET) - CNRS UMR8207
S011

Combination of polymers and covalent organic frameworks towards oriented materials over long distances.

Covalent Organic Frameworks (COFs) are light organic crystalline materials presenting a periodic structure over several dimensions, a high porosity and an important chemical tunability. All their properties make the COFs of great interest for applications in molecular separation, gas storage, drug delivery or sensing for example. Nevertheless, COFs are by nature crosslinked materials and most of them are isolated as polycrystalline powders and the importance of processability for their applications has only recently emerged. Moreover, controlling crystal nucleation and growth has recently received attention from researchers but remains a challenge in the field while the resulting nanostructures greatly influence the COF properties. Our lab proposes an original "win-win" combination of polymers and COFs to pave new ways for designing multi-scale materials showing oriented and tunable porosity over long distances with capture properties.

Day:2-
11:00:11:15

Ms Roukaya ACHOUR - Univ. Lille, CNRS, INRAE, Centrale Lille, UMR 8207-UMET-Unité Matériaux et Transformations, F-59000 Lille, France
OC101

Self-Immolative Polymers: a new way to depolymerize macromolecular architectures, leading to innovative drug delivery vectors.

Self-Immolative Polymers (SIPs) are stimuli-responsive macromolecules which undergo a fast cascade depolymerization reaction in response to the stimulus. This unique behavior allows the elaboration of temporary structures with high potential of use as drug delivery vectors. In this work, SIPs sensitive to both

UV and NIR light have been developed. Amphiphilic macromolecular architectures were designed in order to ensure the formation of self-assemblies. The triggered depolymerization of the structures was monitored by different methods, proving the on-demand and controlled kinetics. These SIP-based structures are likely to overcome important barriers encountered in the field of drug delivery, such as the passive release of the drugs, and to provide On/Off release profiles.

Day:2- 11:15:11:30

Ms Phuong Do Thi - Queensland University of Technology
OC101

Programming Photodegradability into Vinylic Polymers via Radical Ring-Opening Polymerization

Incorporation of photolabile moieties into the polymer backbone holds promise to remotely-control polymer degradation. However, suitable synthetic avenues are limited, especially for radical polymerizations. Here we report a strategy to program photodegradability into vinylic polymers by exploiting the wavelength selectivity of photocycloadditions for radical ring-opening polymerization (rROP). Irradiation of coumarin terminated allylic sulfides with UVA initiated intramolecular photocycloaddition producing cyclic macromonomers. Subsequent RAFT-mediated rROP with vinylic monomers yielded copolymers that inherited the photoreactivity of the cyclic monomer. Irradiation with UVB initiated efficient photocycloreversion of the coumarin dimers, causing polymer degradation within minutes under UVB light or days under sunlight exposure. The synthetic strategy was demonstrated to be applicable for other photolabile linkages, allowing for tuning degradation wavelengths for vinylic polymers.

Day:2- 11:30:11:45

None Jennifer Hughes - University of Sheffield
OC101

Reusable and self-healing thermoplastic elastomers via covalent Diels-Alder cycloadducts between bisfuran poly(ester urethane) prepolymers and bismaleimide poly(butadiene urethane) prepolymers.

To combat the plastic waste problem, existing material must be recyclable and new polymers should be degradable or reprocessable. Compatibilisation of polymers is one way for existing polymers to be recycled. The formation of covalent Diels-Alder cycloadducts between furan-terminated poly(ester urethane) prepolymers and maleimide-terminated poly(butadiene urethane) prepolymers has been used to compatibilise poly(ε-caprolactone) and poly(1,4-butadiene). DA-copolymers with varying amounts of PBD and PCL (25, 50 & 75wt%) were synthesised and compared to copolymers containing 100% PBD or PCL. DSC, DMA, TGA, tensile testing, SAXS & WAXS show that the copolymers display tuneable thermomechanical, & morphological properties. The 50wt% PBD:PCL copolymer shows excellent elastomeric properties, demonstrating how this approach can make new useful materials via upcycling of polymer waste. All TPUs also display self-healing properties and can be reprocessed 3 times with >80% stress-recovery.

Day:2- 11:45:12:00

Mr Natanel Jarach - The Hebrew University of Jerusalem
OC101

Fully Recyclable Cured Polymers for Sustainable 3D Printing

The most prevalent materials used in Additive Manufacturing are polymers and plastics, which are recognized for their negative environmental impact. In recent years, a new sustainable alternative has been emerging: reversible covalent bond-containing polymers (RCBPs). These polymers can be recycled, reprocessed, and reused multiple times without degrading their properties. Nonetheless, they have two significant drawbacks when used in 3D printing. First, some require adding new materials every reprinting cycle, and second, others require high temperatures for (re)printing, limiting recyclability and increasing energy consumption. This study introduces fully recyclable RCBPs as a sustainable approach for radiation-based printing technologies. The photopolymerization of the materials showcased in this study is based on a novel catalyst for cycloaddition reactions, enabling printing at lower temperatures than previously reported RCBPs (50 ℃ lower than the lowest reported). Depolymerization

Day:2-12:00:12:15

Mr Jens Van Hoorde - Ghent University
OC101

The scalable synthesis and application of monodisperse, N-substituted polyurethanes

Due to the statistical nature inherent in the polymerization process, both commodity plastics and polymers synthesized through controlled methods, such as RAFT and ATRP, exhibit a certain degree of dispersity. Sequence-defined polymers, characterized by uniform macromolecules, provide a solution to issue through their precisely defined length and monomer order. This enables them to target applications that are beyond the reach for non-uniform macromolecules.

Often, these macromolecules are made on a solid support, which constraint the scalability and consequently hampers potential applications. In this approach, however, a scalable synthesis method was developed to make N-substituted polyurethanes in a support-free manner. Furthermore, these polymers show a depolymerization behaviour that could be exploited for the read-out (so-called sequencing) of data-containing macromolecules.

Day:2-12:15:12:30

Mr Nichollas Guimarães Jaques - University of Bordeaux and KIT
OC101

Tools to achieve high molecular weight thermoplastic non-isocyanate polyurethanes: from transurethanization to click-chemistry

Polyurethanes (PUs) are essential polymers, often produced via the reaction of diisocyanates with polyols. Due to the toxicity of isocyanates and their synthesis via phosgene, alternative sustainable options like non-isocyanate polyurethanes (NIPUs) are being researched. The most promising synthesis route for thermoplastic NIPUs is the polycondensation of dimethyl carbamates and diols. However, such carbamates are prone to side reactions and are less reactive than isocyanates, thus resulting in relatively low molecular weight NIPUs. In this work, the transurethanization was monitored by SEC, which enabled the optimization of the reaction to yield high molecular weight NIPUs. Moreover, a novel and more sustainable way is proposed to access diallyl carbamates, potential monomers for synthesizing non-isocyanate poly(sulfide urethane)s by the thiol-ene reaction. The properties of the obtained NIPUs were tuned by the type of monomers and were compared with their respective isocyanate PUs.

Day:2-14:00:14:15

Dr Viko Ladelta - King Abdullah University of Science and Technology (KAUST)
OC101

Polyglycolide-based (Co)polymers via Living Ring-Opening Polymerization

Living/controlled ring-opening polymerization (ROP) of glycolide (GL) has never been reported due to the extremely low solubility of its homopolymers in common solvents. Herein, we report the first living/controlled anionic ROP of GL in strong protic fluoroalcohols (FAs), which are conventionally considered incompatible with anionic polymerization. Well-defined polyglycolides (PGAs, ƒê < 1.15, Mn up to 55.4 kg mol‚Äì1) were obtained at room temperature. NMR analysis and computational study revealed that FAs simultaneously activate the chain-end and monomer without being involved in initiation. Furthermore, by combining polyhomologation and organic/metal "catalyst switch" strategy with the living ROP of GL, we synthesized for the first time, a pentacrystalline pentablock quintopolymer, polyethylene-b-poly(ethylene oxide)-b-poly(Œµ-caprolactone)-b-poly(L-lactide)-b-polyglycolide (PE-b-PEO-b-PCL-b-PLLA-b-PGA). Variable temperature solid-state nuclear magnetic resonance spectroscopy, X-ray diffraction, and differential scanning calorimetry revealed the existence of five different crystalline phases.

Day:2-14:15:14:30

Dr Zengshe Liu - USDA/ARS/ NCAUR
OC101

Plant Oil-based Polymers Prepared in Supercritical and Subcritical CO2 Media

This presentation will summarize the plant oils based polymers prepared in the supercritical or subcritical CO2 media. We will report the polymerization of soybean oil, epoxidized soybean oil and euphorbia oil

(EuO) by using Lewis acids catalyst in green media and explore their industrial applications, such as surfactants, lubricants, hydrogels and so on. A variety of analytical techniques have been used to characterize formed polymers, including FTIR, 1H-NMR, 13C-NMR, differential scanning calorimetry (DSC), thermogravimetric analysis (TGA), and gel permeation chromatography (GPC).

Day:2- 14:30:14:45	**Dr Neha Yadav - University of Birmingham OC101**

Designing water-soluble aliphatic polycarbonates for consumer product applications

The synthesis of functional degradable polymers has garnered interest in the past years. Among the available degradable materials, aliphatic polycarbonates (APCs) have gained attention due to their biodegradability, biocompatibility and low toxicity. These features make them attractive, not only as potential biomaterials but also in broader applications, including consumer products. Furthermore, APCs can be easily synthesised from biosourced chemicals making them a sustainable alternative to commercially used formulation polymers. Polymer structures can strongly influence the properties of consumer products and affect their biodegradation. In this regard, the use of degradable APCs in place of common non-degradable polymers offers an opportunity to design environmentally benign consumer formulations. Herein, we synthesised a series of novel water-soluble functional APCs with a wide range of molecular weights and architectures and their physical properties studied.

Day:2- 14:45:15:00	**Mr Edward Shellard - University of Oxford OC101**

Al(III)/K(I) Heterodinuclear Catalysts to make Oligoester Polyols by Ring Opening Copolymerization of Epoxides and Anhydrides

Low molar mass hydroxyl end-capped polyesters/oligoesters are important components in liquid formulations and to make higher polymers. Epoxide/anhydride ring opening copolymerization catalysis is a diverse method to make these materials, with the molar mass and chain end groups being controlled by added protic compounds (chain transfer agents, CTA) during the catalysis. One challenge within the field is to discover catalysts that can tolerate large quantities of CTA. Here, a new class of air-stable Al(III)/K(I) heterodinuclear catalysts are presented that are both very tolerant to high loadings of CTA and even show enhanced rates when CTAs are added. The catalysts are applied at very low loadings (0.0125 mol% cat), show high activities, productivities and selectivities. Rates increase as the amount of CTA is added, with catalysis effective up to 1000 eq. CTA. The polymerization catalysis and the properties of these hydroxyl end-capped oligoesters will be presented.

Day:2- 15:00:15:15	**Dr Volkan Filiz - Helmholtz-Zentrum hereon OC101**

Polymers of Intrinsic Microporosity (PIMs) had become quite famous for their high permeability for many gases caused by the large fractional free volume created by the contorted polymer chains with the spiro kinks, especially PIM-1, published in 2004 by P. Budd and N. McKeown. Since then and in many research groups worldwide a broad variety of new monomers and comonomers had been employed to improve the PIMs family further, driving the gas permeability peaks well above the Robeson¬¥s upper bound 2008 or generally improving the selectivity of glassy polymers for selected gases. Our group successfully introduced tetrahydroxy-anthracene derivatives as PIM comonomers [7] that could be widely varied by Diels-Alder reaction with maleinamines [8] offering versatile substitution possibilities at the nitrogen atom. Ranging from methyl-group to different substituted aromatics [9] and to poly(ethyleneglycol)s [10], the concept is effectively applicable with rather simple chemistry. Permeability resp. selectivity of the respective membranes lay on or only slightly below the Robeson¬¥s Upper Bound. 2,3,6,7-tetrahydroxy-9,10-dibutyl-N- allylmaleimide-anthracene (1) was synthesized to be employed as comonomer for new copolymers PIM1-(1)-50, either by reaction of (1), spirobisindane (2) and 2,3,5,6-tetrafluoro-dicyanobenzene (3) to obtain random PIM1-(1)-50r as well as in the reaction of (1) and tetrafluoro-trimer (9) to form alternating PIM1-(1)-50a. Polycondensation reactions were followed by sampling and analysis with SEC and 1H-NMR. Both copolymers were characterized by NMR, FT-IR, TGA and SEC. They are achieved in molecular weights well above 100 kg/mol and are easily processed in common solvents like tetrahydrofuran and chloroform. Copolymers PIM1-(1)-50 form transparent and elastic films from solution casting. Cross linkage of PIM1-(1)-50 films by reaction with 1,6-diazidohexane (10) at 200¬∞C proceeds effectively by the allyl side groups and leads to insolubility in common solvents; PIM-1 does not cross link under same conditions. Gas permeability is about 20% higher for random PIM1-(1)-50r compared to alternating copolymer PIM1-(1)-50a.

Day:2-15:15:15:30

Mr LEI LEI - Institut de Chimie et des Matériaux Paris-Est, ICMPE – CNRS
OC101

Degradable PEO-like Particles by Aqueous Photo-initiated Polymerization-Induced Self-Assembly

In this presentation, we will present a novel photo-initiated polymerization-induced self-assembly (photo-PISA) approach for the preparation of pH-degradable block copolymer nanoparticles. Specifically, we conducted the photo-PISA of 2-hydroxypropyl methacrylate (HPMA) at room temperature in water, utilizing a poly[(ethylene carbonate)75-co -(ethylene oxide)31]-based macro chain transfer agent (PECEO-mCTA) to obtain pH-degradable PECEO-b-PHPMA nanoparticles. By controlling the degree of polymerization and the total solid content, we successfully achieved a series of amphiphilic copolymers with diverse morphologies, including spheres, worms, and vesicles. The poly[(ethylene carbonate)75-co-(ethylene oxide)31]block contained in copolymer nanoparticles enable their degradability under basic conditions. In summary, our photo-PISA method offers a direct, precise, and environmentally friendly route to synthesize pH-degradable block copolymer nanoparticles under well controlled polymerizatio

Day:2-16:00:16:15

Professor Umut Bulut - Acibadem University
OC101

A functionalized conjugated polymer as a biosensing platform

As the focus of health care is now shifting from central hospital-based treatment to home-based treatment, there is a growing interest in developing low-cost and user-friendly biosensors for the rapid and early detection of diseases. Conjugated polymers are good candidates to build biosensing platforms to identify and quantify a target molecule. A novel amino-functionalized, conjugated, alternating polymer possessing benzodithiophene and benzenediamine moieties was synthesized, characterized. The copolymer was coated onto a glassy carbon electrode to serve as an immobilization platform for a biorecognition molecule, where glucose oxidase enzyme was employed as a model compound. The biosensor response was measured by the decrease in oxygen level due to the enzymatic reaction at a potential of -0.7 V versus silver/silver chloride and glucose levels in human serum samples were determined. Surface modifications were analyzed via cyclic voltammetry and field emission scanning electron microscopy

Day:2-16:15:16:30

Dr Philipp Bohn - Karlsruhe Institute of Technology
OC101

GaBr3-catalyzed reduction of esters towards uniform poly(ethylene glycol)

We report an alternative approach for the synthesis of uniform PEGs based on the selective GaBr3-catalyzed reduction of esters. For the complete reaction cycle, three catalytic reactions were investigated to be performed in a repetitive fashion, guarantee mild reaction conditions, the suppression of side products, and thus simple purification steps. IR and NMR spectroscopy have proven to be powerful analytic tools for monitoring of the carbonyl reduction. The ester precursors, bearing a benzyl protecting group, are obtained via Candida antarctica Lipase B (CALB)-catalyzed transesterification. After reduction, the benzyl ether is cleaved to recover the alcohol and complete the reaction cycle. Each reaction step can be performed on multigram scales and consistently deliver high yields. Careful characterization via NMR, HR-MS and SEC was performed to confirm the high purity of the products.

Day:2- 16:30:16:45	**Dr Jing LYU - University College Dublin OC101**

Active Kinetic Chain Length: Guide for Control in Atom Transfer Radical Polymerization

Since ATRP was developed, various strategies have been adopted to design well-controlled ATRP procedures. However, there is no single criterion that could be used for various ATRP reaction conditions. Herein, we introduce a new factor – Active Kinetic Chain Length (AKCL) that can guide the design of well-controlled ATRPs. We demonstrate that under a certain reaction system, the smaller value of AKCL, i.e., a smaller initial number of monomer units added to a growing chain during a chain active period, can decrease polymer dispersity and also diminish the radical termination. The effects of AKCL were compared with other parameters affecting dispersity and livingness in ATRPs based on analytical equations and Monte Carlo simulations, which clearly demonstrates the design principle of AKCL. This new AKCL criterion proposed in this work for achieving well-controlled ATRP would greatly simplify the future ATRP design and promote the synthesis of well-defined polymeric materials.

Day:2- 16:45:17:00	**Mr Thomas La Porta - Université de Bordeaux, ENSMAC OC101**

CALCIUM-LITHIUM SYSTEMS AS INNOVATIVE BIMETALLIC INITIATOR FOR THE ANIONIC POLYMERIZATION OF BUTADIENE: TOWARDS CONTROL AND HIGH 1,4-TRANS MICROSTRUCTURE

Synthetic rubbers such as polybutadiene are widely used in tires and the microstructure, known to be influenced by different parameters such as temperature, solvent, and process, plays a key role in thermo-mechanical properties. The versatility and livingness of anionic polymerization is also known to supply a large variety of polymers and block copolymers. Focused on this mechanism, additives or the solvent permits to modulate the vinyl content. However, the modulation of 1,4-trans units vs 1,4 cis units, with low vinyl content, is not well known in anionic polymerization. Herein, we present the first controlled anionic polymerization of butadiene using an innovative bimetallic Ca:Li which allow the polymerization of butadiene in apolar medium. The influence of the [Ca]/[Li] ratio on the polybutadiene microstructure (which could reach 80% trans), kinetics, control and the livingness of the polymerization, as well as the nature of the propagative center, are investigated and discussed.

Day:2- 11:00:11:15	**Dr Benoit Briou - Orpia Innovation OC102**

Cashew NutSell Liquid (CNSL), a versatile biobased platform molecule for the synthesis of chemical alternatives for the industry

Cashew nutshell liquid (CNSL) is a crude oil extracted from cashew nutshells. Among the renewable resource materials available, CNSL is a promising starting material due to its abundant availability, low cost and high potential functionalization. Once purified and isolated, cardanol, cardol, and anacardic acid, phenolic compounds bearing an unsaturated alkyl chain, are available for many chemical modifications on diverse reactive sites such as aromatic ring, phenolic hydroxyl, carboxylic acid, and the unsaturation of the side chain. Their structures induce biological activity, thermal stability, and plasticizing effect. Several building blocks for the synthesis of additives or monomers have been made by chemical transformation respecting, as sustainable as it could be. Surfactants, plasticizers, paint binders, and monomers have been developed from this multi-skilled natural resource.

Day:2- 11:15:11:30	**Dr Alexandra Mutch - The University of Tasmania OC102**

Applications of polymerisable eutectics in 3D printing and multi-responsive materials

There is a growing need for development of environmentally sustainable practices in chemical synthesis and one approach is to replace conventional volatile organic solvents with deep eutectic solvents (DESs). There are several classes of DESs and the most commonly utilised in polymer chemistry is a combination of hydrogen bond donor (HBD) and hydrogen bond acceptor (HBA) species, forming a stable mixture with a lower melting point compared with the individual components. Previous studies have shown that polymers made from eutectic mixtures can have improved mechanical and thermal properties, and polymerisation kinetics as compared with the equivalent polymers prepared through 'traditional solvent' methods. Many commercially available monomers can act as HBDs or HBAs in a eutectic mixture, allowing for the design of a wide variety of simple and cheap polymerisable eutectics (PEs).

The presented work details the combination of N-isopropylacrylamide (NIPAM), acrylamide (AAm) and 2-hydroxyethyl methacrylate (HEMA) in various combinations to form PEs. A UV photoinitiator was added to the PE mixtures, allowing for rapid photopolymerisation kinetics as evaluated by in situ photo-DSC and photorheology measurements. The versatility of the PEs was demonstrated through the addition of a photoswitchable spiropyran acrylate monomer, as well as applying the PE formulation as a stereolithography-based 3D printing resin.

Day:2-11:30:11:45

Dr Manas MAHAPATRA - Postdoctoral Fellow, Centre for Education and Research on Macromolecules (CERM), CESAM Research Unit, University of Liege, Belgium
OC102

Non-conventional Fluorescent Non-Isocyanate Polyurethane Foams for Multi-Sensing Applications

Multifunctional foams with intrinsic fluorescence properties able to sense multiple guest molecules are still challenging to prepare. Herein, we report the facile and upscalable synthesis of aliphatic intrinsically fluorescent non-isocyanate polyurethane (NIPU) foams from a mixture of a CO2-based cyclic carbonate and polyamines as greener alternatives to isocyanate-based polyurethane foams. The NIPU foams show non-traditional fluorescence, high thermal stability, photostability and excellent recyclability. The hydrogen bonding, structural rigidity and crosslinking density help in non-traditional fluorescence via cluster-luminescence. The NIPU foams are used for sensing-capturing gaseous formaldehyde, and on-off sensing-quantification of biologically important metal ions from aqueous solution. The foams are also able to selectively sense some antibiotics, enabling their facile smartphone-based detection-quantification.

Day:2-11:45:12:00

Ms Elise COURTECUISSE - Université de Bordeaux - CNRS - Bordeaux INP
OC102

Dioxyamines and dihydrazides as efficient linkers for the synthesis of chitosan-block-dextran copolysaccharides

Block copolymers containing polysaccharides are increasingly being considered for their sustainability, biodegradability, and biological properties. The first achievement came in the late 2000s with the advent of the Huisgen 1,3-dipolar cycloaddition to design hybrid copolymers containing a polysaccharide block and a synthetic one. The next step is to synthesize copolymers made exclusively of polysaccharides, i.e. block copolysaccharides. In this context, it is relevant to use a click chemistry approach specific to the reducing end of polysaccharides. Here, we propose difunctional linkers based on hydrazide or oxyamine groups. These linkers offer notable benefits, such as their high reactivity with the reducing end at room temperature regarding yield and reaction rate, their water solubility, and their commercial availability. This work presents the detailed synthesis and characterization of chitosan-b-dextran as model block copolysaccharides.

Day:2-12:00:12:15

Mr Fabian Kolodzy - DWI - Leibniz-Institute for Interactive Materials e.V., RWTH Aachen University
OC102

Co-Solvent-Triggered Release of the Natural Herbicide Okanin from pVCL-Microgels

The overuse of pesticides causes environmental pollution. For this reason, more efficient application strategies are required to ensure sufficient food production while enhancing the sustainability in agriculture. Microgels are crosslinked polymer networks with stimuli-responsive swelling behavior. This stimuli-responsiveness facilitates a controlled release of agrochemicals. In this work, pVCL-based microgels were investigated as carriers for the natural polyphenolic herbicide okanin. The loading capacity of okanin was determined by UV/Vis. Dynamic light scattering and microscopy techniques revealed a collapse of the microgels caused by formation of okanin-mediated crosslinks. The loading capacity and the loading efficiency were improved by incorporation of GMA moieties indicating a hydrophobic nature of the interactions. Finally, okanin was released from the microgels by co-solvent triggered release in the lab and on leafs confirming the herbicidal activity.

Day:2-12:15:12:30
Dr Dafna Knani - Braude College of Engineering
OC102

Simulation of the bioadhesive gelatin-alginate conjugate loaded with antibiotic drugs

Molecular modeling methods were used to study a novel bioadhesive comprised of gelatin (protein) and alginate (polysaccharides), crosslinked with EDC and NHS. Three antibiotic drugs were added to the bioadhesive: Vancomycin, Ofloxacin and Clindamycin. The crosslinking degree was estimated by calculating the enthalpy of mixing of gelatin with alginate and their interaction with the crosslinking agents. The interaction of alginate-gelatin conjugate with the antibiotics was estimated and it was found that the most significant interaction is with clindamycin. The degradation rate of gelatin-alginate was related to its interaction with water. It was found that the conjugate is highly hydrophilic. Gelatin is more soluble in water than both alginate and alginate-gelatin, and is probably the part in the conjugate that governs the solubility and degradation rate. Therefore, the degradation rate of the conjugate can be controlled by changing the proportion between gelatin and alginate.

Day:2-12:30:12:45
Mr Roberto Terracciano - University of Warwick
OC102

Poly(2-oxazoline) based Thermoresponsive Stomatocytes

The design of biocompatible and biodegradable nanostructures with controlled morphological features remains a predominant challenge in medical research. Stimuli-responsive vesicles offer significant advantages in drug delivery, biomedical applications, and diagnostic techniques. The combination of poly(2-oxazoline)s with biodegradable polymers could provide exceptional biocompatibility properties, proposed as a versatile platform for the development of new medicines. Therefore, poly(2-ethyl-2-oxazoline) (PEtOx) and poly(2-isopropyl-2-oxazoline) (PiPrOx) possessing a hydroxy terminal group that acts as an initiator for the ring-opening polymerization of D,L-lactide (DLLA) have been utilized in this study. The resulting amphiphilic block polymers were used to create polymersomes, which undergo solvent-dependent reorganization into bowl-shaped vesicles or stomatocytes. By blending PEtOx-b-PDLLA and PiPrOx-b-PDLLA copolymers, a thermoresponsive stomatocyte was generated, where the opening narrowed and irreversibly closed with a slight increase in temperature. Detailed TEM analysis reveals the formation of both closed and fused stomatocytes upon heating the sample above the critical solution temperature of PiPrOx.

Day:2-14:00:14:15
Dr Florian Wurm - University of Innsbruck
OC102

Cellulose acetate fibers from cigarette filter machinery for mixed fiber yarn applications

Cellulose acetate (CA) advantageously has limited chemical and microbial resistance. CA is less prone to form microplastics as microfibers, biodegrades reasonably, and easily mechanically disintegrates. Possible substitution of polyester therephthalate fibers can reduce microplastic pollution. CA does not contribute to carbon enrichment of the atmosphere, and can be spun on existing machinery.

Accordingly, staple fibers were spun using a common cigarette filter machine. The crimped CA fibers after the stuffer box, mixed with lyocell fibers, were ring spun to yarns. From these knit fabrics were generated.

Fiber type specific dyeing, as separation of CA from fabrics was conducted. Dye-CA separation was possible.

The stuffer box introduces physical and mechanical cross-linking of the fibers. Though detrimental, these are acceptable using adequate crimp settings. The carding properties of CA fibers dictate the yarn quality and homogeneity. Low cardability results in weak yarns.

Day:2-
14:15:14:30

Associate Professor SITI NURUL AIN BINTI MD. JAMIL - UNIVERSITI PUTRA MALAYSIA
OC102

OPTIMISATION OF CONTROLLED - CHEMICAL SYNTHESIS OF CALCIUM PEROXIDE NANOPARTICLES WITH DEXTRAN AS STABILISER VIA RSM-CCD

In aquatic environments, nanoscale calcium peroxide (nCPs) has shown great promise for the environmentally benign breakdown of pollutants. However, because of the high surface-to-volume ratio of nCPs, rapid hydrolysis and uncontrollably burst oxygen release might result in excessive oxygenation and surpassing the required levels for pollutant degradation. Therefore, in this study, Dextran (DEX) was used for the synthesis of nCPs and designated as nCPs-DEX. DEX offers a protective layer not only to enable the controlled released of oxygen during pollutant destruction, but also to stabilise the polymerization of nanoparticles by avoiding irreversible (aggregation) process. The properties of nCPs-DEX were then ascertained by FTIR, BET, EDX, TGA, DSC, FESEM, XRD, and BET. As a result, it was verified that the synthesised nCPs (2 g DEX) had a higher surface area (52.31 m2/g) and a smaller average mean size (2.33 ¬± 0.81 nm) than the nCPs (0 g DEX) and (1 g DEX). The goal of this study is to apply the Response Surface Methodology (RSM) to optimise the process variables and the controlled-chemical synthesis of nCPs (2 g DEX). Applying Central Composite Design (CCD) allowed for the effective completion of all analyses. The combined influences of parameters including the volume of H2O,ÇÇ, the rate of stirring, and the molarity of NaOH were examined in relation to the mass of nCPs (2 g DEX). ANOVA was used for the statistical analysis, and the results showed that the experimental parameter had a strong correlation with R2 of 0.9697. The numerical optimisation revealed that 2.8 M of NaOH, 50 mL of H2O,ÇÇ, and an 80 rpm of stirring rate could be reached with a R2 desirability of 0.969.

Day:2-
14:30:14:45

None Nikoline Frederiksen - The Danish Polymer Centre, DTU
OC102

Novel silicone materials with cyclic polymers

Cyclic polymers have been an academic curiosity for decades because of their endless structure that results in unique physical properties compared to the physical properties of linear polymers. The most prominent limitation in the research on cyclic polymers has been the limited quantity of cyclic polymer that could be prepared. Improvements in synthetic procedures in the recent years have opened up for the possibility of incorporating cyclic polymers into topological materials.1,2

In this project we are developing strategies to prepare different types of silicone networks containing cyclic polymers. Hereafter the properties of the networks are analysed in order to determine how the networks containing cyclic polymers differ from classical networks of linear polymers and thereby determine possible uses.

References

[1] F. M. Haque, S. M. Grayson, Nature Chemistry 2020, 12, 433–444.
[2] J. Tran, J. Madsen, A. L. Skov, ACS Omega 2022, 7, 46884-46890.

Day:2-
14:45:15:00

Mr Anthony Monmagnon - CEA Grenoble
OC102

Development of biobased Non-isocyanate polyurethane (NIPU) flexible foams with optimised reactivity

The substitution of polyurethane foams (PUF) with Non-Isocyanate Polyurethanes (NIPU) from CO2-derived cyclocarbonates is of great interest to avoid toxic isocyanates, but this requires optimizing the crosslinking kinetics.

New bi-component resins with high biobased content (70-90 wt%) were synthesised from carbonated vegetable oil with diamines for the production of NIPU foams with a wide range of properties. Curing cycles shorter than 10 min at 60 °C, were optimized using an in situ NMR spectroscopy method and by adjusting the rates of catalysts and residual epoxides, allowing for the industrial deployment of these materials. Modulation of the mechanical and thermal properties was studied by varying the nature and functionality of the monomers. NIPU foams with Tg around -40°C, density lower than 150 kg/m3, and compression set lower than 6%, were obtained, in good agreement with automotive seat specifications.

Day:2- 15:00:15:15	**Ms Phanumat Latsrisaeng - Ghent University OC102**

Structure-property relationship of polycarboxylate superplasticizers in alkali-activated slag system

Superplasticizers (SPs) are a group of chemical admixtures that are commonly used in the concrete industry to improve the workability of the concrete. At present, commercially available SPs are predominantly based on polycarboxylate ether (PCE) comb-shaped copolymers. However, the performance of these PCE SPs is rather limited in alkali-activated slag (AAS) systems. Here, the structure-property relationship of PCE SPs in an alkali-activated system based on slag was studied. Well-defined polymers were obtained by synthesizing the SPs via controlled reversible addition-fragmentation chain transfer (RAFT) polymerization. The structural parameters which include the monomer composition, side-chain, and backbone length were systematically altered and their dispersion capacity was assessed through mini-slump tests and rheometer measurements. It can be concluded that fine-tuning the chemical structure of the synthesized SPs is essential to obtain efficient working SPs in AAS systems.

Day:2- 15:15:15:30	**Mr Luis Santos Correa - Karlsruhe Institute of Technology (KIT) OC102**

Sunflower oil based thermosets via the Passerini three component reaction

Tricarboxylic acids are molecules of interest for the synthesis of highly cross-linked polymers. Herein, a synthesis route to a novel triacid from high oleic sunflower oil is described by applying a ruthenium catalyzed oxidative cleavage of its double bonds. This bio-based triacid was used for the synthesis of cross-linked materials via the Passerini three component reaction.

Ten different polymeric materials were synthesized by variation of aldehyde and diisocyanide components and subsequently characterized via IR spectroscopy, swelling tests, thermogravimetric analysis (TGA), differential scanning calorimetry (DSC), and tensile tests. The characterization of the insoluble polymeric networks was complemented by the synthesis of model compounds to enable analysis in solution via nuclear magnetic resonance (NMR) spectroscopy. Due to the fast curing of all polymers at room temperature, adhesive tests were performed to demonstrate their potential application as glues.

Day:2- 16:00:16:15	**Mr Joey Hodges - Anton Paar Ltd OC102**

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Day:2- 16:30:16:45	**Mr Felix Leibetseder - Johannes Kepler University OC102**

Sequence-defined copolymers – Scalable synthesis pathways as a door-opener into energy materials research

Sequence-defined copolymers have always been of high interest in the field of polymer chemistry. Properties that can be generated through alternating or block structures are frequently very different from random copolymers and promise great potential in high-tech applications, herein demonstrated for battery materials. However, real-world applications are often limited due to poor efficiencies during synthesis, sensitive reagents, or expensive starting materials. An economical, scalable synthesis yielding a wide variety of alternating acrylamide copolymers is presented and previously inaccessible alternating copolymers were synthesized. The polymers were tested together with their corresponding block and random counterparts for their use as lithium-ion battery components. Furthermore, application-related properties like adhesion and ion-conductivity are evaluated and structure-property relationships are demonstrated.

Day:2- 16:56:17:00	**---- Anna-Lena Ziegler - University of Helsinki OC102**
Tuning the characteristics of poly(2-phenyl-2-oxazine)-based invers thermogels	

Day:2- 11:00:11:30	**Dr Annette Christie - Syngenta OC103**
The Role of Polymers in Sustainable Crop Production: Innovations, Challenges and Opportunities	
The agricultural industry is currently undergoing a period of remarkable transformation, driven by technological advancements, environmental considerations, and evolving consumer demands. This dynamic landscape presents an exciting opportunity to explore and leverage innovative solutions. Syngenta Group is a leading technology company for sustainable agricultural innovation. Syngenta,Äôs mission is to offer large and small farming businesses the tools to address a wide range of challenges associated with crop productivity and health, to manage the effects of climate change and to help preserve biodiversity. Ultimately, innovations from Syngenta Group,Äôs crop protection and seeds divisions help farmers to ensure sustainable food, feed, fibre and fuel production. Polymers are currently utilized for a diverse range of applications in practically every commercially available agrochemical product. Consequently, the adoption of new advancements in polymer science, holds significant potential to address the challenges of modern farming practices. This presentation will delve into the diverse applications of polymers in agriculture, focusing on their pivotal role in enhancing sustainability and optimizing crop yield. From novel materials to smart delivery systems for agrochemicals, the use of polymers offers multifaceted solutions to improve biological performance of both chemical and biological active ingredients and the overall agricultural productivity. Through case studies and scientific insights, this presentation aims to provide an overview of the current state, challenges and future potential of polymers in agriculture, emphasizing their contribution to sustainable and efficient farming practices. In particular, with increasing awareness of the lifetime and cycle of polymers within the environment, interest in applying biodegradable polymers for a broad range of applications has significantly expanded. Over recent years there has been intensive research to build understanding & reproducible testing of the chemical and physical mechanisms underlying the breakdown and metabolization of biodegradable polymers within the environment. This presentation will detail the regulatory requirements within Europe, highlighting significant progress as well as current and future challenges in this area. In addition, controlled delivery techniques are revolutionizing agricultural practices, enabling targeted and efficient delivery of inputs while minimizing waste. Polymers play a critical role in precision application systems. By harnessing the wide variety of properties enabled with varying polymer chemistry, precision application technologies can optimize the dispersion and retention of agrochemicals, fertilizers, and other inputs, thereby maximizing their impact on crop health whilst minimizing the number of sprays required. In conclusion, with the evolving landscape of agriculture, reshaping the way we think and use polymers in agricultural practices has the potential to reshape how we design and develop future formulations. As the industry continues to embrace innovation and sustainability, the role of polymers in agriculture will undoubtedly expand, offering novel solutions to address the challenges of modern farming while contributing to a more sustainable and resilient agricultural sector.	

Day:2-11:30:11:45
Dr Christopher Kay - Interface Polymers Ltd
OC103

How to start and scale-up a diblock copolymer business worth >£20 million

Interface Polymers is a Warwick spin-out working towards a £100 million+ valuation. In the last 7 years we've built a team of 15, raised £11million equity and £1.5million in grants from InnovateUK. We now have a pilot plant in India able to make two diblock copolymer products at the multi-ton scale and we are in a phase of market proving. Subject to sales orders in the next 12-18 months, we intend to raise enough capital to build a profitable commercial (1000 MTA) plant, which when operational would turn us into a significant supplier of polymeric specialty additives.

Day:2-11:45:12:00
Dr Daniel David Stoebener - Ghent University
OC103

Exploiting the co-nonsolvency-assisted gelation of stimuli-responsive polymers for the fabrication of fast and switchable hydrogel actuators

Responsive polymer materials display high potential for numerous applications, e.g., stimuli-responsive hydrogels can be used as mechanical actuators in soft robotics. However, the utility of hydrogel actuators is often limited by restricted swelling kinetics. Thus, the incorporation of pores into the hydrogel network is often necessary to achieve fast and reversible response rates. Herein, we fabricate superporous hydrogels via a versatile template-free co-nonsolvency-assisted gelation approach. We show that the free radical crosslinking polymerization in aqueous organic co-nonsolvent mixtures yields hydrogel actuators with highly accelerated response rates. Based on different comonomers, thermo- and pH-responsive hydrogels can be obtained, and their stimuli-responsive properties harnessed to create soft actuators with tailored properties. Overall, the presented polymerization-induced phase separation approach bears great potential for the design of micro/nano-structured materials.

Day:2-11:45:12:00
Dr Rajesh Theravalappil - King Fahd University of Petroleum and Minerals
OC103

Synergistic effect of various carbon fillers on the mechanical properties and electrical/thermal conductivities of ethylene-butene copolymer composites

Ethylene-Butene copolymers (EBC) with a butene content of 14 mol% was mixed with two types of fillers to study the synergistic effect on its properties. The fillers used were multi-walled carbon nanotubes (MWCNT) and Printex carbon black and their mixture were introduced in different compositions (0.5 – 10 wt%). Solutions of these copolymers in toluene were prepared first and fillers added to it and composites were prepared out of it. Tensile properties of the composites were measured using a universal testing machine along with Shore-A hardness. Electrical and thermal conductivities of the composites also were analyzed and found to be increasing with increasing filler loading. After the evaluation of properties of EBC composites, it could be concluded that incorporation of MWCNT and carbon black fillers has enhanced the conductivities and mechanical properties considerably without compromising on their hardness much. Morphological studies also supported the enhancement in properties

Day:2-12:00:12:15
Ms Frances Dawson - University of Bath
OC103

Strands vs crosslinks: degradation and regelation of poly(acrylate) gel networks synthesized by RAFT polymerization

Covalently crosslinked polymer networks, such as thermoset materials are difficult to recycle. To overcome this, degradable units can be incorporated into the network structure within the crosslinker or into the polymer backbone, which can be cleaved chemically to soluble fragments. Controlled radical polymerization techniques such as RAFT must be used to afford degradable networks at a variety of crosslink densities. Dibenzo[c,e]oxepane-5-thione (DOT) can be used as a comonomer, allowing network made by both FRP and RAFT to be fully degraded. Both forms of degradable networks can produce thiol functional fragments, suitable for repolymerization by thiol oxidation to disulfide linkages. These fragments are very different, with fragments formed through disulfide cleavage in the crosslinker having a higher Mn and lower dispersity than the fragments made through the C-S bond cleavage of copolymerized DOT. Both types of network produce fragments that can reform into a solid gel.

Day:2-12:15:12:30	**Mr Daniele Giannantonio - University of Birmingham** **OC103**

Day:2-12:15:12:30	**Ms Georgina Burgoyne Morris - University of Cambridge** **OC103**

Self-healing hybrid polymer hosts for solid-state triplet-triplet annihilation upconversion

Triplet-triplet annihilation upconversion (TTA-UC) has potential to boost solar cell performance by converting sub-bandgap photons to useful energies. However, for practical device integration the development of effective, long-lasting solid-state host materials is crucial.[1]

This work aims to develop novel TTA-UC hosts based on a family of organic-siliceous hybrid polymers known as ureasils, previously reported as excellent hosts for luminescent solar concentrators[2] and visible light communications.[3] Here additional hindered urea crosslinks are introduced to introduce self-healing behaviour, which could enhance the lifetime and utility over practical timescales. Results will be presented linking the structural and physical properties of self-healing ureasils to their photophysical performance.

1 M. J. Bennison et al., Macromolecules, 2021, 54, 5287–5303.
2 I. Meazzini et al. J. Mater. Chem. C, 2016, 4, 4049–4059.
3 A. Bastos et al., ACS Omega, 2018, 3, 13772–13781.

Day:2-14:00:14:15	**Dr Raju Bej - Free University Berlin** **OC103**

Mucus-Inspired Synthetic Hydrogels

Mucus is a dynamic biological hydrogel, composed primarily of the glycoprotein mucin, that exhibits unique biophysical properties, and forms a barrier to protect underlying cells against broad-spectrum viruses. Bulk-scale availability of suitable materials for model systems is a major impediment to understand the complex biological role of mucus. Using RAFT polymerization technique, we developed a methacrylate-based dendronized polyglycerol sulfate (MIP-H) as a mucin-inspired copolymer. MIP-H shows elongated single-chain fiber morphology and potential inhibitory activity against many viruses such as HSV-1 and SARS-CoV-2. MIP-H produces hydrogels with tunable bulk-rheological properties and microstructures using PEG-dithiol or tetra-thiol as a cross-linker. Synthesis, micro and macro rheological characterization, network structures by cryo-SEM and protective barrier properties of the hydrogels against viral infection will be highlighted in the presentation.

Day:2-14:15:14:30	**Mr Adrian Eliasson - KTH Royal Institute of Technology** **OC103**

Highly ductile cellulose based material through glycerol incorporation using ultrasonication

Cellulose is an abundant biopolymer already widely used, while also being bio-degradable and recyclable. Although cellulose is a polymer it does not show typical polymeric behaviours such as thermo-processability which most synthetic polymers do. Our approach is to incorporate a small amount of plasticizer into the lignocellulose matrix. The hypothesis is that the small plasticizing molecules will reduce the strong intermolecular interactions within cellulose and enhance molecular mobility. Successful implementation will increase the lignocellulose's thermo-processability and yield a material that can be processed through conventional thermo-processing such as extrusion or hot-pressing allowing more advanced shaping opportunities than existing methods.

Our work has shown that glycerol that is incorporated into fibers through ultrasonication and then formed into sheats can increase their ductility from 0.5% to 30% without losing significant mechanical integrity.

Day:2- 14:30:14:45	**Mr Stephan Maes - Ghent University OC103**
Controlling Dynamicity in Covalent Adaptable Networks: Tuning the Catalysis or adjusting the Dynamic Bonds?	
Covalent Adaptable Networks are crosslinked polymeric structures containing dynamic bonds, that can undergo exchange reactions under specific conditions. Numerous dynamic chemistries have been described in the last decade, however sometimes these exchange reactions remain sluggish and need optimisation. In this contributed talk, different of these optimisation strategies will be discussed. The use of a highly active catalyst is often the most attractive, yet most of the times not the best option as this catalyst might render the system too dynamic. Multitudes of different optimised catalyst systems have been reported, however, we will show that using a switchable weak catalyst is often highly likeable. Next to catalysis, in the second part of this talk the influence of the environment of the dynamic bond and different decoration options will be discussed.	

Day:2- 14:45:15:00	**Mr Michael Goeschl - TU Wien OC103**
Sulfonium Borate Photoinitiators for high performance and low discoloration in Hot Lithography of Epoxy Resins	
A novel high-temperature 3D printing process called Hot Lithography has enabled the printing of many previously unavailable monomer systems, like the epoxy monomer BADGE. Photoacid generators like sulfonium hexafluorophosphates and perfluorinated tetraphenylborates are well established as initiators for this process. The newly developed sulfonium borate initiator SBCN demonstrates a lower molecular weight and a more cost-effective, scalable synthesis compared to the state of the art. When combined with the epoxy monomer BADGE, which is commonly used in industry, SBCN surpasses commercial initiators across a wide temperature range. Formulations containing SBCN are storage stable even at elevated temperatures and can be sensitized by anthracene derivatives. Hot lithography at 90 °C using the SBCN-BADGE system yields printed parts with excellent layer quality and minimal discoloration compared to state-of-the-art sulfonium initiators.	

Day:2- 15:00:15:15	**Mr Keven Walter - Humboldt-Universität zu Berlin OC103**
Unveiling Debondability: Switchable Thiol-Catechol Connectivity (TCC) Adhesives.	
In the current era of circular economy, the pursuit of sustainable synthetic adhesives remains ongoing. The increasing need for a debonding mechanism aligns seamlessly with the European Green Deal's focus on consumer rights to repair. Addressing this challenge involves drawing inspiration from nature, where the marine mussel stands out for achieving exceptional adhesion through its protein glue. These mussel proteins, rich in L-DOPA with catechol functionalities, play a key role in cohesive curing and surface bonding. In this context, we introduce a class of redox-switchable pressure-sensitive adhesives (PSAs) that are designed to exhibit a significant reduction in adhesion upon exposure to an oxidative trigger. The PSAs are obtained through a robust and straightforward polyaddition pathway that employs thiol-quinone Michael addition, resulting in thiol-catechol connectivities (TCCs). Derived from a series of phenol or catechol species, bischinones are synthesized by oxidative pathways and, in combination with commercially available multithiols, form a versatile platform for the subsequent production of TCC polymers.	

Day:2- 15:15:15:30	**Ms Nicole Edelstein-Pardo - Tel Aviv University**

Day:2-
16:00:16:15

Professor Carlos Scuracchio - Federal University of S√£o Carlos
OC103

Use of vulcanised rubbers and block copolymers to build mechanical sensors and actuators based on electroactive polymers

Technological advances in the aerospace, biomedical, and robotics industries stimulate the need for innovative and sustainable devices, such as electromechanical devices, which are materials capable of mimicking biological systems in appearance, functionality, and operation. For practical applications, they must combine several properties, such as i) high ionic conductivity, ii) flexibility, and iii) chemical, mechanical and structural stability. Such properties can be obtained by engineering amphiphilic copolymers, which can self-assemble into well-defined morphologies with nanometric domains. Thus, it is possible to effectively dissociate ionic conductivity from mechanical properties, Young's modulus, and ionic conductivity according to the size of the blocks and functional groups. In addition to this strategy, use of natural fillers, such as nanocellulose, and electrodes made from conductive natural rubber contribute to a more sustainable approach to this type of device. In this presentation, it will be presented strategies for advancing the development of bio-inspired sensors and actuators, leveraging the remarkable properties of ionic conductive block copolymers.

Day:2-
16:15:16:30

Dr Aleksander Hejna - Poznan University of Technology
OC103

Photooxidation and thermooxidation of PLA as a function of its stereochemistry

Polylactide (PLA) is the most commonly used bioplastic. Its performance is driven by the L- and D- isomers' content, which strongly affects the crystallinity, inducing variations in processing, solubility, thermal or mechanical performance, and degradation rate. The impact of PLA chirality on biodegradation has been repeatedly investigated due to the environmentally friendly character of this polymer. However, despite PLA's susceptibility to oxidative degradation and its importance in multiple applications, its correlation with the content of particular isomers has been so far overlooked. Reported studies dealing with this phenomenon are predominantly based on one PLA grade despite the indisputably significant impact of its structure and differ with applied oxidation conditions. Herein, photooxidation and thermooxidation of PLA grades differing with L- and D-isomer content were evaluated under the same conditions, providing clear and straightforward information about this material.

Day:2-
16:30:16:45

Dr Zhen Wang - Max Planck Institute of Colloids and Interfaces
OC103

Sustainable photonic glass pigments from brush block copolymers

Growing societal concerns over microplastic pollution and resource sustainability is driving the pigment industry to search for sustainable alternatives. One promising avenue is block copolymer (BCP), which is known to self-assemble into structurally coloured materials. However, its real-world application has been hindered by limited exploration into the suitability of biocompatible and (bio)degradable monomers. In this talk we will show that biocompatible BCPs can be self-assembled within emulsified microdroplets, which upon drying form microparticles with a porous 'photonic glass' architecture. The colour from these 'pigment' can be tuned by either the BCP properties or the fabrication conditions. Finally, the relationship between the microparticle morphology and its optical response was investigated for BCPs with similar composition but different thermal behaviour. This revealed the formation mechanism for the porous structure and allowed for a strategy to enhance colour purity.

Day:2-
16:45:17:00

Ms Kai-Jhen Huang - National Taiwan University
OC103

Anion Effects on Photophysics, Electrochromic, and Electrofluorochromic Behaviors of Triphenylamine-based Pyridinium Salts and Their Derivative Polymers

In this study, we investigate the triphenylamine-based pyridinium salts (TPA-Pys) with the hydrogen group (TPA-Py-H) or cyano group (TPA-Py-CN) on their photophysics, electrochromic (EC), and electrofluorochromic (EFC) properties. Because of their acceptor-donor-acceptor designs, TPA-Pys showed intriguing fluorescence behaviors. Moreover, by the replacement of four anions (Br–, BF4–, ClO4– , and PF6–) and incorporating an electro-withdrawing cyano group, the quantum efficiency (ϕPL) could be significantly enhanced in both the solution and solid states, such as TPA-Py-CN-BF4 showed the ϕPL of 88.3%. Consequently, TPA-Py-CN-BF4 was also prepared to investigate the EFC performance. The EFC device exhibited the photoluminescence contrast ratio of 11 between the fluorescent neutral state and the non-fluorescent oxidized state. Furthermore, the derived polymers (TPA-PV-H and TPA-PV-CN) demonstrated outstanding quantum efficiency with a similar anion relationship to small molecules.

<table>
<tr><td>**Day:2-
11:00:11:15**</td><td>**Professor Zhen Jiang - University of Wollongong
OC107**</td></tr>
<tr><td colspan="2">Designing tissue-like, high-performance soft actuators</td></tr>
<tr><td colspan="2">Polymeric gel-based soft actuators exhibiting tissue-matched Young’s modulus (10 Pa-1 MPa) promise to be core components in future soft robotics with inherently safe human-machine interactions. However, these materials are still in their infancy, and many significant challenges remain presenting impediments to their practical implementation, including poor mechanical properties, slow actuation speed and limited actuation performance.

In our lab, we propose molecular design principles to overcome these limitations. First, our molecular design concepts to improve mechanical properties of hydrogel actuators will be introduced. I will also talk about our strategies to realize fast actuation speed. In addition, how to design strong and fast hydrogel actuators will be discussed. Finally, our recent progress in realizing high values in several aspects of actuation performance metrics for this class of materials will be introduced.</td></tr>
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<tr><td>**Day:2-
11:15:11:30**</td><td>**Associate Professor Ying Zhao - Institute of Chemistry, Chinese Academy of Sciences
OC107**</td></tr>
<tr><td colspan="2">Inveastigation on Unexpected Nucleation Behavior of Microcrystalline Nucleating Agent Crystal for Isotactic Polypropylene</td></tr>
<tr><td colspan="2">Despite significant progress, the key factors that determine the nucleating ability of nucleating agents in the epitaxial crystallization dynamics have been not fully understood. N,N¢-dicyclohexylterephthalamide (DCHT), an aromatic bisamide β-nucleating agent that can be dissolved in isotactic polypropylene (iPP) melt, shows a dual nucleation capability for the β- and α-crystals of iPP. The mechanism underlying the effect of morphological characteristics of DCHT on the formation of crystalline structure of iPP has been reported, and a new DCHT crystal morphology “microcrystalline agglomerates” was found to show high nucleation selectivity for β-crystal. In this work, we investigate the content dependence of microcrystalline DCHT crystal formation and the underlying mechanism of ultra-high selection for the nucleation of β-crystals of iPP with 0.03~0.05 wt % DCHT was proposed on the basis of POM, DSC and in situ WAXD results.</td></tr>
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<tr><td>**Day:2-
11:30:11:45**</td><td>**Professor Bruno Urbano - University of Concepcion
OC107**</td></tr>
<tr><td colspan="2">Nanocomposite Hydrogels</td></tr>
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<tr><td>**Day:2-
12:00:12:15**</td><td>**Mr Alexandros Magiakos - University of Warwick
OC107**</td></tr>
<tr><td colspan="2">Polymeric arsenicals as a unique, tunable and responsive platform for biomaterials</td></tr>
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Polymeric arsenicals are tunable, reactive, responsive and biocompatible scaffolds with distinct reactivity, providing an interesting platform for functional and (re)active materials in the field of polymer and (bio)materials science. To date, numerous metal and arsenic drugs have been extensively used in medicine due to antimicrobial / anticancer activity, followed by intrinsic and acquired resistance as major problems in their action. Meanwhile, nanotechnology and polymeric materials in nanoparticle or gel formulations, have emerged as effective platforms for metallo-drug delivery. Designing polyarsenical block copolymer/homopolymer scaffolds that undergo simultaneous self-assembly and loading of metal complexes into supramolecular formulations, can achieve the goal of efficient drug delivery and enhanced therapeutic activity, by employing dual pharmacophore properties.

Day:2-12:00:12:15 | **Ms Katherine Arlete Gouveia Jovel - University of Mons** | **OC107**

CO2 Valorization as Eco-friendly Physical Blowing Agent for Tailoring Properties in Non-Isocyanate Polyurethane Thermoset Foams

Polyurethane (PU) foams, vital for energy-efficient insulation, face safety hurdles due to harmful isocyanates. Non-isocyanate PUs (NIPUs) offer a solution aligning with EU regulations and climate goals. A synthesis route involves aminolysis of bio and CO2-based 5-membered cyclic carbonates (5CC) to produce polyhydroxyurethanes (PHU). We report an eco-friendly and sustainable method for the fabrication of thermosetting NIPU foams using supercritical CO2 as a blowing agent. The method involves CO2 pressure-induced absorption, CO2 temperature-induced desorption, and curing of 5CC/amine resins. At high temperatures, two simultaneous processes drive cellular structure formation: CO2 release and crosslinking of the PHU network. We studied the foaming/curing temperature and stabilizers impact on the final properties of NIPU foams. Tailored foam properties: 270-451 Kg/m3 density, 16-350 KPa compression modulus, 0.99-0.33 mm cell sizes. scCO2 foaming ensures controlled NIPU foam fabrication.

Day:2-14:30:15:45 | **Ms Karla Itzel Garfias Gonzalez - KTH Royal Institute of Technology** | **OC107**

Fiber surface functionalization: a key to recyclable composites with reversible interface bonding.

The request for robust composites for demanding applications is constantly increasing. However, good recycling solutions that give value to end of life composites and prevent waste accumulation, are still a challenge. The implementation of covalent adaptable networks offers promising chemical and mechanical recycling opportunities to circulate fiber reinforced composites. Our research shows that fiber surface functionalization can be a tool to improve the composite properties and to promote the recyclability. As an example, we demonstrated that, matching the surface functionality of aramid fibers with the dynamic chemistry of an epoxy polymer matrix lead to a reversible fiber-polymer interface to regain higher quality composites.

Day:2-14:45:15:00 | **Mr Yuta Kawasaki - Graduate School of Engineering, Kobe University** | **OC107**

X-ray Analyses of Residual Stress at Adhesion Interface between Isotactic Polypropylene and Epoxy Resin

Residual stress is generated at the adhesion interface between different substrates due to their difference of thermal expansion coefficients. This residual stress causes deterioration of adhesion through cracking and detachment at the interface. X-ray stress measurements are one of the promising candidates as quantitative and non-destructive analysis methods of the residual stress.

Evaluations of residual stress at adhesion interfaces are developing, and are required to understand adhesion mechanism. In this study, epoxy resins (EP) were cured on isotactic polypropylene (it.PP) substrates, and we evaluated the dependence of the residual stress on adhesion conditions through X-ray diffraction method. The tensile residual stress on plasma treated it.PP was 11.7 MPa. This value is similar to the calculated one obtained from the difference of the thermal expansion coefficients of epoxy resin and that of it.PP.

Day:2- 15:00:15:15	**Mr Abraham Herzog-Arbeitman - MIT OC107**

Topological toughening of polymer networks via controlled cleavage of network junctions

The toughness of polymer networks is key to applications, yet tuning of network toughness independently of other properties remains difficult. Recently, it has been shown that placement of mechanochemically weak cyclobutane “mechanophores” into the strands of end-linked networks produces weaker materials, while installing similar mechanophores into the cross-links of pendant-cross–linked networks can produce tougher materials; however, it remains unknown how to design mechanically active networks of the same topology with both greater or lower toughness. Here, we install cyclobutane mechanophores as end-linked network junctions, and find that while the elastic moduli of these materials are identical to controls lacking cyclobutanes, their toughness can be substantially increased or decreased based on molecular-scale substituent effects. We suggest that maintaining network strand continuity upon junction rupture is key to network toughening.

Day:2- 16:00:16:15	**Professor Amina Mikayilova - institute of Radiation Problems OC107**

PLASTIC WASTE AND ITS MANAGEMENT STRATEGIES FOR ENVIRONMENTAL SUSTAINABILITY IN AZERBAIJAN

This article analyzes the management of plastic waste in Azerbaijan, highlighting an annual per capita generation of 240-250 kg of plastic waste. The waste primarily includes items like PE bags, containers, balloons, and bottles. The country employs three main mechanisms for waste management in different regions: in Baku, the capital, waste is transported to the Balakhani landfill by state-owned communal facilities, where private enterprises sort and process it for disposal; in strategically important cities and regional centers, waste is taken to unprotected landfills; and in rural areas, household and plastic waste is inadequately managed, leading to environmental pollution. Over the past 5 years, the government has introduced three policy documents and amended legislative acts to improve plastic waste management. Notably, there is an upcoming "Producer Responsibility" law crucial for implementing these policies. The abstract also provides insights into the ongoing Resource Recovery

Day:2- 16:15:16:30	**Dr Peng Huang - University of Manchester OC107**

Credit cards in a Circular Economy

The increase in plastic usage, with less than 16% being recycled, poses environmental risks. Transitioning to a circular economy is essential for sustainability. While mechanical recycling encounters challenges, chemical recycling, particularly in selective processes, emerges as a promising global waste management strategy. Here, we present proof-of-concept work on circularising a Mastercard through the redesign of card composition, selective catalytic depolymerisation, and re-polymerisation, achieving closed-loop recycling without significant property downcycling. This sustainable process extends to the recovery of embedded metal components. Life cycle assessment and techno-economic analysis of two chemical recycling scenarios highlight potential environmental and economic benefits. The facile recycling strategy is adaptable to other types of polyesters and opens up new routes for the end-of-life management of complex multi-layered materials that currently escape the recycling loop.

Day:2- 16:30:16:45	**Assistant Professor Daniel Portinha - Ingénierie des Matériaux Polymères, UMR 5223 OC107**

Chemolysis of poly(dimethyl siloxane)-based polymers into functional polymeric structures : chemical upcycling towards a circular model

Polymeric materials in general and silicone in particular have revolutionized key sectors such as healthcare, construction, electronics... When used as structural materials, their durability along their functional lifetime appears as beneficial, while being problematic for the environment at their end-of-life if not collected. To avoid this, chemical upcycling of polymers that exploits a chemical transformation to either reobtain virgin monomer or convert them into other useful synthetic chemicals, has emerged as a complementary alternative to existing valorization processes such as mechanical recycling or incineration. Not only it contributes to preserve resources by transitioning to a circular model, but it also converts "waste" into market value chemicals. In this context, our recent results on the upcycling of silicone based polymeric materials (linear, gels, crosslinked materials) in functional oligomers that can be reused in novel elastomeric formulations, will be presented.

Day:2- 16:30:16:45	**Ms Luanna Moura - Université de Pau et des Pays de l'Adour (UPPA) OC107**

Critical analysis of the synthesis of different bio-sourced hydrogels

Human growth demands an increasing supply to provide the population with food, impling a stress over agricultural sector where demands to produce larger quantities have to live with new and harder restrictions on the methods and materials used for its development. Moreover, climate changes have increased the severity of droughts and inundations, making the bioavailability of certain nutrients and definately water a matter of concern for the proper development of crops. The present study focused in using a Kraft lignin precipitated by an organic acid in the formulation of a lignin-based hydrogel to be used in agricultural soil. This lignin was studied in its chemical composition and swelling capacity and compared with a technical lignin. Results showed that precipitated and technical lignin have different characteristics, however, hydrogel was formed. Hydrogels were studied in their chemical composition, morphology, thermal properties, and swelling capacity in deionized and tap water.

Day:2- 17:15:18:00	**Professor Michael Brook - McMaster University BUTTERWORTH HALL**

Improving the Circularity of Synthetic Elastomers: Compostable Silicones

Silicone oils depolymerize and are readily converted back to sand, water and CO2 in the environment. Reticulated silicone elastomers are highly resistant to degradation under many aggressive conditions, which can hinder their ability to undergo decomposition to natural constituents at end of life in the environment. We will describe strategies to encode both organic and biological linkers in silicone elastomers that permit effective reuse/repurposing/recycling with various trigger conditions including redox, high ionic strength, and light. These routes allow one benefit from higher molar mass polymers directly without the need to depolymerize to monomers. The efficacy of this strategy is also demonstrated by the ability to degrade – in industrial composting - (bio)erodible crosslinks based on saccharides, peptides and disulfide-linked monomers. The relatively small changes in physical properties of silicone elastomers with these atypical crosslinks will be described.

Day:2- 09:00:09:45	**Professor Christine Luscombe - Okinawa Institute of Science and Technology BUTTERWORTH HALL**

The unexpected kinetics in the synthesis of glycolated polythiophenes

Conjugated polymers with ethylene glycol side chains are emerging as ideal materials for bioelectronics, particularly for application in organic electrochemical transistors (OECTs). To improve the OECT device performance, it is important to develop an efficient synthetic strategy that will provide access to novel high-performing materials besides focusing on molecular design. While a lot of efforts are being devoted to designing of new polymers by modifying the glycol side chains, understanding how their nature affects the polymerization kinetics and eventually the polymer structure and properties is not known. In this work, we have studied the influence of the content of the ethylene glycol side chain and its linkage on the formation of the active Grignard monomer species upon Grignard metathesis in three thiophene derivatives. Kinetic studies by GPC show different growth characteristics from the standard Kumada Catalyst Transfer Polymerization (KCTP).

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<tr><td>**Day:3-
09:45:10:30**</td><td>**Professor Heather Maynard -
BUTTERWORTH HALL**</td></tr>
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<tr><td>**Day:2-
16:15:16:30**</td><td>**Mr James Cresswell - Durham University
S020**</td></tr>
<tr><td colspan="2">Synthesis and material insights of tailored poly(vinyl alcohol) for improved performance in next-generation laundry detergent pods</td></tr>
<tr><td colspan="2">Poly(vinyl alcohol) (PVA) is a versatile, biodegradable and non-toxic polymer with recent interest in applications for single-unit dose laundry detergent packaging. Challenges persist, especially regarding PVA pouch seal properties. Current computational models lack empirical validation. Our study employs PET-MADIX polymerization for well-defined PVA synthesis to create model systems for material property analysis. We introduce labelling techniques—deuterium for small angle neutron and bromine for ion beam analysis—to investigate PVA's structure, dynamics, and chain migration. This work deepens the understanding of the impact of polymer chain end groups on aggregation behaviour, as well as elucidating the polymer chain dimensions as a function of the degree of acetylation. Rheological analysis of model PVAs sheds light on the nature of the polymer macrostructure and the impact on physical properties.</td></tr>
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<tr><td>**Day:3-
11:00:11:30**</td><td>**Professor María J. Vicent - Príncipe Felipe Research Center
ARTS CENTRE THEATRE**</td></tr>
<tr><td colspan="2">Versatile Polypeptide-based Nanoconjugates for Multimodal Therapeutic Applications</td></tr>
<tr><td colspan="2">Polypeptides are already playing a major role on a number of different relevant areas such as nanomedicine. The physico-chemical parameters of a polypeptide-conjugate, and hence its biological performance, are defined by an intricate interplay of multiple structural factors. This highlights the need for detailed structure-activity relationship studies to develop the hierarchical strategies of polypeptide conjugate design. However, structural complexity also represents a unique opportunity, since small changes at the structural level might endow nanomedicines with outstanding and unexpected biological performance. An overview of the strategy followed in our group to achieve promising nanocarriers with inherent tropism for therapeutic and/or diagnostic applications will be given. Tissue tropism and subcellular organelle targeting with rationally-designed polypeptides will be discussed and also, their applications as targeted drug delivery therapeutics for advanced cancer treatment.</td></tr>
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<tr><td>**Day:3-
11:30:12:00**</td><td>**Professor Julien Nicolas - CNRS, Univ Paris-Saclay
ARTS CENTRE THEATRE**</td></tr>
<tr><td colspan="2">Vinyl Polymer Engineering for the Development of New Materials for Biomedical Applications</td></tr>
<tr><td colspan="2">A lot of effort is currently focused on the design of degradable vinyl polymers to produce eco-friendly materials or materials suitable for biomedical applications. Herein, we present our recent advances in radical ring-opening polymerization (rROP) of cyclic ketene acetals (CKAs) and in particular:
(i) the discovery of a new copolymerization system that enables the synthesis of well-defined vinyl copolymers exhibiting a rapid hydrolytic degradation in water or PBS, faster than that of PLA andeven PLGA, together with a tuneable upper critical solution temperature;
(ii) a simple two-step polymerization process based on polymerization-induced self-assembly (PISA) able to generate aqueous suspensions of CKA-containing vinyl copolymer nanoparticles;
(iii) the use of thionolactones to generate degradable thioester-containing polymer particles by aqueous PISA in one step.</td></tr>
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Day:3- 12:00:12:30	**Professor Eric Appel - Stanford University ARTS CENTRE THEATRE**
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Day:3- 12:30:12:45	**Professor Aydan Dag - Bezmialem Vakif University ARTS CENTRE THEATRE**
Multifunctional Phototherapeutic Nanocarrier System for Combination Therapy of Melanoma	
Skin cancer is one of the most common cancers worldwide. In this study, nanocarrier systems were constructed which were condensed from sugar, peptide monomers and protoporphyrin IX (PIX). Nanoformulations were obtained by Paclitaxel (PTX) encapsulation followed by miR-21i integration. The developed delivery system has desirable combination therapeutic efficacy for PTX/miR-21i as well as intracytoplasmic release properties derived from its sequential degradation triggered by the pH microenvironment in tumour cells. Moreover, PIX can mediate PDT accompanied by the ROS generation upon light irradiation, which accelerates the degradation of the carrier as well as the release of cargoes while decreasing the anti-apoptotic resistance of cancer cells. In vitro results showed that the phototherapeutic carrier system exhibited excellent synergistic therapeutic efficacy against melanoma. This platform may be a promising drug/gene codelivery for the treatment of various cancers.	

Day:3- 11:00:11:30	**Associate Professor Derya Baran - KAUST ARTS CENTRE WOODS SCAWEN**
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Day:3- 11:30:12:00	**Professor Natalie Stingelin - Georgia Institute of Technology ARTS CENTRE WOODS SCAWEN**
Cool plastics for energy sustainability	
With seabirds trapped in multipack drink rings, and mid-ocean islands of indestructible rubbish, the idea that plastics could play a big part in a sustainable future world might seem far-fetched. However, new smart plastics may yet rescue the reputation of this all-consuming 20th century material. Research into 'cool plastics' for cars and buildings could reduce the need for air conditioning and, thus, improve their energy efficiency. We will present recent efforts to design plastics of desired optical functions targeted for a greener world. We will discuss the potential of such systems that can offer the same flexibility, softness and light weight as commodity plastics but can control the flow of light and heat therefore assisting energy management in buildings and greenhouses in the form of heat mirrors, photovoltaic applications when used as anti-reflection coatings and semi-transparent mirrors, as well as building blocks for novel optical structures that can lead to quantum devices	

Day:3- 12:00:12:15	**Assistant Professor Joshua Tropp - Texas Tech University ARTS CENTRE WOODS SCAWEN**
Standardizing the Characterization of Conductive Hydrogels	
Conductive hydrogels are promising materials with mixed ionic-electronic conduction to interface living tissue (ionic signal transmission) with medical devices (electronic signal transmission). The hydrogel form factor also uniquely bridges the wet/soft biological environment with the dry/hard environment of electronics; these unique polymeric composites have been designed for biosensing, tissue engineering, soft actuation, energy storage, brain-machine interfacing, e-skin, and many other contemporary applications. Here, we will discuss the distinct challenges of characterizing the structure and electrochemical properties of conductive hydrogels. Addressing the need for standardized characterization methods, we explore the implications of accurate property assessment and suggest protocols to enhance reproducibility toward comparing different materials across the literature.	

Day:3- 12:15:12:30	**Professor Mohammed Al-Hashimi - Texas A&M University at Qatar ARTS CENTRE WOODS SCAWEN**

Thiazole Ladder Polymers for Plastic Electronics and Organic Solar Cells

Plastic electronics has made great commercial and scientific progress over the past decade, predominantly driven by the potential of applications such as field effect transistors for flexible backplanes and e-paper, and solar cells for large area energy generation. ID TechEx, the UK-based market research company, "estimated that over the last two decades global investments into plastic electronics technologies has exceed $10 billion US. The field of π-conjugated organic semiconductors has significantly advanced over the past decade due to the extensive research that has been carried out for the fabrication of cost-effective, large-area, and flexible printed plastic electronics. Amongst the conjugated polymers, alternating donor-acceptor (D-A) units are widely utilized in the fabrication of organic photovoltaics (OPVs), and organic field-effect transistors (OFETs). With specific modifications of the D-A moieties, one can progressively tune the energy levels and absorption properties as

Day:3- 12:30:12:45	**Dr Megan Westwood - University College London ARTS CENTRE WOODS SCAWEN**

Understanding hydrogen bonding interactions in conjugated polymers for self-healing electronics

As electronic devices become increasingly integrated in our lives, the progression from portable to wearable devices is inevitable and could offer advanced healthcare diagnostics in future generations. Aiming to mimic human skin, these new materials must be flexible and have the ability to heal in response to stress without compromising their properties. Minimizing disruption to the microstructure of π-conjugated polymers is crucial to optimizing their electronic properties which could be achieved through intrinsic self-healing. Functionalizing with supramolecular moieties allows the polymer matrix to be continuously restored via strong, dynamic interactions after damage. Herein we present the synthesis of a novel co-polymer series with tethered H-bonding groups. We present insight into how the mechanism of self-healing operates in these complex materials and how general design rules can allow development of the charge transport properties for efficient self-healing.

Day:3- 01:30:12:00	**Dr Laurent Bouteiller - Sorbonne University ARTS CENTRE CINEMA**

Janus nanorods formed by hydrogen bonding of end-functionalized polymers for surface nanopatterning or protein binding

Janus nanorods, i.e. one-dimensional colloids that have two faces with different compositions and functionalities, are useful as building blocks for advanced functional materials. We previously described a robust and versatile strategy to form micrometer long Janus nanorods with diameters in the 10-nanometer range, by self-assembly in water of end-functionalized polymers (Nature Commun. 2020, 4760). In a first part I will describe their use as building blocks for surface nanopatterning applications. The second part will focus on their functionalization to allow selective binding of amyloid proteins.

Day:3- 11:00:11:30	**Professor Pol Besenius - Johannes Gutenberg University Mainz ARTS CENTRE CINEMA**

Supramolecular Design of Synthetic Vaccines and Injectable Biomaterials

Peptide secondary structures can be harnessed to design monomers capable of self-assembling into supramolecular polymers in aqueous media. Decorating the surface with immunogenic molecular patterns results in pathogen-mimicking entities and potential vaccine candidates. In the context of antitumor vaccines, the challenge is to overcome self-tolerance mechanisms to enforce an immune response against endogenous, tumor-associated glycopeptide motifs. To this end, a co-stimulation of B cells with Th cells is mandatory, which we aim to achieve using a co-presentation of different epitopes and immunostimulating agents at the surface of multicomponent supramolecular polymers . In this contribution I focus on our recent success using snthetic glycopeptides from the MUC1 repeat sequences.

Day:3-
12:00:12:15

Dr Mostafa Ahmadi - Johannes Gutenberg University of Mainz
ARTS CENTRE CINEMA

Enforced coordination geometry in metallo-supramolecular polymer networks

Supramolecular bonds have been introduced in synthetic materials to obtain biomimetic functions. Among them, metal–ligand coordination is unique in designing transient polymer networks. Despite the control over spatial configuration is extremely advanced in supramolecular coordination complexes, it has been rarely employed in polymer science. Addressing this gap, we graft tetraPEG with mono-, bi-, and tridentate pyridine, phenanthroline, and terpyridine, which form coordination geometries, directly correlating to macroscopic properties of the hydrogels. To enforce specific coordination geometries against the preferences of metal ions, we mix the precursors with a tetraPEG functionalized with 1,9-dimesytilene substituted phenanthroline, which is unable of homoleptic complexation but allows heteroleptic complexation with former ligands, reinforcing tri-, tetra-, and pentagonal geometries, the comply of metal ions with the requirements of which is studied on micro- and macroscale.

Day:3-
12:15:12:30

Assistant Professor Zehuan Huang - Peking University
ARTS CENTRE CINEMA

Slow means strong: Highly compressible glass-like supramolecular polymer networks

Supramolecular polymer networks are non-covalently crosslinked soft materials that exhibit unique mechanical features such as self-healing, high toughness, and stretchability. Previous studies have focused on optimizing such properties using fast-dissociative crosslinks. Herein, we describe non-covalent crosslinkers with slow, tuneable dissociation kinetics that enable high compressibility to supramolecular polymer networks. The resultant glass-like supramolecular networks have compressive strengths up to 100 MPa with no fracture, even when compressed at 93% strain over 12 cycles of compression and relaxation. Retarding the dissociation kinetics of non-covalent crosslinks enables access of such glass-like supramolecular materials, holding substantial promise in applications including soft robotics, tissue engineering and wearable bioelectronics.

Reference:
[1] Z. Huang et al. Nat. Mater. 2022, 21, 103.
[2] Z. Huang et al. J. Am. Chem. Soc. 2020, 142, 7356.

Day:3-
12:30:12:45

Mr Sébastien Berruée - Sorbonne Université
ARTS CENTRE CINEMA

Tuning self-assembly of hydrophilic polymers in water through an aromatic supramolecular structure directing unit (SSDU)

The self-assembly of hydrophilic polymers in water can be driven using different strategies, the most common being the introduction of hydrophobic end-groups to the polymer chain1. Previously, our team demonstrated that the incorporation of a bis-urea sticker (acting as a supramolecular structure directing unit, SSDU) into a RAFT agent can trigger homopolymer self-assembly into nanofibers, via unidirectional hydrogen-bonding2.

In this work, we incorporated an aromatic SSDU into the core of the hydrophilic polymer chains to drive their self-assembly in water. The structure-property relationship of these nano-scale assemblies were studied by a combination of cryoTEM and UV/VIS absorption spectroscopy. These techniques enabled us to identify the different types of aggregates present in the assemblies as a result of the characteristic absorption bands observed.

(1) Zhang, J. et al. Chem. Commun. 2015, 51 (58), 11541–11555
(2) Mellot, G. et al. Macromolecules 2018, 51 (24), 10214–1022

Day:3- 11:00:11:30	**Professor Powel Chmielarz - Rzeszow University of Technology OC105**

Reversible deactivation radical polymerization: Outlook for eco-friendly synthesis of functional materials

The lecture concerns the characterization and optimization of ATRP methods aimed at obtaining polymers of various structures and architectures. A crucial aspect was the development of new concepts controlled by external reducing agents, involving reduced catalyst loading through electrochemical methods (eATRP) or polymerization without the need for a catalytic complex (metal-free ATRP). A breakthrough includes a significantly simplified procedure for synthesizing polymer brushes using microliter volumes of the reaction mixture. Additionally, modifications can be carried out directly on the laboratory bench without the need for an anaerobic atmosphere. The novelty of the work involves not only the use of an environmentally friendly solvent (water) but also ATRP controlled by both external (blue light) and internal factors. The entire series of works serves as a guide, inspired by the principles of "green chemistry," for the synthesis of materials with desired properties.

Day:3- 11:30:12:00	**Professor Adrian Figg - Virginia Tech OC105**

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Day:3- 12:00:12:30	**Ms Maria Nefeli Antonopoulou - ETH Zurich OC105**

Acid-Triggered Radical Polymerization of Vinyl Monomers

Reversible addition-fragmentation chain-transfer (RAFT) polymerization is one of the most versatile and robust controlled radical polymerization methods owing to its broad material scope and high tolerance to various functionalities and impurities. However, to operate RAFT polymerization, a constant supply of radicals is required, typically via exogenous thermal radical initiators which are not only challenging to transport and store, but also primarily responsible for termination and end-group heterogeneity. Herein, we present an acid-triggered RAFT polymerization which operates in the dark and without any conventional radical initiator. The dual role of highly abundant acids is to initiate, and also to accelerate the polymerization was uncovered, yielding polymers with low dispersity and high end-group fidelity. The method could also be applied to the synthesis of well-controlled high molecular weight block copolymers as well as to free radical polymerization.

Day:3- 12:15:12:30	**Dr Petra Utroša - National Institute of Chemistry OC105**

Synthetic polypeptides prepared by photoinduced ring-opening polymerization of N-carboxyanhydrides

Light is an attractive trigger for polymerization because it can be controlled temporally and spatially, and photoinduced polymerization has become an important technology for additive manufacturing of polymers. Ring-opening polymerization (ROP) of N-carboxyanhydrides (NCAs) provides a modular platform for the preparation of synthetic polypeptides that have great potential for biomedical applications. Light can be used for the photocrosslinking of polypeptides by post-polymerization modification of the polypeptide with photoresponsive groups [1]. Alternatively, photolatent amines open up possibilities for photoinduced ROP of NCAs. In this work, we focused on inducing ROP by using photocaged amines that release basic catalysts upon illumination. We investigated the polymerization of γ-benzyl-L-glutamate NCA triggered by the photoreleased catalysts and shed the light on photochemistry of NCAs.

[1] P. Utroša, D. Pahovnik, et al. Macromolecules 2022, 55, 5892.

Day:3-
12:30:12:45

Associate Professor Khalid Ferji - Lorraine university
OC105

Artificial Intelligence Uncovering Phase Diagram Insights in Polymerization-Induced Self-Assembly

Polymerization-Induced Self-Assembly (PISA) enables versatile nanostructure formation, but predicting resulting morphologies remains challenging.

Leveraging Artificial Intelligence (AI), we investigate the impact of hydrophilic block size on PISA morphology within a well-known system.

Utilizing supervised machine learning (ML) and deep neural networks, we train models on datasets from the literature to predict phase diagrams for a broad range of hydrophilic block sizes.

Initial experiments validate the accuracy of our predictions.

Our research demonstrates AI's potential in unraveling complex PISA dynamics, promising significant advancements in this field.

Day:3-
11:00:11:30

Professor Michael Shaver - University of Manchester
OC003

There Is No Silver Bullet: Depolymerisation, Mechanical Recycling and Policy Pressure for a Sustainable Future

The complexity of polymers and the diversity of their application make circularity very hard. We have presumed that there is a single solution - a panacea - to solve this challenge, but indeed a family of polymer science interventions are needed to make a sustainable system. This talk will explore some of our work on developing complementary solutions, including (a) efforts to integrate and align complex plastics policy at the local, national and international level; (b) improve mechanical recycling by quantifying and qualifying recyclate; and (c) working with complex multi-materials to develop circular economies, such as our recent work creating the world's first circular Mastercard.

Day:3-
11:30:12:00

Professor Michael Meier - Karlsruhe Institute of Technology (KIT)
OC003

New cellulose chemistry from a sustainability perspective: renewability is not enough

In order to develop truly 'green' polymeric materials, using renewable resources is insufficient. The renewable feedstocks rather have to be used in a sustainable fashion by combining as many of the principles of green chemistry as possible. Applying quantitative methods of sustainability evaluation are further necessary to compare and select the most sustainable approaches.

Within this contribution, the focus will be on new approaches for the synthesis of polymeric materials from cellulose, an abundant renewable feedstock that does not compete with food or feed. Sustainable functionalization strategies of cellulose, including new solubilization and catalysis concepts as well as the use of multicomponent reactions, will be introduced. Synthesis concepts, sustainability aspects and material properties will be discussed.

Day:3-
12:00:12:30

Professor Steve Howdle - University of Nottingham
OC003

Sustainable, Clean, Green and other Coloured Polymers

We describe the development of new polymers that are designed to deliver functionality but where possible are derived from renewable resources and are degradable. Applications include new Polymer Liquid Formulations (PLFs) that are now demanded by the personal care and home care industries that are required to be renewable (to lower carbon footprints) and degradable (to avoid potential bioaccumulation). In all cases these are prepared with sustainable chemical approaches.

We also describe a new approach to 3-D printing via laser sintering (SLS). Here we are developing new approaches to deliver functionality to the existing commercial process by introducing a thin functional coating to the base polymeric particles. This will be illustrated by demonstrating a range of colours and functionalities that can introduced very effectively using supercritical carbon dioxide processing.

Day:3- 11:10:11:40	**Dr Antonella Esposito - Universit√© de Rouen Normandie ARTS CENTRE STUDIO**

Microstructural consequences of isothermal crystallization in homo- and co-polyesters based on 2, 5- and 2, 4-furandicarboxylic acid (Andrew Keller Award)

Different position isomers of furandicarboxylic acid (FDCA) can be obtained from the biomass by a Henkel disproportionation reaction. 2,5- and 2,4-FDCA are obtained in amounts that are large enough to be used for the synthesis of polyethylene furanoate (PEF). The homopolyesters obtained with ethylene glycol (EG) and either 2,5- or 2,4-FDCA have a completely different crystallization behavior, for 2,5-PEF can crystallize whereas 2,4-PEF cannot, even after very long annealing times. The synthesis of random copolyesters with EG and different ratios of 2,5/2,4-FDCA may therefore allow to tune PEF crystallization ability. The partial replacement of 2,5-FDCA by its position isomer could help disrupting crystallinity analogously to what happens when EG is partially replaced by cyclohexane dimethanol (CHDM) in glycol-modified polyethylene terephthalate (PETg).

This work investigates the thermal behavior of the homopolyester 2,5-PEF and the microstructural consequences of copolymerization (replacement of small amounts of 2,5-FDCA with 2,4-FDCA). Crystallization is performed in isothermal conditions after cooling down from the molten state, and investigated with both conventional DSC and Fast Scanning Calorimetry (FSC). When the amount of 2,4-FDCA-based repeating units is low (10 and 15 mol %), crystallization still occurs but with an increased induction time. Neither the crystalline nor the rigid amorphous fractions are significantly affected by copolymerization. Due to multiple and complex microstructural reorganizations observed at relatively slow heating rates, conventional DSC is inaccurate and does not provide a reliable microstructural depiction of these polyesters. The use of FSC is recommended, for it allows to obtain a better characterization of the quality and thermal stability of the formed crystals.

Day:3- 11:40:12:10	**Dr Anna Liguori - University of Bologna ARTS CENTRE STUDIO**

Unexpected self-assembly of carbon dots during digital light processing 3D printing of vanillin Schiff-base resin

Bio-based and recyclable composite thermosets were obtained through digital light processing (DLP) 3D printing

by dispersing cellulose-derived carbon dots (CDs) in a photocurable vanillin Schiff-base resin. The exposure of

CDs to DLP induced a partial reduction of the oxygen functionalities and a self-assembly of CDs into micrometric

fibers embedded in the thermoset matrix. A comparison with the vanillin Schiff-base thermoset, illustrated lower

transition temperature from the glassy to the rubbery state and inferior shape memory properties for the CD

containing thermoset. This is ascribed to a lower crosslinking density due to the replacement of the covalent

interactions of the thermosets with supramolecular interactions generated inside the microfibers and between the microfibers and the surrounding matrix. This can also explain the inferior mechanical rigidity of the composites with respect to the single component thermosets. However, the supramolecular interactions endow the composites with better mechanical and chemical recyclability with an almost complete preservation of the original mechanical properties.

Day:3- 12:10:12:40	**Dr Maria Cristina Righetti - National Research Council of Italy (CNR) ARTS CENTRE STUDIO**

Coexistence of two lamellar populations in poly(ethylene vanillate) reorganized upon heating

The structural evolution of poly(ethylene vanillate) (PEV) crystals, after isothermal crystallization at Tc = 180 ,ó¶C, was explored by synchrotron wide-angle and small-angle X-ray scattering (WAXS and SAXS) measurements. The WAXS/SAXS analyses proved that an additional more perfect crystal population starts to grow exactly in correspondence of the exotherm displayed by the specific heat capacity curve. The study ascertained that two different reorganization/recrystallization mechanisms occur upon heating: the more perfect crystals originate from a recrystallization process, whereas the original crystals undergo small and progressive perfection maybe without previous complete fusion. Deconvolution of the double Lorentz-corrected SAXS profiles was performed to calculate the temperature evolution of the lamellar thickness for the original and additional crystal populations. The two crystal populations appear to differ substantially in the temperature evolution of the lamellar and amorphous thicknesses. Hypotheses on the relative location of the two different crystal stacks as well as on the possible thermodynamic reason that triggers the formation of the more perfect crystal population have been formulated.

Day:3- 11:00:11:30	**Dr Marianne Stol - Kraton OC002**

KRATON POLYMERS: FROM POLYMER DESIGN TO APPLICATION

The emergence of anionic, living polymerization in the 1950s enabled the synthesis of polymers with controlled structures. A result of controlled molecular architecture was the distinct phase separation and self-assembling morphologies of polymers containing discrete blocks. The self-reinforcing nature of such styrenic block copolymers was recognized for its broad commercial potential as a new class of polymers; styrenic thermoplastic elastomers (TPE-S).

Today, the annual global consumption is significant. Applications as diverse as roads we drive on, cars in which we drive, daily personal care products we use, and cosmetics we apply are all enhanced by the properties of TPE-S. New TPE-S continue to be developed. This presentation will show the versatility of S, Bd and Ip combined in block copolymer architectures which leads to an array of different applications, all based on the self-assembly of these materials. Some of these applications will be highlighted.

Day:3- 11:30:11:45	**Dr Silvio Curia - MedinCell SA OC002**

BEPO®: A BIORESORBABLE POLYMERIC IN SITU FORMING DEPOT FOR THE TUNABLE SUSTAINED RELEASE OF ACTIVE PHARMACEUTICAL INGREDIENTS

MedinCell is a commercial-stage pharmaceutical company developing long-acting injectables (LAIs) for the sustained release of active pharmaceutical ingredients (APIs) using its proprietary technology, BEPO®. BEPO® is composed of a blend of PEG-PLA copolymers dissolved in a biocompatible solvent, together with an API, yielding injectable solutions or suspensions. Upon injection into the subcutaneous tissue, the solvent diffuses out allowing for the precipitation of the copolymers: this results in the formation of a depot that entraps the API. The drug release is then driven by diffusion and polymer degradation.

Here, an overview of the potential of BEPO® to sustain the release of APIs from days to months will be shown. Then, the focus will be on the results from in vitro and in vivo degradation studies.

Overall, our results illustrate that the kinetics of bioresorption can be precisely tuned, offering the potential of designing LAIs with distinctive durations of action.

Day:3- 11:45:12:00	**Dr Paul Hunt - Croda Europe Ltd OC002**

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Polymers in Liquid Formulations (PLFs) are a broad group of polymers that are used as rheology modifiers, emulsifiers and binders in many day-to-day items including household detergents, cosmetics and agrochemicals. The vast majority of these polymers are derived from fossil fuel sources and they do not degrade in the environment. Despite their importance to society and the global economy, and in contrast to the intense recent focus on the sustainability of plastics, there has been very little coordinated effort to address the sustainability of PLFs. There is a clear requirement and demand to make these vital ingredients more environmentally friendly; could they be developed from renewable resources and could they be biodegradable after their use?

In this presentation we will discuss approaches Croda are taking in the development of commercially viable novel biobased and biodegradable polymers which may be an alternative to traditional PLFs such as polyacrylates. The presentation will address questions regarding performance characterization, and we would also like to share a view on the biodegradation testing methodology versus proof of persistence versus stability in formulation, an important balance to achieve when developing sustainable polymers for the future.

Day:3- 12:00:12:15	**Dr Steph Edwards - Unilever OC002**

SweatSENSE: Development and validation of a novel polymeric ink based sweat sensor

TBC

Day:3- 12:15:12:30	**Dr Mary Jones - Ferring Controlled Therapeutics OC002**

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Day:3- 11:30:12:00	**Dr Edgar Wong - University of New South Wales** **OC004**

Smart Enzyme-Responsive Antimicrobial Dendrons: Towards Overcoming the Selectivity Issues of Membrane-Active Antimicrobials

Antimicrobial resistance is one of the most urgent health threats the world is facing. In this context, a large number of non-antibiotic antimicrobials have been investigated, including synthetic cationic amphipathic macromolecules. Despite the promising activity of this class of compounds, most cause toxicity and fail to progress in clinical trials because of their non-selective binding toward mammalian cells. To overcome this low selectivity issue, our group have been recently developing novel smart antibacterial prodrug compounds where the culpable cationic amino groups could be precisely uncaged/unmasked under specific stimuli (e.g., light and enzyme) to confer antimicrobial activity. Specifically in this talk, smart compounds that are responsive toward beta-galactosidase and beta-lactamase enzymes will be revealed. It is with the hope that such approach will encourage further development of next generation smart antimicrobial agents.

Day:3- 12:00:12:15	**Dr Anna Constantinou - Imperial College London** **OC004**

Introducing a New Family of Biodegradable Antibacterial Polymers: A Structure-Activity Study

Antimicrobial resistance (AMR) is a major threat to human health, with AMR-related infections estimated to be the leading cause of death by 2050. Antibacterial polymers are great candidates for tackling AMR to balance the complete lack of new antibiotic discoveries since the 1980s. Here, we present a new family of biodegradable antibacterial polymers, synthesised by step-growth polymerisation, incorporating tertiary amines bearing pendant alkyl side chains. We investigated the antibacterial properties of these polymers against; E. coli, P. aeruginosa, K. pneumoniae, and S. aureus, tuning their antibacterial efficacy with the polymer's hydrophobicity whilst preserving their biocompatibility with mammalian cells - distinguishing them from other well established polycationic antimicrobials. These findings are promising for developing new antimicrobial platforms to facilitate a reduction in the prevalent use of antibiotics, decreasing AMR and thereby preserving their longevity.

Day:3- 12:15:12:30	**Ms Sidra Kanwal - Freie Universität Berlin** **OC004**

Sulfonium-Based Polymers for Antimicrobial Use: Influence of Structure and Composition

Antimicrobial polymers (AMPs) disrupt bacterial cell membranes through cationic and hydrophobic moieties, offering an alternative to conventional antibiotics. While quaternary ammonium salts (QAS) are extensively studied, sulfonium cations are currently explored to widen polymeric therapeutic options. Here, we investigate different factors influencing antimicrobial activity in side-chain sulfonium-based AMPs. For this, we combine sulfonium cations with different hydrophilic and hydrophobic groups to create a polymer library. Additionally, we examine the position of cationic and hydrophobic groups on the polymer backbone, i.e., same center (SC) and different center (DC) structures. MIC values indicate following trends: 1) increased hydrophobicity enhances bacterial growth inhibition but reduces selectivity over human cells 2) SC polymers were more effective but less selective than DC polymers 3) In comparison, sulfonium AMPs show superior bactericidal activity than their QAC analogues.

Day:3- 12:30:12:45	**Mr Alexandre Pistol - CEA** **OC004**

Synthesis, grafting and in vitro study of polyionenes, toward a comprehension of the antibacterial mechanism

Our research revolves around mitigating bacterial growth. Our focus is on antimicrobial peptide-like polymers, denoted as polyionenes. We engineered novel variants of polyionenes, and we determined their minimal inhibitory concentration (MIC) on E. coli and S. aureus, and their cytotoxic threshold on murine fibroblasts. We observed that our polyionene polymers exhibited competitiveness with the literature, regarding the MIC values and cytotoxicity profiles. Furthermore, we unveiled that our polyionene, with a simple chemical modification, can either be non- or very specific against our two Gram+ and Gram- strains. Beyond this investigation, we conducted shotgun proteomics experiments to investigate the protein response of E. coli to our polyionene. We identified the proteins that were the most over- or under-expressed. Moreover, we exhibited a constant down regulation of stress response proteins, which indicates that the bacteria lowers its defenses while exposed to polyionene.

Day:3- 11:00:11:30	**Dr Lee Fielding - The University of Manchester OC104**

Stimuli-responsive soft materials from polymerisation-induced self-assembly derived nanoparticles

Nanomaterial containing self-assembled hydrogels formed from self-assembled block copolymer worm-like micelles can be readily prepared through in situ RAFT polymerization or by utilizing temperature dependent copolymer morphology transitions. Depending on the copolymer/nanomaterial combination, the prepared materials can be 3D printable, thermo-responsive, self-healing, electrically conductive, magnetic or adhesive. The nanomaterial type, morphology and concentration, and co-polymer concentration dramatically affect the properties of the nanocomposite gels, and a combination of analytical techniques are used to examine their properties. The unique properties afforded by these gels grants them the potential to be useful as functional materials in temperature responsive information protection, as injectable biomaterials, and as sensors.

Day:3- 11:30:12:00	**Dr Colin Bonduelle - LCPO-CNRS, University Of Bordeaux OC104**

From natural proteins to polymer synthesis by aqueous ring-opening polymerization

Proteins are natural building blocks that have many features still unrivaled by their synthetic counterparts, including chemical diversity, hierarchical structure, etc. Compared to proteins, peptidic polymers are much simpler macromolecules in which amino acids are statistically repeated. However, those polypeptides combine advantageous features of synthetic polymers (solubility, process, rubber elasticity, etc.) with those of natural proteins (secondary structure, functionality, biocompatibility, etc.). The most efficient route to polypeptides is a chemical methodology: the ring-opening polymerization (ROP) of amino acid N-carboxyanhydride (NCA) monomers. This talk will illustrate how aqueous ROP of NCA monomers opens new perspectives in the field to build polymers with unprecedented self-assembly behavior, hysteretic thermoresponsiveness and/or stimuli-responsive fluorescence.

Day:3- 12:00:12:15	**None Floriane ISSELIN - Institut des Molécules et Matériaux du Mans OC104**

Aqueous RAFT-PISA Synthesis of Multi-Clickable Polymer Nanoparticles

Polymerization induced self-assembly (PISA) provides a route to aqueous dispersion of polymer nanoparticles through the in-situ self-assembly of amphiphilic block copolymers. PISA combined to reversible addition-fragmentation chain transfer (RAFT) polymerization in water allows the synthesis of polymer nanoparticles with a tunable chain-end hydrophilic shell depending on the starting RAFT agent.

In the present work, the synthesis of multi-clickable polymers nanoparticles with a cationic core and a poly(ethylene glycol) shell with clickable chain-ends is achieved via aqueous RAFT-PISA using a dispersion process. Peptides conjugation onto the multi-clickable handles anchored at the surface of the polymer nanoparticles will give access to multi-targeting cationic therapeutic carriers.

Floriane ISSELIN, Sagrario PASCUAL, Sandie PIOGE, Laurent FONTAINE

<table>
<tr><td>**Day:3-**
12:15:12:30</td><td>**Eleonora Hochreiner - Utrecht University**
OC104</td></tr>
<tr><td colspan="2">Designer drug delivery vehicles via polymerization-induced self-assembly (PISA)</td></tr>
<tr><td colspan="2">Polymerization-induced self-assembly (PISA) has proven to be a versatile route towards high concentrations of micellar nanostructures with tunable chemistries and morphologies. In contrast to conventional self-assembly protocols, where the synthesis and assembly of the block copolymer building blocks are performed in two separate, consecutive steps, PISA relies on a one-pot procedure where block copolymer formation and assembly occur simultaneously. While this is highly appealing for the field of drug delivery, the influence of the formation pathway on the physical chemical properties (such as the shape), drug loading, and stability in complex biological media are not well understood. With our study we aim to fill this knowledge gap and ultimately formulate pathway-structure-performance relations towards highly efficient drug delivery micelles.</td></tr>
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<tr><td>**Day:3-**
12:30:12:45</td><td>**Dr Andrea Belluati - Technische Universität Darmstadt**
OC104</td></tr>
<tr><td colspan="2">Life, synthetic: biocatalytic polymerisation-induced self-assembly for artificial cells</td></tr>
<tr><td colspan="2">Artificial cells, as biomimetic microstructures, replicate natural cell functions, playing a crucial role in synthetic biology. We developed polymer-based artificial cells capable of protein expression, synthesized using biocatalytic atom transfer radical polymerization-induced self-assembly (bioPISA), where myoglobin aids in creating amphiphilic block copolymers that form giant unilamellar vesicles. These GUVs can encapsulate various cargos, including enzymes and plasmids. Remarkably, they can express proteins, when provided with the building blocks: both enzymes and cytoskeleton components could be produced. Therefore, GUVs produced via bioPISA can emulate self-synthesizing bacteria. Additionally, they can be designed with can be further equipped with internal compartments in sequential reactions, imitating the eukaryotic cell subdivisions.</td></tr>
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<tr><td>**Day:3-**
11:00:11:30</td><td>**Dr Konstantinos Ntetsikas - Physical Science and Engineering Division, KAUST Catalysis Center, King Abdullah University of Science and Technology (KAUST), Saudi Arabia**
OC106</td></tr>
<tr><td colspan="2">Designing Macromolecules on Silica Nanoparticle Surfaces</td></tr>
<tr><td colspan="2">Grafting nonpolar polymer chains onto the surface of polar nanoparticles (e.g., silica) is an effective way to enhance particle/matrix interactions and thus promote their homogeneous dispersion within a nonpolar matrix, leading to improved mechanical properties. In this work, we performed anionic polymerization high vacuum techniques to synthesize œâ-triethoxysilyl polystyrene (PS-TEOS), polystyrene-b-polyisoprene (PS-b-PI-TEOS) and miktoarm star [(PS)2PS-TEOS, (PS)2PI-TEOS and (PS)2PI-b-PS-TEOS)] macromonomers followed by hydrolysis/condensation, leading to the in-situ formation of grafted (grafting through) silica nanoparticles (NPs).1,2 The molecular characteristics of the precursors (polymer-TEOS) were determined by 1H NMR, SEC, and MALDI-ToF mass spectroscopy, and the formation of polymer@SiO2 NPs by FT-IR, 29Si solid-state NMR, TEM, TGA, DLS, and STEM-EDX mapping. The role of polymer@SiO2 NPs on the mechanical properties and morphological features of matrices (PS or PS-b-PI-b-PS) was investigated by tensile testing and scanning electron microscopy (SEM). The proposed general method controls the molecular weight, chemical composition, particle size, and grafting density of nanoparticles and effectively improves the mechanical characteristics of the nanocomposites.</td></tr>
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<tr><td>**Day:3-**
11:30:11:45</td><td>**Dr Jean-Christophe Daigle - Hydro-Québec**
OC106</td></tr>
<tr><td colspan="2">Improving Next Generation of Lithium Batteries Using Polymer Chemistry</td></tr>
<tr><td colspan="2">One of the most promising approaches for limiting climate change is the use of alternative and greener sources of energy (wind, solar, etc.). It is therefore imperative that a Li-ion battery with high energy density and longer life cycle be developed. One of the major challenges faced in this pursuit was gas evolution</td></tr>
</table>

during cycling. To combat liquid electrolyte degradation due to M2+ dissolution in LMFP, we integrated a polymer for scavenging ions as a binder in the cathode preparation, which effectively decreased the degradation during cycling. Although these new materials reduce gas evolution, they do not eliminate it. Therefore, we developed a polymer coating capable of trapping the carbon dioxide, major component of gases generated during cycling and, in turn, preventing pouch cell inflation. Also, we scrutinized polymers as electrolytes. The aim of this program was exploring polymers, especially single-ion polymers, as alternative to the classical PEO-based electrolytes.

Day:3-
11:45:12:00

Dr Kostas Parkatzidis - Stanford University
OC106

Photocatalytic Depolymerization of Polymers Made via Reversible Reactivation Radical Polymerization

Depolymerization of polymers synthesized by reversible-addition fragmentation radical polymerization enables the regeneration of virgin-quality raw materials which can be subsequently subjected to an unlimited number of re-polymerization/recycling cycles. Present chemical recycling strategies typically operate under extreme dilute conditions, require high temperatures and catalyst loadings, and do not allow for temporal regulation over depolymerization. Herein, we propose a catalytic photothermal ATRP depolymerization that significantly suppresses the reaction temperature from 170 to 100 °C while enabling temporal regulation. Specifically, in the presence of low ppm catalyst concentrations, the depolymerization during the dark periods could be completely eliminated, thus allowing to modulate the rate by simply turning the light “on” and “off”. Notably, our approach could be carried out at high polymer loadings (up to 2M), and near-quantitative yields could reached.

Day:3-
12:00:12:15

Ms Ras Abasi - Queen's University
OC106

Crosslinking CO2-Switchable Polymers for Paints and Coatings Applications

Industry's response to the harmful emissions of volatile organic compounds (VOCs) from solvent-based paints is a shift toward environmentally friendly alternatives. Despite advancements in water-based formulations, solvent-based coatings still outperform them in many high-performance applications. We have previously demonstrated the potential of CO2-switchable polymers for achieving aqueous zero-VOC formulations with a film formation process similar to solvent-based coatings. This technology combines environmental friendliness with high performance. The focus of this study is on enhancing solvent resistance of the coating through a 1K CO2-switchable crosslinking reaction. Possible reactions were initially investigated using model compounds that are small molecule analogs of the polymer and crosslinking agent structures, and assessing their reactivity in the presence and absence of CO2. The coating formulation was then evaluated in terms of stability and crosslinked coating performance.

Day:3-
11:00:11:30

Professor THEODORA KRASIA - UNIVERSITY OF CYPRUS
OC109

Electrospun nanocomposites fibers with potential use in optoelectronics

The design and development of functional polymer-based nanocomposites attracts significant attention nowadays owned to their unique properties, deriving from the combination of polymers with nanostructured materials of either organic or inorganic origin.

Electrospinning – which has already reached the industrial sector – is one of the most powerful and versatile fabrication methods used in the production of nanocomposite materials in the form of micro- and nanofibers [1]. Such fibrous nanocomposites are highly attractive in biomedical [2], environmental [3], sensing [4] and catalytic applications [5], owned to their unique properties including high surface to volume ratios, high porosity and multifunctionality.

This presentation provides an overview of our recent research activities on the fabrication of electrospun fibrous nanocomposites consisting of various polymer types (i.e. insulating polymers, polyelectrolytes and semiconducting polymers) combined with organic-inorganic lead halide perovskite nanocrystals [6], all-inorganic lead halide perovskite quantum dots [7] and luminescent graphene quantum dots. Information on their chemical and morphological characterization is provided and the effect of the nanostructured additives on the materials' mechanical performance and optoelectronic properties is presented and discussed.

Day:3-
11:30:12:00

Professor Youhua Tao - Changchun Institute of Applied Chemistry, Chinese Academy of Sciences
OC109

None

None

Day:3-
12:00:12:30

Professor Tae-Lim Choi - ETH Zurich
OC109

Universal Suzuki catalyst-transfer polymerization for precision synthesis of donor/acceptor conjugated polymers

We report a highly efficient Suzuki–Miyaura catalyst-transfer polycondensation (SCTP) of various arene monomers including 3,4-propylenedioxythiophene (ProDOT), 3-alkylthiophene (3AT), benzotriazole (BTz), and quinoxaline (QX) using bench-stable but highly active Buchwald dialkylbiarylphospine Pd G3 precatalysts and N-methylimidodiacetic (MIDA)-boronate monomers. This more stable boronates increased the life-time of the monomers by slowing down protodeborylation, and at the same time, the polymerization rates were increased by highly active Buchwald Pd precatalysts. This catalyst sytems can promote controlled polymerizations regardless of electronic natures of the arene from strong donor to strong acceptor-type monomers. We can further expand the monomer scope beyond homopolymerization to include controlled polymerization of donor-accpetor A,B-alternating conjugated copolymers. Lastly, block copolymers with several combination was also presented here.

Day:3-
12:15:12:30

Mr Nathan (Sung Yuan) Hsu - University of Toronto
OC109

Direct arylation polymerization of degradable imine-based conjugated polymers

Conjugated polymers form the cornerstone of bioelectronics, energy harvesting, and light-emitting devices due to their tunable structure-function relationships, mechanical flexibility, and biocompatibility. Although significant strides have been made to improve their optoelectronic performance, there have been limited investigations to endow them with degradability. Imine-based conjugated polymers are degradable by acid hydrolysis and maintain competitive electronic performance. However, current imine-based conjugated polymers are synthesized by imine polycondensation or Stille cross-coupling polymerization, which can require synthetic steps, and the latter involves toxic tin reagents. Direct arylation polymerization (DArP) is a more atom-efficient and benign polymerization alternative. This presentation will discuss the synthesis of a degradable imine-based conjugated polymer via DArP. The acid degradation properties of the polymer will be discussed along with future directions.

Day:3-
12:30:12:45

Dr Lydia SOSA VARGAS - Sorbonne Université
OC109

Donor-Acceptor Polymers for High-Performance Organic Solid-State Lasers

Despite significant progress in organic light-emitting diodes (OLEDs), the development of efficient solid-state organic lasers (OLDs) remains a challenge. Conventional molecular gain materials suffer from limited wavelength coverage, stability, and efficiency. To address these limitations, we have designed novel lasing polymers composed of electron donor and acceptor moieties. We expect yhese polymers to offer improved intermolecular packing, processability, and potential for higher efficiency. In this presentation, we will discuss the synthesis, characterization, and application of these D-A copolymers in vertical-cavity surface-emitting laser (VCSEL) diode.

Day:3-
11:00:11:30

Dr Didier Gigmes - Aix-Marseille University/CNRS
FAB003

Solid Polymer Electrolytes for Lithium Metal Battery

The development of alternative transportation modes such as electric has become a key need for a sustainable long term development. Among different technologies, lithium-metal polymer battery (LMPB) is one the most attractive. Unfortunately, the use of lithium metal associated with liquid electrolyte, is the source of safety problems due to a possible irregular metallic lithium electrodeposits during the recharge. To avoid this issue, solid polymer electrolytes (SPE) were developed. However, their development has been hampered by two hurdles i/ the inability to design a SPE that exhibits both a high ionic conductivity and good mechanical properties and ii/ during battery operation, lithium ions carry only a small fraction of the overall ionic current favouring dendritic growth and limited energy density. To overcome these drawbacks, in this communication we will present our latest results on the synthesis as well as their in-depth characterization of SPE designed for LMPB.

Day:3-
11:30:12:00

Professor Mathias Destarac - Université Toulouse 3 Paul Sabatier
FAB003

Thiocarbonyl radical polymerisation for the preparation of degradable vinyl polymers

Many strategies have been developed to introduce degradable functionalities in vinyl polymers. Of these, one of the best known involves the use of radically polymerizable cyclic monomers such as cyclic ketene acetals for radical ring-opening polymerisation to form degradable in-chain ester groups. Recently, thionolactones have appeared as suitable monomers for inserting degradable thioester linkages in polymers by thiocarbonyl addition-ring opening (TARO) polymerisation. We here report the structurally simple and easy-to-make epsilon-thionocaprolactone and other unsubstituted thionolactones of different ring sizes to prepare copolymers with vinyl esters comprising both ring-opened thioesters and ring-closed thioketal linkages. An original strategy for on-demand chemical degradation of these copolymers is proposed. The reactivity of thionoglycolide and derivatives in copolymerisation is also presented, with fast and quantitative degradation of the resulting copolymers.

Day:3-
12:00:12:30

Professor Masami Kamigaito - Nagoya University
FAB003

Precision Synthesis of Degradable Vinyl Polymers by Controlled Polymerization of Designed Monomers

The synthesis of degradable polymers is one of the most important topics in chemistry as a solution to global environmental issues caused by plastic wastes. In particular, this is highly challenging for vinyl polymers, which are robust but difficult to degrade due to their stable carbon-carbon main chains. One of the effective ways is to put degradable units into the polymer chains by designing monomers as well as polymerization reactions, where degradable units containing heteroatoms (X) are incorporated in the polymer chains during copolymerization with vinyl monomers. We proposed several approaches to this purpose: (1) direct ring-opening polymerization of cyclic monomers, (2) addition ring-opening polymerization of exo-methylene monomers, (3) addition rearrangement polymerization of vinyl monomers, and (4) direct addition polymerization of C=X bonds.

As for approach (1), we prepared 7-membered cyclic thioacetal (7-CTA) and investigated living cationic copolymerization of 7-CTA and vinyl ethers via degenerative chain-transfer to the C–S bonds. 7-CTA copolymerized efficiently with various vinyl ethers by ring opening of the cyclic thioacetal bonds to result in the copolymers having thioacetal units in the main chains. Furthermore, the resulting internal thioacetal bonds serve as in-chain dormant species to allow homogeneous propagation of vinyl ethers for all internal segments to afford copolymers with controlled overall and segmental molecular weights. The obtained polymers can be degraded into low- and controlled-molecular weight distributions via hydrolysis.

Approach (4) involves direct radical copolymerization of simple thioamide derivatives with C=S bonds and common vinyl monomers such as styrenes, acrylates, acrylamides, and vinyl acetate. In particular, N-acylated thioformamides copolymerized smoothly in all cases to produce copolymers containing thioether units in the backbones. The resultant copolymers had high glass transition temperatures and were readily degradable under ambient conditions. Other approaches (2) and (3) were also available and will be discussed.

Day:3- 12:30:12:45	**Dr Vincenzo Taresco - University of Nottingham FAB003**

Glycerol-based Sustainably Sourced Resin for Volumetric Printing

Volumetric printing (VAM) represents a revolutionary advancement in the field of Additive Manufacturing, as it allows for the creation of objects in a single process, rather than in a layer-by-layer approach. A current limitation of VAM is the availability of suitable resins with the required photo-reactivity and from renewable sources. To support the application of this technology, we have developed a sustainable resin based on polyglycerol, a bioderived, colourless, and easily functionisable oligomer produced from glycerol. To transform polyglycerol into a photo-printable resin we adopted a simple and scalable synthesis. Polyglycerol-acrylate fulfils all the necessary criteria for volumetric printing and was successfully used to print a variety of models with intricate geometries. Furthermore, by incorporating dopants, we demonstrated the ability to print objects with a diverse range of functionalities, including temperature sensing probes and a biodegradable polyester excipient.

Day:3- 11:00:11:30	**Professor Elizabeth Gillies - The University of Western Ontario FAB008**

Design, Synthesis and Applications of Glyoxylate-based Self-immolative Polymers

Degradable polymers are of growing interest for many areas, including biomedical applications, smart materials and devices, and to address plastics pollution. Significant progress has been made using polysaccharides, polyesters, and a growing number of bio-based polymers. However, in some cases it is desirable to control precisely when and where polymers degrade. Self-immolative polymers are a growing class of degradable polymers that undergo end-to-end depolymerization following a stimulus-mediated backbone or end-cap cleavage. This presentation will describe the development of glyoxylate-based self-immolative polymers. The synthesis and end-capping of poly(ethyl glyoxylate) will be presented, followed by its conversion to polyglyoxylamides with different structures and properties. Self-immolative block copolymers and hydrogels will also be described. Finally, the presentation will cover examples of how these polymers can be applied in areas such as drug delivery and medical imaging.

Day:3- 11:30:12:00	**Professor Holger Frey - Johannes Gutenberg-Universität Mainz FAB008**

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Day:3- 12:00:12:30	**Professor Daniel Taton - University of Bordeaux FAB008**

Organocatalyzed Group Transfer Polymerization-Induced Self-Assembly and Stereoselective Ring-Opening Polymerization

Two distinct cases employing organic catalysts, combining both high catalytic activity or high (stereo)selectivity for polymerization reactions, will be discussed. Firstly, it will be shown how chiral aminoureas and aminothioureas can be associated in duo with an organic base to induce a cooperative and efficient ring-opening polymerization (ROP) of racemic lactide. These combinations indeed lead to high catalytic activity via an isoselective ROP process, producing metal-free, semi-crystalline polylactides, opening up new possibilities in organic catalysis for stereocontrolled polymerization. Secondly, we will show how an organic catalyst as simple as tetrabutylammonium bis-benzoate has enabled to access self-stabilized methacrylic-based polymeric nanoparticles, following a group transfer polymerization-induced self-assembly (GTPISA) pathway. GTPISA can be carried out at RT in n-heptane as a nonpolar medium, achieving stable, metal-free and sulfur-free nanoparticles of various sizes and morphologies.

Day:3-11:00:11:30
Professor Tony Ryan - The University of Sheffield
S021

Neofossils: How polymers could sequester a gigatonne of carbon dioxide a year

The value proposition is simple: use photosynthate that sucked carbon dioxide out of the atmosphere to make solid plastic, use it repeatedly, then safely curate it, e.g. as building material. The business model, consumer behaviour & policy transformations required are enormous but the reward is C-sequestration at scale. The technical challenges are to convert of 20% of nonedible biomass into biogenic petrochemical feedstock to make fossil-identical plastic, to design sustainable and functional curation routes, and generate value for plastic to be collected as captured carbon.

Day:3-11:30:12:00
Professor Hans Boerner - Humboldt-Universität zu Berlin
S021

New functionalities - New opportunities: The Thiol-catechol Connectivities (TCCs) as Key to (re)New(able) Adhesives.

Mendon

Day:3-12:00:12:15
Professor Francesca Kerton - Memorial University of Newfoundland
S021

Catalytic synthesis of polyesters and polycarbonates, and their depolymerization

In metal-free catalysis, the Kerton group has shown that arylboranes can be used as catalysts, in the presence of a suitable co-catalyst or as a pre-formed Lewis acid/base adduct, to prepare either cyclic organic carbonate or polycarbonate products from epoxides and carbon dioxide. Following on from this work, we have investigated tandem copolymerization-polymer functionalization reactions where the catalytic borane can hydrosilylate pendent olefin groups along the polycarbonate chain. These catalyst systems can also copolymerize cyclic anhydrides with epoxides including bioderived limonene-oxide, and terpene-derived anhydrides. Due to differences in reactivity between epoxides and anhydrides, block polyester-carbonates can be produced. We have also shown that the polycarbonate blocks can be depolymerized catalytically opening the door towards future repurposing and the circular economy.

Day:3-12:15:12:30
Professor Shunjie Liu - Changchun Institute of Applied Chemistry, Chinese Academy of Sciences
S021

Efficient Synthesis of CO2-Polyols

Carbon dioxide-based polyols (CO2-polyol) are emerging polyurethane precursors with economical and environmental benefits, however, the limited efficient catalytic systems restrict the sustainable development of this field owing to the poor proton tolerance for most of current catalysts. In this report, we proposed a strategy of constructing polymeric catalyst that polymerizing the active center into one polymer chain. In contrast to conventional single-site catalysts that suffer from activity loss at dilute conditions, the resulting polymeric aluminum porphyrin catalysts anchoring multiple aluminum porphyrin complexes at the side chains displayed excellent polyols selectivity (>99%) and high polymerization rate (turnover number of 50,000). Moreover, colorless CO2-polyol with ultralow molecular weight (<500 g/mol) can be obtained owing to the enhanced proton tolerance.

Day:3-12:30:12:45
Dr Arianna Brandolese - University of Birmingham
S021

Turn the tide towards sustainable polymer synthesis: development, application, and end-of-life assessment of biopolymers

In this contribution, a journey towards the preparation of sustainable polymer will be presented.

Among the readily available renewable biocompounds, fatty acids, after a preliminary conversion into the corresponding epoxides, embody a promising monomer for the ring opening copolymerization (ROCOP) along with cyclic anhydrides or with CO2.

New bio-based dicarbonate building blocks derived from β-elemene were instead employed for the preparation of new non-isocyanate based oligo-urethanes (NIPUs) using commercial and relevant diamines. A first set of trials were performed to investigate the application of these oligomeric NIPUs for coating preparation. Sustainable polymer preparation was lastly explored through step-growth polymerisation promoted by Lewis bases oganocatalysts. Unprecedently, the use of N-heterocyclic carbene catalysis was reported in the polycondensation of diols or diamines with dialdehydes under oxidative conditions for the synthesis of polyesters and polyamides.

Day:3-11:00:11:30	**Dr Matthew Derry - Aston University** **S020**

Ionic liquid-directed block copolymer self-assembly

Copolymers containing blocks with differing affinities to ionic liquids have the potential to yield a range of functional materials via both solution and bulk self-assembly. We report for the first time a polymerisation-induced self-assembly formulation in ionic liquid that yields worm ionogels for next generation responsive gel electrolytes. The in situ formation of such worm ionogel electrolyte materials via efficient and convenient synthesis routes at lower copolymer concentrations compared to many existing formulations without the need for organic co-solvents, post-polymerization processing or purification is a significant advancement. We also present a method of harnessing ionic liquids to modify bulk block copolymer self-assembly behaviour to generate a range of nanomorphologies that lend themselves to nanolithography applications.

Day:3-11:30:12:00	**Professor Jianzhong Du - Tongji University** **S020**

Fusion-Induced Particle Assembly and Intracellular Peptide Assembly

We present a new concept of fusion induced particle assembly (FIPA), which can be applied to construct a range of new higher-order nanostructures such as tetrapod polymersomes, and giant polymersomes with a latticelike membrane. Furthermore, we propose crystallization driven FIPA (CD-FIPA), which can achieve living growth of the diameter of cylindrical micelles. In addition, a new strategy for treating drug-resistant tumors will be presented based on intracellular peptide self-assembly.

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Day:2-12:00:12:15	**Dr Noushin Rajabalinia - Queen's University** **S020**

Measurement of Radical Polymerization Kinetics of Sparingly Water-Soluble Monomers in Organic and Aqueous Solvents

The properties of waterborne polymer dispersions synthesized by emulsion radical polymerization are influenced by reactions in the aqueous medium and the growing particles. In most cases models representing the process do not consider the difference in the propagation rate coefficients (kp) of monomers in water and non-polar particles. However, pulsed-laser polymerization studies have shown that solvent polarity affects both kp homopropagation values and copolymerization reactivity ratios due to monomer-monomer and monomer-solvent hydrogen-bonding. Therefore, it is vital to develop experimental procedures to measure chain-growth kinetics of sparingly water-soluble monomers under emulsion polymerization conditions. In this work we study the copolymerization of model non-functional monomers with increased water solubility with carboxylic-acid monomers to develop an improved

understanding of the aqueous-phase polymerization kinetics of commonly used monomers in emulsion polymerization.

Day:3- 12:12:12:30	**Dr Livius Muff - University of California Santa Barbara S019**
Functional Motifs for Self-reporting and Stimuli-responsive Materials	
Materials that change their color, shape, and mechanical properties in response to external stimuli, such as light, heat, electricity, or magnetic fields, have piqued the curiosity of scientists from different research areas for decades. Research on stimuli-responsive motifs, including photoswitches, mechanophores, and shape memory materials have enabled recent advances in soft robotics, drug delivery systems, and sensors. Despite progress, stimuli-responsive materials have limited commercial applications, with photochromic sunglasses being a rare example. The limited commercial success of stimuli-responsive materials stems from the complex, sensitive, inefficient, and incompatible chemistry needed for their synthesis and/or operation. We propose a new class of stimuli-responsive motifs as co-polymerizable additives for polyurethane syntheses to create commercially relevant polymers that change their appearance when subjected to mechanical forces or in response to light irradiation.	

Day:3- 11:00:11:30	**Dr Lei Tao - Tsinghua University S019**
New functional polymers by multicomponent reactions	
Traditional polymers are prepared by mono- or two-component reactions. These polymers have a single structure and their functions are mainly mechanical strength. We developed a multicomponent strategy for polymer synthesis, and prepared polymers by using different multicomponent reactions (MCRs). The obtained polymers have multicomponent main/side chains that endow polymers new functions. These studies demonstrate that MCRs are powerful tools to develop new functional polymers.	

Day:3- 11:30:12:00	**Professor Guillaume De Bo - University of Manchester S019**
-	
-	

Day:3- 12:00:12:15	**Mr Peiguan Sun - University of Washington S019**
Mechanochemical Perturbation of Bullvalene Rearrangements in Polymer Networks	
The highly dynamic behavior of bullvalene has shown many promising solution-state applications in recent reports. Few works were done to investigated bullvalene application in the solid states partially due to difficulties in the characterization of such dynamic system. In this work, we probe whether bullvalene rearrangements can be perturbed through mechanical force through incorporating bullvalene into polymer networks. We found that the resulting mechanical behavior of such material exhibits dynamic characteristics. In the meantime, most polymer mechanophores utilize either a non-reversible chemical reaction or a reversible, low barrier physical change to bring mechanoresponsive behavior to materials. This dynamic behavior of bullvalene as a mechanophores potentially bridge this gap as a “reversible” chemical mechanophore. We then further explore the use of bullvalene in creation of materials with novel mechanical and rheological properties.	

Day:3- 12:30:12:45	**Associate Professor Aurelia Charlot - Ingenierie des Materiaux Polymeres/ INSA Lyon S019**
Carboxymethyl cellulose functionalizations by green Passerini three-component reaction: towards thermosensitive hydrogels	

The use of green chemical routes to modify polysaccharides is a powerful tool for the biomass valorization. The Passerini three-component reaction (P-3CR) is particularly relevant since it allows the coupling between a carboxylic acid, an aldehyde (or a ketone), and an isocyanide to obtain a single final product. This work deals with P-3CR in water to modify carboxymethyl cellulose (CMC) to generate thermosensitive chemical and physical hydrogels. Firstly, P-3CR with different ketones reagents has been done, and CMC derivatives reactive in radical polymerization were synthesized. Their copolymerization with ethylene glycol-based monomers led to chemical hydrogels displaying thermo-induced swelling/deswelling cycle. Secondly, P-3CR was exploited to design dually functionalized grafted CMC-based copolymers bearing both hydrophobic moieties and oligomers presenting a LCST. The copolymers exhibit a thermal response ranging from a viscosifying effect to a reversible physical gelation.

Day:3- 11:00:11:30	**Assistant Professor Samuel Jones - University of Birmingham** **S018**

Broad-spectrum and biocompatible star polymer virucides

We are in a constant and ever evolving battle with viruses. Our only defence are vaccines or antivirals. Both are typically developed in response to viral outbreaks meaning that any defence we mount is reactive and not proactive. Despite the clear need for improved interventions against viruses, there is a lack of innovation, novel materials, targeted approaches and systematic studies.

In this talk I will discuss some of the approaches we have developed towards a proactive broad-spectrum antiviral response option. Typically sulfonated polymers, which have been known to have antiviral properties for over 60 years, have a reversible (virustatic) mode of action and are this medically limited. I will show that by using a star polymer architecture it is possible to access a virucidal mechanism. I will present the broad-spectrum in-vitro properties and in-vivo (murine) treatment of viral infections.

Day:3- 11:30:12:00	**Dr Paco Fernandez-Trillo - Universidade da Coruña** **S018**

New Polymers to Interface with Biology and Medicine

n this talk, I will give an overview of the research we conduct in my laboratories, where we combine supramolecular, peptide and polymer chemistry to prepare well-defined nanomaterials for biomedicine. In particular, we employ dynamic and responsive chemistries that allow us to explore biological activity (e.g. siRNA delivery, microbial behaviour) in a timely fashion and understand how our polymers and nanoparticles affect biological function. A strong focus in our laboratories is to develop materials for drug delivery, in particular polymers and particles sensitive to external stimuli, which we use for the delivery of antimicrobials or nucleic acids. To this end, we will briefly discuss our work on the enzyme responsive delivery of antimicrobials and food additives, the delivery of nucleic acids to cells and tissues or our work in developing biofilms for biotechnology.

Day:3- 12:00:12:15	**Dr Nathan Boase - Queensland University of Technology** **S018**

Polymer-membrane interactions as a target for polymeric antivirals

With new viral threats continually emerging, pathogen-specific antivirals are unlikely to remain effective. Pandemic pathogens, like SARS-CoV2 and HIV, are enveloped viruses possessing a lipid-membrane. The lipid envelope offers a promising therapeutic target that is highly conserved across viral domains. This project developed antiviral polymers to effectively target the viral membrane. A high-throughput polymerisation strategy using PET-RAFT was used to generate a library of >150 polymers (>600 batches), investigating the effect of composition, molecular weight, and batch reproducibility on antiviral efficacy, measured using a high-throughput immunoplaque assay. Analytical techniques (QCM-D, reflectometry) were used to probe lipid membranes to understand the mechanism of action of antiviral polymers and key physicochemical properties driving interactions will be discussed. The benefit of these analytical techniques to polymer nanomedicine more broadly will also be introduced.

Day:3-
12:15:12:30

Dr Anastasiia Murmiliuk - University of Milan
S018

Polyelectrolyte/protein synergism for the design of reversible pH-responsive micelles and targeted drug delivery

Co-assembly of polyelectrolytes (PE) with proteins can be used to design complexes with different morphologies, charge distribution and tunable properties for targeted delivery of a cargo. However, the complexity of protein structure limits the ability to predict and tune properties of the formed nanoparticles. Our goal is to reveal the main triggers for the morphological transition of protein/PE complexes, their encapsulation efficacy and particles stability by systematic study of complexes formed by block copolymers with proteins and ionic drugs. We showed that copolymers consisting of weak PE and neutral hydrophilic block co-assemble with proteins at pH close to protein IP and the morphology of the particles can be tuned by varying pH and nature of proteins. The formed protein/PE complexes with an excess of a charge can be used for encapsulation of an ionic drug thus allowing us to use these nanocarriers with tunable charge, stability, internal structure, and size for drug delivery.

Day:3-
12:30:12:45

Ms Francesca Portone - University of Parma
S018

Day:3-
11:00:11:30

Dr Simon Harrisson - LCPO
S013

Controlling Comonomer Distribution in Asymmetric and Gradient Copolymers

Natural polymers make use of a restricted set of monomers to fill a vast range of functions through exquisite control over the placement of each monomer in the polymer chain. In synthetic polymers, by contrast, we rely on bespoke monomers to create functionality, with restricted control over their placement. We have investigated the effect of changing the spatial distribution of comonomers in copolymers made by controlled radical polymerization. For copolymers of acrylic acid (AA) and butyl acrylate (BA), passing from a block copolymer to an asymmetric stepwise gradient while maintaining a constant overall composition leads to dramatic changes in pH-response and self-assembly behavior. Copolymers of N-isopropyl acrylamide (NIPAM) and dimethyl acrylamide (DMA), on the other hand, show thermal responses that depend on the distribution of NIPAM units within the copolymer chains. These effects demonstrate how the properties of a polymer may be tuned by rearranging its component monomers.

Day:3-
11:30:12:00

Professor Robin Hutchinson - Queen's University
S013

Scalable Routes to Block Copolymers via Cu-Mediated Reversible-Deactivation Radical Solution Polymerization

Cu-mediated polymerization is investigated as a method to produce acrylic polymers of controlled chain-end functionality and well-defined structure, enabling the production of uniform block copolymer materials using mild temperature, inexpensive reagents, low solvent levels, and reactor configurations currently used commercially. Reaction conditions and feeding strategies were optimized to accelerate methyl acrylate polymerization in a semi-batch system, leading to a 2-fold reduction in reaction time with no loss in control compared to previous studies of this system. The learnings were then applied to the homopolymerization of di(ethylene glycol) methyl ether methacrylate (DEGMEMA) and to the production of acrylate-acrylate and acrylate-methacrylate block copolymers. Reactions with high inter-block conversion were completed in 4 h or less with no intermediate purification or additional catalyst, thus yielding a promising scalable method to produce block copolymers.

Day:3-12:00:12:15	**Assistant Professor Joji Tanaka - University of North Carolina at Chapel Hill** **S013**

Application of RAFT interchange with RAFT step-growth polymers

In the presence of two or more CTAs, an exchange occurs between the fragmenting R-group and thiocarbonyl thio-bearing Z-groups, that we termed 'RAFT interchange'. Despite the widespread use of the RAFT process in controlling radical polymerization, RAFT interchange remains underutilized in the field. We introduce a mathematical framework that holds immediate applications for design and predictability in utilizing the RAFT interchange process. Moreover, our recent discovery of RAFT step-growth via the Z-group approach offers a unique dynamic polymer backbone as a platform for further exploration. The synergistic application of RAFT interchange with RAFT step-growth polymer backbones features a mild partial depolymerization strategy as well as generation of novel hybrid copolymers.

Day:3-12:15:12:30	**Dr Francesco De Bon - University of Coimbra** **S013**

Synergistic Radical Taming in Emulsion for Scalable, Efficient, and Environmentally Friendly Polymer Synthesis

Contrary to the established picture of considering the mechanisms of Inner Sphere Atom Transfer (ISET-AT, of ATRP) and Degenerative Transfer (DT, of RAFT) as separated, if the two are combined in emulsion, the outcomes of this approach defy their mere sum. Indeed, they synergistically enhance each other and the overall polymerization outcomes, compensating for the respective weaknesses. For example, the best outcomes are obtained in conditions in which the separated mechanisms are unsuccessful. This let us use very low Cu metal and surfactant loads, offering many advantages for industrial-like polymer production with reduced environmental impact. Combining two radical taming mechanisms can open new avenues for polymer science, offering new insights into an unconventional and uncommon method of polymerization. This innovative approach provides a fertile ground for advancing the frontiers of polymer science.

Day:3-12:30:12:45	**Dr Peter Roth - University of Surrey** **S013**

Radical ring-opening polymerization of thionolactones: Block copolymers and networks with labile backbone thioesters

We present the development and emerging applications of the radical ring-opening polymerization of thionolactones. This process gives labile backbone thioesters. The first-generation thionolactone, dibenzo[c,e]oxepin-5(7H)thione (DOT), copolymerises rapidly with acrylates, acrylamides, and styrene. The process is compatible with RAFT and ATRP and enables the preparation of complex copolymer architectures. The thioesters can be cleaved selectively through aminolysis, thiolysis, and—within seconds—oxidative hydrolysis.

The incorporation of small (0.25 mol-%) amounts of DOT into crosslinked n-butyl acrylate networks enabled the preparation of pressure-sensitive adhesives that performed similar to commercial samples. Upon selective degradation of the backbone thioesters, the adhesive properties changed, enabled the fast detachment of model labels and the full dissolution of the adhesive residue, offering new routes for the recycling of label-adorned materials.

Day:3-11:00:11:30	**Dr Bernhard V. K. J. Schmidt - University of Glasgow** **S011**

Hydrophilic Polymers: Self-assembly and Multi-phase Systems

Water-soluble polymers play a crucial role in contemporary polymer science.[1] A significant feature of hydrophilic polymers is their self-assembly and phase separation behaviour enabling molecular partitioning and structure formation. In this talk, an overview of recent developments regarding polymers in aqueous environment will be presented with a focus on aqueous two-phase systems, w/w emulsions and self-assemblies as a completely water-based barrier-free compartmentalized system. We use polymer chemistry approaches to obtain new components for these aqueous systems, e.g. high molecular weight polyacrylamides[2] or to introduce stimuli response.[3,4]

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Day:3- 11:30:11:45	**Professor Monica Bertoldo - University of Ferrara** **S011**

Aqueous dispersions of biodegradable polyesters for packaging application: preparation, stability and their use to obtain films

Aqueous dispersions of polymers can be obtained through emulsion polymerization or dispersion of preformed polymers. In this study, the latter approach was used to obtain dispersions of poly(lactic acid), using various low molecular weight or block-copolymer surfactants. The effect of these surfactants on dispersion formation, morphology, and stability over time was thoroughly investigated. The dispersions that exhibited good stability over time were then tested to produce films either alone or in combination with poly(vinyl alcohol) or xanthan gum. The conditions that allowed the dispersed particles to merge into a continuous film were found to depend on the temperature and composition of the dispersion. The optimized conditions for film formation were ultimately utilized to produce free-standing films or films on paper substrates, which were characterized for their thermal, mechanical, and gas barrier properties.

Day:3- 11:45:12:00	**Ms Laura Sinniger - UCBL** **S011**

Block copolymers based on ethylene and methyl methacrylate by combining catalytic chain transfer polymerization and radical emulsion polymerization in water

Polyethylene (PE) is one of the most widely produced polymers due to its low production costs and excellent mechanical properties. Identifying macromolecular architectures based on ethylene and polar monomers could allow to combine the properties of PE with the functionality of polar units. Our team has recently developed the synthesis of poly(methyl methacrylate)-b-PE block copolymers using w-unsaturated PMMA oligomers prepared by catalytic chain transfer polymerization (CCTP) in the radical solution polymerization of ethylene using dimethylcarbonate (DMC) as solvent. The present study successfully transposed this approach to a polymerization in aqueous dispersed media by using w-unsaturated PMMA oligomer latexes obtained by CCTP directly as seeds in the radical emulsion polymerization of ethylene in water. Stable PMMA-b-PE spherical particles were obtained.

Day:3- 12:00:12:15	**Dr Martin Ocepek - Helios Resins** **S011**

Sustainable polymers in coatings industry: Organic resins perspective

In recent years, industrial resins and coatings development trends have been significantly influenced by the escalating awareness of sustainability, evolving legislation, and customer expectations.

Current (industrial) research is focused on exploring potential substitutes for fossil-based building blocks for polymer (resin) synthesis to re-shift back to sustainable coatings. Still, these novel systems must not only have lower environmental impact but also needs to meet all visual, protective, and other functional properties.

Bio-based carbon validation can be achieved through 14C or bio-mass-balance (BMB) certification. Simultaneously, diverse alternative bio-substances are under investigation within various coating systems, with considerations for both, performance and cost-effectiveness.

The principal objective of increasing bio-based carbon is the first and most important step. However, accurate Life Cycle Assessment (LCA) is needed to objectively claim sustainable resins.

Day:3-
12:15:12:30

Ms Eileen Smith - IOM member
S011

Dynamic Polymer Nanocomposites Engineered via Particle-Based Crosslinks

Inherent self-healing properties make materials formed from noncovalent networks attractive as they can repair fractured surfaces facilitated by highly mobile chain segments and by possibilities of achieving fast reversible associations at ambient conditions. However, noncovalent networks are prone to creep and considerable material deformation on loading. Multivalent binding of ligands on one entity via noncovalent interactions is collectively much stronger and display qualitatively different properties than those of underlying monovalent interactions. Here, we introduce the concept of nanoparticle-based crosslinks with enhanced bond strength and systematically studying the effect of positive cooperativity in polymer networks. Secondly, these materials are designed to have access to two or more thermodynamic states where the bond dynamics of polymer networks are reversibly programmed using tunable interfacial interactions between nanoparticles and polymers.

Day:4-
14:00:14:30

Dr Graeme Moad - CSIRO

Electrochemical initiation and RAFT polymerization

RAFT (reversible-addition-fragmentation chain transfer) polymerization is a reversible deactivation radical polymerization (RDRP) that provides a mechanism for chain equilibration and, with appropriate choice of conditions, can endow living character on radical polymerization. A process is required to initiate polymerization. In principle, any method for generating initiating radicals might be used.

Three processes for electrochemically initiated RAFT polymerization will be described (a) direct electrochemical reduction of the (macro)RAFT agent at the electrode, (b) mediated reduction of a RAFT agent,3 and (c) electrochemical generation of initiating radicals at the electrode. These processes will be considered with relation to designing a scalable process with the effective spatial and temporal control for production of well-defined polymers by emulsion polymerization.

Day:3-
11:00:11:15

Dr Stephen Knox - University of Leeds
OC101

Autonomous particle synthesis - integrating machine learning optimisation algorithms, automated online analyses (NMR, GPC, DLS) and RAFT polymerisation in flow

Application of automation and machine learning algorithms to polymer science represents an exciting opportunity for exploration and optimisation of polymerisations. Polymer nanoparticles are a critical technology in many high impact applications, including drug delivery and high-performance materials. For such high value applications, control over the structure and size of these nanomaterials is required, with an efficient and reproducible route to preparation. This work shows an autonomous platform capable of many-objective optimisation of particle synthesis, with an automated flow reactor and online automated analyses (NMR, GPC, DLS). We use RAFT dispersion polymerisation to demonstrate the opportunities this technology provides; where it enables the collection of a tremendous amount of data in vastly reduced working times relative to conventional methods, and integration of machine learning algorithms to reach optimal products accounting for trade-offs in different objectives.

Day:3-
11:15:11:30

Ms Marta Mestre Membrado - EHU-UPV (POLYMAT) and VITO
OC101

Chemical recycling of polyamide 6

Polyamides are used in a wide range of everyday applications due to their high chemical stability and great physical properties. Polyamides are linked through amide bridges that might be catalytically cleaved to recover monomers for subsequent repolymerization processes. However, the high chemical inertness of the amide groups hinders its chemical dissociation and harsh conditions are required to cleave the amide groups to obtaining back monomers. In this study, we investigate the depolymerization of polyamide 6 in the presence of different organocatalysts. Therefore, we explore different organic acids and reaction conditions to understand the reaction mechanism and optimize the depolymerization process.

Day:3- 11:30:11:45	**Mr Tomaz Pirman - Helios Resins OC101**

Utilization of biobased itaconates in sustainable polymer synthesis - modelling free radical copolymerization

Sustainability of commercial acrylic polymers can be greatly improved with the use of biobased monomers. Esters of itaconic acid provide a good alternative to oil-based monomers since they enable incorporation of different functionality and side chain length. The drawback of these monomers is their susceptibility to depropagation and overall lower rates of polymerization. In this work we propose to counter this disadvantage by using a highly reactive non-depropagating comonomer.

A series of batch copolymerizations of dibutyl itaconate and butyl acrylate were conducted to investigate the influence of the comonomer on rate, copolymer composition and polymer molar masses. The results were used to develop a comprehensive copolymerization kinetic model of the system to guide further development. Semi-batch experiments at commercially relevant process conditions demonstrated that up to 50% itaconate content can be feasibly incorporated in the copolymer resins.

Day:3- 11:45:12:00	**Ms Stella Afroditi Mountaki - ETH Zurich OC101**

Chemical recycling of bromine-terminated polymers synthesized by ATRP

Chemical recycling of polymers is one of the biggest challenges in macromolecular science. In recent reports, remarkable achievements have been made by utilizing polymers prepared by controlled radical polymerization to trigger low-temperature depolymerization. However, in the case of atom transfer radical polymerization (ATRP), depolymerization has nearly exclusively focused on chlorine-terminated polymers, even though the overwhelming majority of polymeric materials synthesized with this method possess a bromine end-group. Herein, we report an efficient depolymerization strategy for bromine-terminated polymethacrylates employing a cost-effective and non-toxic iron catalyst (FeBr2/L). The effect of various solvents and the concentration of metal salt and ligand on the depolymerization are judiciously explored and optimized, allowing for a depolymerization efficiency of up to 86% to be achieved in just 3 minutes. Notably, the versatility of this depolymerization is exemplified by its compatibility with chlorinated and non-chlorinated solvents, and both Fe(II) and Fe(III) salts. This work significantly expands the scope of ATRP materials compatible with depolymerization and creates many future opportunities in applications where the depolymerization of bromine-terminated polymers is desired.

Day:3- 12:00:12:15	**Mr Guillem Seychal - University of Mons OC101**

Design of high-performance polyhydroxyurethanes and their derivatives for more sustainable structural natural fiber composites

This study explores the use of polyhydroxyurethane (PHU) as eco-friendly matrices in structural composites made from natural fibers (NF). We create PHU by reacting epoxide derivatives with CO2, resulting in cyclic carbonates and subsequent PHU formation through a straightforward aminolysis process. We highlight the strong compatibility between PHUs and NF on multiple levels, employing mechanical characterization, AFM, and DFT modeling. Our findings are compared to those of traditional epoxy materials. Flax/PHU composites notably surpass epoxy counterparts, showcasing superior mechanical properties with a modulus and ultimate stress exceeding 30 GPa and 430 MPa. By combining them with epoxy, we broaden the applicability of PHU-based composites to industrial process. This hybrid approach adjusts the processability and final properties of the materials to meet industrial requirements. These innovative matrices open avenues for high-performance sustainable structures.

Day:3-12:15:12:30	**Mr Abderrahmane Lakchini - Department of english studies -FPN-** **OC101**

"Quantum Nanostructures: Catalyzing Green Chemistry for Sustainable Synthesis and Environmental Preservation"

Exploring quantum-inspired nanostructures for eco-friendly synthesis, minimizing environmental impact while advancing sustainable practices in chemistry.

Day:3-12:30:12:45	**Ms Anisha Patel - Aston University** **OC101**

A Greener Future for Commercial Inkjet Printing

Inkjet printing is a technology commonly used to print images and text on a range of absorbent/non-absorbent media. The use of organic solvents in inkjet ink has significantly decreased due to the damage they inflict upon our environment, thus water-based inks are becoming a much-preferred choice. However, using aqueous-based formulations as a replacement can be problematic due to their lack of resistance to various conditions (e.g. harsh weathering) and hence has limited use. These drawbacks can be overcome by using polymeric dispersants. It has been previously demonstrated that the addition of an amphiphilic block copolymer with a thermally triggerable crosslinking segment can enhance the properties of industrial ink formulations. As there is currently there is a substantial drive towards more sustainable processes, a new amphiphilic block copolymer will be synthesised to contain a cross-linkable segment which will not require the extensive thermal treatment used previously.

Day:3-11:00:11:15	**Ms Agathe Zanon - CRPP** **OC102**

Electrostrictive block copolymers for sensing and energy harvesting

Enhancing the electrostrictive coefficient in dielectric materials can be achieved by introducing heterogeneities that can generate dielectric relaxations and promote interfacial polarization. In our study, interfaces of high dielectric contrast are generated by the microphase separation of block copolymers (BCPs). We used RAFT polymerization to synthesize methacrylate-based BCPs with one block functionalized with ionic groups. We observed that the electrostriction coefficient strongly depends on the structure of the self-assembled BCP chains. In particular, the materials display low electrostrictive coefficients when the ionic blocks are confined as spheres in the insulating matrix. However, an enhancement of electrostriction coefficients is observed when the ionic blocks form near-percolated networks. This study presents a promising avenue for tuning electrostrictive properties in soft dielectric materials with implications in sensing and energy harvesting.

Day:3-11:15:11:30	**Ms Anmol Anmol - The University of Manchester** **OC102**

Functionalized [7]-Helical Nanographenes: Impact of Donor and Acceptor Groups on their opto-electronic and chiroptical properties

Helical bilayer nanographenes are a new class of 2D-chiral materials which are being studied extensively because of their excellent physicochemical properties. However, impact of donor and acceptor groups on helicene backbone of these layered compounds have not been explored. Herein, we plan to study the impact of four different donor and acceptor groups on opto-electronic properties. Synthetic design involves a π-bridge as a linker between two hexa-peri-hexabenzocoronene units, which undergoes cis and trans isomerization in Diels–Alder cycloaddition. High temperature reaction conditions in cycloaddition overcomes the interconversion energy required for cis isomer to convert into trans. Interestingly, Scholl reaction of both isomers have produced functionalized [7]-Helical Nanographenes. Various cyclodehydrogenation reaction conditions are employed to successful synthesis of helical macromolecules. These nanographenes have displayed excellent photo physical and chiroptical properties.

Day:3- 11:30:11:45	**---- Morgan Skala - University of Washington OC102**

Liquid assisted grinding enables the direct mechanochemical functionalization of polystyrene

Utilizing chemistry to modify the structure of waste polymers, or "upcycling," can impart new properties and applications in industry. To circumvent issues and improve sustainability in current solution-state upcycling processes, we propose the post-polymerization modification of polystyrene (PS) and PS waste via a solid-state mechanochemical functionalization enabled by liquid assisted grinding (LAG). We utilize LAG not only to improve mixing, but to decrease the rate of polymer degradation in the ball mill. Importantly, this method modifies discarded plastic, including dyed materials, through a more sustainable route for potential applications in clean energy materials, adhesives, and polymer networks. Ultimately, this work serves as a proof of concept for the mechanochemical post-polymerization modification of commodity polymers, and we anticipate future remediation of plastic waste via similar mechanochemical reactions.

Day:3- 11:45:12:00	**Mr Gianluca Forcina - LTM/CNRS OC102**

Nano-lithography with high-chi block copolymers: inter-relation between self-organization and dewetting kinetics

The directed self-assembly of high-χ block copolymers (BCPs) stands as a powerful tool for manufacturing very high resolution features (< 10 nm) in microelectronics. However, these BCPs must be deposited onto neutral underlayers to promote the useful organization perpendicular to the substrate, which can induce dewetting of the BCP layer. To counteract such dewetting, a rigid top coat can be deposited onto the BCP layer prior to the promotion of the self-assembly. If the top coat is capable of crosslinking through light exposure, it can serve as a photoresist and be patterned via lithography. The non-exposed regions can be removed during a development step, and after thermal annealing, the BCP will dewet in these regions while simultaneously self-assembling beneath the crosslinked top coat in the other regions. This experimental configuration allows to simultaneously investigate the kinetics and mutual influence of both microphase separation and dewetting.

Day:3- 12:00:12:15	**Ms Ivone Marselina Nugraha - CNRS OC102**

A New Mixed Conductive Polymer for Replacing PVDF Binder and Carbon Additive at the Positive Electrode in Li-Ion Batteries

The performance of Li-ion batteries (LIBs) relies on the effective modulation of the microstructure level and the interface stability within the electrodes. Binders play a crucial role in ensuring mechanical integrity by interconnecting the active materials (AMs) with the electronic conductor additive and firmly attaching them to the current collector (CC). However, the widely used Poly(vinylidenefluoride) (PVDF) binder has drawbacks: low electrical conductivity requiring the addition of carbon black (CB), weak interactions with AMs & CC, and use of toxic solvents in processing. This study explores a new mixed electronic/ionic conductive polymer for replacing PVDF/CB in LIBs. It notably enhances electronic conductivity and Li+ diffusion within the electrode, facilitating faster charge/discharge rates at high current densities and forming a better interface layer promote stability over extended cycles. These promising results introduce a new binder to traditional PVDF/CB formulations.

Day:3- 12:15:12:30	**Ms Mutsumi Kobayashi - Graduate School of Engineering, Kobe University OC102**

Control of Phase-Separated Structure of Epoxy Resin/Polyether Sulfone Blends in Carbon Fiber Reinforced Plastics and Their Mechanical Properties

For widespread use of carbon fiber reinforced plastics (CFRP) in frameworks of aircrafts and sport gears, toughening of epoxy resin (EP) matrix in CFRP has been attempted. The blends of poly (ether sulfone) (PES) and epoxy resin form phase-separated structures during their curing process, and the mechanical properties depends on their structure. In addition, the structure is expected to receive large impacts by the increase of interface between carbon fibers (CF) and EP/PES matrix. For the development of high-performance CFRP, it is necessary to clarify correlation between phase-separated structure and the reinforcement mechanism of EP/PES blend in CFRP. In this study, the phase-separated structures were controlled through curing processes or surface treatments of CF, and their phase-separated structures were observed with X-ray computed tomography (CT). Dependence of toughness and elastic modulus on their phase-separated structures were investigated.

Day:3- 12:30:12:45	**Mr Kyle Matthew Dabu Reyes - Master's Student OC102**

Controlled Radical Polymerization of Polyacrylamide on Activated Carbon Surface for Flocculation Applications

High molecular weight polyacrylamide (PAM) at 106-10-7 g/mol are excellent flocculants common in the industry. However, PAM,Äôs hydrophilicity limits its adsorption of mature fine tailings (MFTs) and sediment dewatering, so researchers have investigated grafting PAM onto a hydrophobic polymer.2 An area that hasn,Äôt been explored is grafting PAM onto a solid inorganic hydrophobic substrate such as activated carbon (AC) which is widely accessible and has extensive research on surface modification.3,4 As a result, for my master,Äôs project, I have proposed an inorganic-organic hybrid flocculant by grafting PAM on the surface of AC, reducing the total amount of organic polymer required and improving flocculation performance. This will reduce costs and reduce the environmental footprint of the flocculation process.

The hybrid organic-inorganic material would be synthesized by a ,Äògrafting from,Äô approach through surface-initiated activators regenerated by atom transfer radical polymerization (SI-ARGET ATRP)5 forming ,Äòbrush-like,Äô PAM on the surface of AC. This controlled radical polymerization allows great control over PAM,Äôs molecular weight and architecture.6,7 Therefore, allowing the investigation of various molecular weights and architectures for AC-modified PAM (AC-PAM). ATRP has been used to polymerize acrylamide with high molecular weights up to 106 Daltons but was limited by their dispersity.8 This is most likely due to the challenges associated with an aqueous-based ATRP such as disproportionation of CuI/L activator, dissociation of X-CuII/L deactivator, and higher radical concentration leading to termination.9,10 Therefore, a variety of ARGET ATRP parameters including the addition of halide salts, the use of cosolvents, and the feeding of the reducing agent were explored to optimize the aqueous ARGET-ATRP of different molecular weight PAM to design an effective grafted-from AC-PAM organic-inorganic hybrid that can effectively flocculate Mature Fine Tailings (MFTs).

Day:3- 11:00:11:15	**Mr Stefan Wurzer - Anton Paar GmbH OC103**

Determination of temperature and frequency dependent Poisson’s ratio of various polymers using a novel combined torsional-axial rheometer

The feasibility of using a combined torsional-axial rheometer to indirectly measure the complex Poisson's ratio based on shear and Young’s modulus is investigated in this study. To achieve this frequency sweeps at different isothermal conditions are performed in torsion and tension sequentially on a single cylindrical specimen. The following relation is then used to determine the complex Poisson’s ratio using the complex elastic and shear modulus:

v^* (ω)= (E^* (ω))/(2G^* (ω))-1

The method is performed on a number of different materials, including two amorphous polymers, a semi-crystalline polymer, a polymer blend, and copolymer. For all materials but the amorphous polymers, the experimental data show a monotonic increase in the complex Poisson's ratio up to 0.5 as the temperature approaches the α-relaxation. The amorphous materials show a local minimum in the complex Poisson's ratio observed near the α-relaxation, which is not present when annealing the samples.

Day:3- 11:15:11:30	**Dr Steven Huband - University of Warwick OC103**

7 years of lab-based small angle X-ray scattering (SAXS) on polymer systems

In this presentation I will discuss how we run the SAXS instrument (Xenocs Xeuss 2.0) in the University of Warwick X-ray scattering facility and how we support the research of our colleagues both across the university and externally. Small group introductory SAXS sessions on the instrument are available to attendees during the conference. The SAXS was installed in 2017 and we have supported a wide range of research on polymer systems since then. Examples of some of the systems we have studied will be provided including standard nanoparticle morphology/size analysis and more involved in-situ studies using SAXS and X-ray diffraction to understand crystallisation as a function of temperature or strain. Variable temperature studies have allowed us to investigate phase transitions in liquids, gels and solid polymer samples.

Day:3- 11:30:11:45	**Assistant Professor Dong Lyu - Changchun Institute of Applied Chemistry, Chinese Academy of Sciences OC103**

The micro-structure evolution of isotactic polypropylene during die drawing: an in-situ USAXS experiment

Die drawing is one of the most successful solid-state polymer processing techniques. In spite of its extensive application, the deformation mechanism of materials during this process is still unclear. The real-time micro-structure evolution of b-nucleated isotactic polypropylene (iPP) during die drawing is observed via the ultra-small-angle X-ray scattering (USAXS) technique for the first time. It turned out the sample have already been deformed before it entered the die entrance, which contradicts to the previous idea that the deformation started after the sample entered the die entrance. The dimension of cavities was evaluated both during and after die drawing based on the USAXS patterns. An obvious development of the cavities could still be observed after the sample was drawn out of the die during die drawing before the cavities dimensions reached a certain plateau. On the contrary, the dimensions of the cavities were quite similar on the sample position beyond the die exit based on

Day:3- 11:45:12:00	**Dr Sergey Filippov - DWI Leibniz-Institute for Interactive Materials OC103**

The beauty of block and gradient poly-2-oxazolines as it seen by Small-Angle Neutron Scattering (SANS) and Neutron Spin Echo (NSE)

The internal structure of amphiphilic block and gradient co poly(2-oxazolines) based on the hydrophilic poly(2-methyl-2-oxazoline) (PMeOx) and the hydrophobic poly(2-phenyl-2-oxazoline) (PPhOx) was studied in water and water-ethanol mixtures SAXS, SANS, DOSY-NMR, and NSE. Contrast matching SANS experiments revealed that block copolymers form micelles with a uniform density profile of the core. In contrast to popular assumption, the outer part of the core of the gradient copolymer micelles has a distinctly higher density than the middle of the core. NSE experiments show the presence of additional dynamics for the gradient polymer micelles in pure D2O and water-ethanol mixtures. The additional dynamics can be explained qualitatively with the contribution by rotational diffusion from internal parts of the micelles.

Day:3- 12:00:12:15	**Dr Marcos Noé Fanjul Mosteirín - Royal Institute of Technology (KTH) OC103**

Covalent Adaptable Networks with Tailorable Material Properties Based on Renewable Starch Derived Vinylogous Urethanes

Covalent adaptable networks (CANs), represent an opportunity to fill the gap between thermosets and thermoplastics. Structurally, they are crosslinked networks portraying typical thermoplastic properties, such as reshapability, while simultaneously having high mechanical and chemical resistance. In pursuit of the sustainability goals, a series of renewable starch derived 1,4:3,6-dianhydrohextiol were functionalized to bear acetoacetate moieties, enabling CAN formation when reacted with a series of amines. This reaction renders novel vinylogous urethane-based CANs with tailorable thermomechanical properties, by tuning both of the ratios and the nature of the amines. The CANs exhibited a wide range of Tg's as well as a high thermal stability and stress relaxation behaviour. The CANs could also successfully be reprocessed with retained mechanical properties and chemical recycled under acidic hydrolysis of the vinylogous urethane functionality.

Day:3-12:15:12:30	**Mr Lukas Vonbrül - Universität Innsbruck** **OC103**

Solvent blends for selective elastane dissolution and recovery from textiles

Typical solvents for elastane, dimethylformamide (DMF) and dimethylacetamide (DMAc) are toxic and not environment friendly, which makes it difficult to handle them in large quantities. The reported work focuses on the use of dimethyl sulfoxide (DMSO) and 2-methyltetrahydrofuran (2-MeTHF) blends for selective separation of elastane from clothing by dissolution. It can be demonstrated, that elastane can be selectively dissolved at room temperature in ambient atmosphere by mixing these two solvents at a specific ratio. The main solvent component, 2-MeTHF can be sourced from agriculture waste, which makes it very suitable for green chemistry protocols. The analytical results of the treated fabrics indicate successful elastane separation and no sign of degradation of other textile fibres. The 2-MeTHF can be distilled off at mild temperatures, leaving the elastane to precipitate in the DMSO. Separation of the precipitate allows for recovery of the DMSO as well for later reuse.

Day:3-12:30:12:45	**Mr Dy Lazarte - Lazarte** **OC103**

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Day:3-11:00:11:15	**Professor Ching Hsuan Lin - National Chung Hsing University** **OC107**

Upcycling waste polycarbonate to poly(carbonate imine) vitrimers

To achieve sustainability, the waste polycarbonate (WPC) should be recycled. This work reports a 100% atom-efficiency upcycling of WPC to a WPC-derived aldehyde (WPC-CHO). Then, poly(carbonate imine) vitrimers (PCIs) based on the WPC-CHO and two aromatic diamines were prepared. Generally, polyimines can cleave in mild acidic conditions such as 0.1 M HCl(aq) and seldom show good thermal and tensile properties. The PCIs in this work showed good thermal and tensile properties, and an unprecedented resistance toward acid hydrolysis. They can survive even immersing in a 5 M H2SO4 THF/H2O solution for 6 months. This unusual resistance toward acid hydrolysis expands the application of PCIs in an acidic environment. Small pieces of PCIs can be compression molded into a newly formed polymer film at 240 oC. This thermal reprocessability demonstrates the vitrimer characteristic of the PCIs.

Day:3-11:15:11:30	**Mr Jinge You - University of University** **OC107**

A novel method for the rapid synthesis of glycopeptides and a small-molecule drug delivery system targeting human dendritic cells

Glycopolymers have showed great potential for various biomedical applications, ranging from tissue engineering to biosensing, in which glycopeptide, a glycopolymer possessing native proteinaceous backbones and natural glycosidic linkages, is potentially more suitable for translational applications. To date, post-polymerisation glycosylation and glyco-NCA polymerisation are two main methods to approach glycopeptides, while the post-polymerisation route has a limitation on glycosylation rate due to the limited reactivity of peptide side-chain, and the glyco-NCA polymerization route has problem on achieving large glycopeptdes due to the steric bulk of glyco groups. Here, we reported a novel rapid method for the synthesis both glyco-NCA monomers and the corresponding glycopeptides via the glyco-NCA polymerisation route. There are 3 main advantages of this method: 1) Synthesis of the required to glyco-NCA monomer can be achieved in just 10 minutes from a glyco-aminoacid precursor and purified within 2 hours. 2) Glycopolymers with 100% glycosylation (homopolymer) up to DP 80 can be prepared within 0.5-10 hours. 3) Using Ala-NCA as a comonomer, glycopolymers with 50% glycosylation ((glyco-NCA)-r-(Ala-NCA) random copolymer) up to DP 200 could be prepared within 2 hours and block copolymers could be prepared using a one-pot method. Applying this novel method, we developed polymeric nanoparticles for the targeted delivery of BIRB0796, a small-molecule p38 inhibitor reported to stimulate antitumour-function of dendritic cells, to human primary dendritic cells. Mannose-based diblock peptides were synthesised with the novel method described above. Mannose-based nanoparticles were confirmed to be selectively internalised by mannose receptor-expressing cells. BIRB0796 loaded in peptide nanoparticles was observed to activate DC functions at 10-fold lower dose than BIRB0796 loaded in non-peptide-based nanoparticles and 100-fold lower dose than BIRB0796 free drug, which indicates the selective internalisation of mannose-based nanoparticles by dendritic cells and a better intracellular drug release of peptide-based nanoparticles. Generally, we developed a novel method to approach glycopeptides in a short time. And using this novel method, we developed mannose-based peptide nanoparticles to be a small-molecule drug delivery system targeting human dendritic cells.

Day:3-
11:30:11:45

Dr Lynn Anderson - University of Manchester
OC107

The Academic Road to the World's First Truly Climate-Neutral Automotive Vehicle: The Polestar™ 0 project

Sustainable materials design is essential to combat the negative effects of climate change and 'forever' materials polluting the natural environment. Electric vehicle manufacturer Polestar™ and the University of Manchester have embarked on a partnership working towards Polestars moon-shot goal of a truly climate-neutral vehicle by 2030 focusing on sustainable polymers. On this journey, research and industry seek to improve translation to market of novel polymers, increased inclusion of recycled content, and improved recycling processes. Product performance, safety, and environmental risks are anticipated and mitigated while sustainability is quantified and assessed, progressing towards a circular economy through open innovation. The proposed talk will showcase the current research progress of incorporating polymer science from our labs into state-of-the-art Polestar™ vehicles.

Day:3-
11:45:12:00

Ms Gabriela Garbonova - University of Birmingham
OC107

Circular route towards polyhydroxyalkanoates

Polyhydroxyalkanoates (PHAs) are promising biobased alternatives to commodity plastics, especially for food packaging applications. However, their thermal and mechanical properties are limited. We explore synthesizing PHAs from 8-membered diolide monomers (8DL_R) with different R groups using organocatalysts. Organocatalysts have advantages over metal-based catalysts, being easily accessible and purified, and having longer shelf life and lower toxicity.

Day:3-
12:00:12:15

Dr Mateusz Gosecki - Centre of Molecular and Macromolecuar Studies, Polish Academy of Sciences
OC107

Suberin, a renewable feedstock for the synthesis of recyclable thermosets

Day:3- 12:15:12:30	**Ms Elena Rigo - Institut Charles Gerhardt Montpellier OC107**
4-vinyl guaiacol: a key-intermediate for biobased polymers	
In recent years, the depletion of fossil fuels, the volatility of petrol prices, the worldwide environmental concerns and the stringent environmental regulations encouraged the design of new biobased monomers and polymers. In order to contribute to this shift, we used 4-vinyl guaiacol (4VG), a lignin-derivative phenolic compound, to synthesize a platform of nine new biobased monomers. The synthesis procedures were investigated through the green metrics calculations in order to quantify the sustainability of our approaches. Their radical homopolymerization in toluene solution initiated by AIBN was studied and the effect of residual 4VG as radical inhibitor on the kinetics of polymerization was also explored. The new homopolymers were characterized by 1H-NMR, size exclusion chromatography, thermal analyses (DSC, TGA) and water contact angle measurements. By varying the length of the alkyl ester group, homopolymers with Tg ranging from 117 to 8°C were obtained. Thus, these new, safe and sustainable biobased monomers could be used in various applications to minimize the environmental impacts of the polymer industry.	

Day:3- 12:30:12:45	**Ms Ainhoa Maiz - Facultad de quimica, EHU/UPV OC107**
Scalable enzymatic synthesis of enantiopure β-hydroxy esters and their subsequent polymerization	
Nowadays, polymer science is finding alternatives to produce plastics in a green way, using materials from renewable sources, called bio-based polymers. A polymer that belongs to the group of bio-based polymers is the PHB, polyhydroxybutyrate. In this project, we will synthesize in lab-scale β-hydroxy ester, which is the repeating unit of the PHB polymer for the subsequent synthesis of the polymer. For the first process, a heterogenous self-sufficient biocatalyst was used, which is able to do an asymmetric reduction from highly abundant β-ketoesters to β-hydroxy esters. In the second step, the β-hydroxy ester will be used for polymer synthesis. For it, the obtained product will be modified by an organic path in order to obtain a 7 member ring. And this molecule will be used to do ring opening polymerization (ROP). In this way, we will merge biocatalysis and polymer chemistry to access more sustainable plastics through an enzymatic synthesis of polymer building blocks.	

Day:4- 09:00:09:45	**Professor Martina Stenzel - BUTTERWORTH HALL**
Synthesis of single-chain nanoparticles for drug delivery	
Single-chain nanoparticles (SCNPs) are widely explored as their shape and size resemble proteins. They have emerged as promising candidates for drug delivery due to their small size and tunable properties resulting from the intramolecular collapse of the polymer chains. In this presentation, we would like to discuss how small changes in the polymer architecture can influence the biological activity and the ability to deliver drugs safely into the cells. Central is an understanding of the physicochemical properties of these nanoparticles and how these properties change with drug loading, but also with the preparation technique of these drug carriers. We also addressed the challenge of drug loading into these ultrasmall nanoparticles. While conjugation is the easiest way to control drug loading, many drugs have no functional handles. Traditional drug entrapment is not possible as the drug leaches out quickly. We therefore device an approach that uses tyrosine and carbohydrates to allow for high loading.	

Day:4- 09:45:10:30	**Professor Feihe Huang - BUTTERWORTH HALL**
Construction of Polymers with Macro-Scale Responsiveness Based on Molecular-Level Motions	
Based on molecular-level motions, nature has created an incredible body of molecular machines perfectly tailored for biochemical pathways and processes required for life. One far-off goal is to design synthetic	

molecular machines with similar or even more complex functions than those of natural systems. Over the years, scientists have built molecular machines with diverse structures and functions based on molecule-level motions. These molecular machines can move spontaneously, change the emission, or adsorb/separate species under external stimuli, showing great application prospects. However, in order to truly prepare artificial intelligent materials with practical applications, it is still necessary to magnify the molecular-level motions to the macro-scale responses. In this presentation, I will introduce the construction strategy of polymers with macro-scale responsiveness based on molecular-level motions. We first design and synthesize innovative mechanical interlocked structures and functional groups with molecular motion properties. Following that, we incorporate these molecular-scale movement elements into polymer backbones, thereby achieving the macroscopic amplification of molecular-scale movements. This process culminates in the preparation of a range of polymers with macroscopic responsiveness. These studies will efficiently combine molecular-level motions and macro-scale responsivenesses, proposing new research directions for the development of responsive polymers.

Day:4- 11:00:11:30	**Associate Professor Georgina Such - The University of Melbourne ARTS CENTRE THEATRE**

The Design of Stimuli-Responsive Nanoparticles using Self-Immolative Building Blocks

Self-immolative polymers have generated interest for the design of nanoparticle delivery systems as they can depolymerise in response to a range of biological stimuli and thus control release of therapeutic cargo. Herein, we discuss the development of two self-immolative delivery systems based on poly(ethyl gloxylamide) (PGAm) and poly(lipoic acid) respectively. It was shown the PGAm system could respond to pH in a two-staged process, first particle disassembly followed by polymer depolymerisation. The ability of this polymer to escape the endosomal compartment was then investigated. We will also discuss a novel lipoic acid system, which demonstrated the ability to load and release nucleic cargo in response to changes in redox potential and successful transfection of plasmid DNA. These studies indicate the potential of self-immolative nanoparticles as potential delivery systems in the future.

Day:3- 11:30:11:45	**Professor Alex Baker - University of Warwick ARTS CENTRE THEATRE**

New Fangled Approaches to COVID-19 and Snake Bite Diagnostics

Every 5 minutes, 50 people are bitten by a snake worldwide, 4 will be permanently disabled and 1 will die. Snake envenomation is a neglected tropical disease (NTD) that requires urgent attention. The current treatment for snake envenomation utilises antibody-based antivenoms and diagnostics. These technologies are high-cost and have storage requirements beyond many end-users.

The COVID-19 pandemic illustrated the value of point-of-care tests (POCT), such as lateral flow devices (LFDs). However, there remains considerable scope for improvement to LFDs, this is because many tests rely on biological reagents (antibody-based "immunoassays") rather than synthetic chemistry. Dr Baker has demonstrated the use of synthetic glyco-polymer functionalised nanoparticles in lateral flow and flow through devices to sense for the spike protein of SARS-COV-2 real patient samples. This technology is now being translated to snake envenomation too, with promising early data indicating its applicability.

Day:3- 11:45:12:00	**Dr Ceren Kutahya - Department of Materials, Department of Bioengineering, and Institute of Biomedical Engineering, Imperial College London, London SW7 2AZ, UK ARTS CENTRE THEATRE**

Injectable and biodegradable polymeric microparticles for prolonged and controlled contraceptive release

Polymeric drug carriers have received much attention as therapeutic medicines due to their flexible physical characteristics, biodegradability and can be produced at industrial scale. Polyorthoesters (POEs) are a class of biodegradable polymer that exhibit surface-erosion behaviour that can prolong payload release with controlled zero-order kinetics. We have developed an ultra-long-acting (12-24 month), biodegradable and injectable polymeric microparticle-embedded hydrogel platform allowing for prolonged and dose-compliant delivery of a clinically relevant contraceptive, and is able to be retrieved to allow for discontinuation of treatment if desired. To achieve this, we have synthesised a library of novel POE polymer formulations to fashion drug-loaded, surface-erodible microparticles capable of long-term drug release. These microparticles are then embedded within a biocompatible hydrogel carrier that allows for subcutaneous delivery and facile retrievability.

Day:4-12:00:12:15

Associate Professor Yujie Xie -
ARTS CENTRE THEATRE

Anisotropic polymer self-assembles for biomedical applications.

Anisotropic structures, exemplified by biological entities such as muscle fibers, wood grain, and cellular tissues, highlight a fundamental mechanism for organizing atoms, molecules, or structural components into configurations with unique geometrical and physicochemical characteristics. Crystallization-driven self-assembly (CDSA) is predicated on the integration of crystallizable moieties into polymer backbones which harnesses crystallization forces to direct polymer chains along predetermined axes, culminating in the formation of stable, complex, and multilevel heterocomponent anisotropic architectures. Leveraging this intricate assembly paradigm, our investigation aims to synthesize highly refined optical barcodes, offering unparalleled accuracy for intricate tracking and authentication endeavors. Moreover, this precise polymer assembly strategy heralds the development of avant-garde biomedical platforms for targeted drug delivery, incorporating therapeutic agents directly into the disease milieu. The strategic modulation of polymer self-assembly mechanisms heralds a new era in biomedical engineering, promising to significantly elevate the specificity and efficiency of therapeutic interventions.

Day:4-12:15:12:30

Dr yinghao Li - University College Dublin
ARTS CENTRE THEATRE

Cyclic poly(β-amino ester)s targeting enhanced gene transfection via cyclic stage control strategy

Gene therapy is a modern medical technology for treating various diseases of a genetic origin. However, the lack of high-efficiency gene delivery carriers, especially polymeric non-viral vectors, significantly hinders its clinical application. Topological structure plays a critical role in the gene delivery of cationic polymers in the development of polymer vectors. In various topologies, cyclic structures are highly attractive due to their unique properties. However, considering the difficulty of synthesis, the polymerisation method significantly affects the obtained cyclic structures. To explore the control of different cyclic structures and their impact on gene therapy, a series of cyclic poly(β-amino ester)s (CPAEs) with different cyclic structures were synthesised by cyclic stage control strategy, and their cyclic structures were confirmed by photoluminescence spectroscopy and nuclear magnetic resonance spectroscopy (NMR). The macro rings proved to be beneficial with trans-gene ex

Day:4-12:30:12:45

Mr Alexander Fuchs - Julius-Maximilians-University Würzburg
ARTS CENTRE THEATRE

Cationic Polycarbonate Nanogels for Therapeutic Nucleic Acid Delivery

Cationic, core-crosslinked, fully hydrophilic nano(hydro)gel particles can be prepared from synthetic biodegradable materials. The polymer chemistry offers superior customizability compared to lipid nanoparticle alternatives. Effective electrostatic loading enables the encapsulation of therapeutic nucleic acids. Only when complexed inside nanogels, one can control biodistribution, lower toxicity and increase bioavailability at targeted locations.

We prepare such nanogels from cyclic aliphatic carbonate monomers equipped with reactive esters. First, block copolymers are acquired via cationic ring opening polymerization onto PEG. Micelles are then formed by self-assembly, followed by core-crosslinking and cationization yielding fully hydrophilic nanogels. They exhibit defined sizes around 20 nm even upon loading with therapeutic nucleic acids. In vitro and in vivo, they promote intracellular delivery with no relevant toxicities while retaining the therapeutic properties of the cargo.

Day:4- 14:00:14:30	**Dr Pankaj Singla - University of Manchester ARTS CENTRE THEATRE**

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Day:4- 14:00:14:30	**Professor Marloes Peeters - University of Manchester ARTS CENTRE THEATRE**

Double Imprinted Polymer Nanoparticles for Sequential Membrane-to-Nuclear Delivery of Chemotherapeutic Drugs

Nanoparticles functionalized with specific receptors (e.g., antibodies, peptides) are used for targeted drug delivery of anti-cancer agents but their side effects include hypersensitivity reactions, toxicity, inflammation, and life-threatening allergic reactions (Anaphylaxis) [1,2]. Consequently, double imprinted molecularly imprinted nanoparticles (nanoMIPs) against a linear epitope of breast cancer cell receptor estrogen alpha (ERα) and loaded with an anti-cancer agent (doxorubicin, DOX) are synthesized via a solid-phase approach. Surface plasmon resonance (SPR) measurements reveal that the produced nanoMIPs exhibit KD values of 19 nM (against the epitope used for imprinting) and 10 nM (ERα receptor), and thus rival the affinity of nanoparticles decorated with natural affinity reagents (e.g., antibodies, peptides), whilst offering the advantages of low-cost and enhanced cellular uptake due to the receptor mediated endocytosis. We present the results of in vitro flow cytometry that DOX loaded nanoMIPs can preferentially bind to MCF-7 (ERα positive) breast cancer (BC) cells vs MDA-MB-231 (ERα negative) BC cells. Confocal imaging witnessed the above results and showed the sequential movement of the DOX loaded nanoMIPs from membrane to the nucleus of MCF-7 BC cells and achieve delivery of DOX once internalised in the cells (directly to the nucleus). As a result, enhanced cell toxicity in MCF-7 cells (~80%) as compared to MDA-MB-231 cells (~15%) is observed via MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl-2H-tetrazolium bromide) cytotoxicity assay in a time dependent manner. Overall, this study provides a promising approach for the targeted drug delivery of chemotherapeutic drugs to breast cancer cells, which has the potential to significantly improve patient outcome whilst also reducing debilitating side effects of current treatment.

Day:4- 14:30:14:45	**Associate Professor Feng Jiang - The University of British Columbia ARTS CENTRE THEATRE**

Grafting zwitterion and quaternary ammonium copolymers onto cellulose membrane using surface-initiated atom transfer radical polymerization for antifouling and antibacterial applications

Transparent cellulose membrane shows great biomedical application potentials as biosensors, artificial blood vessels, and tissue engineering scaffolds. However, the membrane fouling, especially biofouling, has been a great concern that limits it application. In this work, polymer brushes with different ratios of sulfobetaine methacrylate (SBMA) and [2-(Acryloyloxy)ethyl]trimethylammonium chloride (DAC) were grafted from cellulose membrane (CM) via surface-initiated atom transfer radical polymerization (SI-ATRP) method for improving its antifouling and antibacterial performance. Surface concentrated polymer grafting on the cellulose membranes can be obtained without significantly sacrificing the optical properties, surface roughness and mechanical performance. The zwitterionic PSBMA chains can lead to an extremely hydrophilic surface with significantly reduced non-specific protein adsorption, therefore, leading to satisfying antifouling property. While both grafted PSBMA and PDAC showed

Day:4- 11:00:11:30	**Professor Iain McCulloch - University of Oxford ARTS CENTRE WOODS SCAWEN**

Understanding the molecular design features responsible for charge transport in organic semiconducting polymers

Organic semiconducting polymers have been shown to be promising candidates to enable high charge carrier mobility in organic thin film transistors, which can find use in flexible displays and other electronic applications. We will take a close look at the molecular features responsible for the high charge carrier mobility of the indacenodithiophene-co-benzothiadiazole copolymer, a benchmark semiconducting polymer employed in organic transistors. This will involve highlighting the influence of conformational coplanarity and side-chain assisted self-assembly to create efficient one-dimensional transport along conjugated polymer backbones, with sterically free “crossing points” allowing interchain hopping. Understanding the impact of both the organic semiconducting polymer design and processing conditions, on both molecular conformation and thin film microstructure has been demonstrated to be essential in achieving the optimal transport properties.

Day:4- 11:30:11:45	**Professor Rusli Daik - Universiti Kebangsaan Malaysia ARTS CENTRE WOODS SCAWEN**

Thermophysical Properties of Nanofluids Consisted of Deep Eutectic Liquid and Polyaniline Nanoparticles

Nanofluids had great potential in various applications due to advanced thermophysical properties and heat transfer performance. This paper describes thermophysical properties of deep eutectic ionic liquids (DES) based nanofluids containing sulfonic acid-doped polyaniline (PANI) nanoparticles. Camphorsulfonic acid doped polyaniline (CSA-PANI), dodecylbenzenesulfonic acid doped polyaniline (DBSA-PANI), naphthalenesulfonic acid doped polyaniline (NSA-PANI) and emeraldine base polyanline (EB-PANI) nanoparticles were synthesized with average diameter of 10 nm, 44 nm, 9 nm and 8 nm, respectively. DES was prepared by heating up choline chloride and glycerol. PANI nanoparticles were then ultrasonically dispersed. The thermal conductivity and specific heat capacity of nanofluids were investigated by using KD2 Pro thermal analyzer and differential scanning calorimeter (DSC) respectively. 4.05%, 4.50%, 4.50% and 3.15% and 8.11%, 9.46%, 9.91% and 6.31% of enhancement in thermal conductivity of DES were achieved at 50¬∞C and 60¬∞C respectively after incorporation of 0.2 wt% of CSA-PANI, DBSA-PANI, NSA-PANI and EB-PANI nanoparticles. The incraese in thermal conductivity related to Brownian motion of PANI nanoparticles and micro-convection of DES. The specific heat capacity of DES decreased after adding various types of PANI nanoparticles. Rheological results revealed that interaction between nanoparticles and DES was contributed to thermal conductivity and specific heat capacity of nanofluids.

Day:4- 11:45:12:00	**Assistant Professor Laure Kayser - University of Delaware ARTS CENTRE WOODS SCAWEN**

Thermo-reversible gelation of conducting polymers

Interfacing electronic devices with biological tissues for electrostimulation or sensing requires materials that are sufficiently compliant to minimize scaring and inflammation to maximize the survival of cells and maintain high electronic performance. To achieve this goal, electronically-conductive hydrogels containing a conducting polymer have been reported. An outstanding challenge, however, is to deploy these materials without invasive surgical procedures. We address this challenge by creating conducting polymers displaying a thermo-reversible gelation just below physiological temperature. The material is an aqueous colloidal dispersion of a polyelectrolyte complex between a thermo-responsive block copolymer (PSS−-b-PNiPAm) and an oxidatively doped conjugated polymer (PEDOT+). I will share the synthesis to this material, its rheological and electronic properties, and examples of its utility, in its pristine form or as a composite, for interfacing with cells and tissues.

Day:4- 12:00:12:15	**Professor Tianyu Wu - China University of Petroleum (Beijing) ARTS CENTRE WOODS SCAWEN**

In-situ fluorescence study on polymer solutions to reveal "Mpamba Effect"

The "Mpamba Effect" refers to the phenomenon that a slightly warmer liquid freezes before a slightly cooler liquid in the same mass and cooling environment. This counterintuitive phenomenon for aqueous solutions has been confirmed by scientists. In order to study this interesting phenomenon, we built a device that can implement in situ fluorescence image acquisition and spectral acquisition, using a substable organic solution of a model fluorescent polymer-poly(3-hexylthiophene) . The results show that there is indeed a "Mpamba effect" in polymer solutions. This is due to the formation of a significant temperature gradient inside the solution at higher superheating. By taking advantage of the uneven spatial distribution of nuclei, we propose a novel strategy for single-crystal dissolution cultivation in the solution system, and successfully obtained single crystals of conjugated polymers up to 1 mm in length.

Day:4-
12:15:12:30

Dr Calum Ferguson - University of Birmingham
ARTS CENTRE WOODS SCAWEN

Emerging methods for the synthesis of photocatalytic conjugated polymer nanoparticles

Photocatalytic conjugated mesoporous polymers (CMPs) have provided a platform for using visible light to catalyse a broad range of important reactions. However, the compatibility of these conjugated materials with green solvents, such as water, remains a significant challenge. Moreover, the diffusion path lengths through the material also limit their use. We have investigated the modification of photocatalytic CMP nanoparticles with a secondary polymer brush using a grafting from approach. Tuning the polymer grafted from the surface of the photocatalytic material enables the dispersibility in a range of solvents. Additionally, we have explored the synthesis of photocatalytic porous polymer nanoparticles using dispersion polymerisation. This allows us to create photocatalytic particles of a controlled size, which allows us to probe the dynamic processes that occur in photocatalytic reactions and investigate which physical factors control photocatalytic efficiency.

Day:4-
12:30:12:45

Assistant Professor Ashok Keerthi - The University of Manchester
ARTS CENTRE WOODS SCAWEN

Synthetic Engineering of Graphene NanoRibbons ,Äì It,Äôs All about Edges

Graphene nanoribbons (GNRs) are considered to be quasi one dimensional (1D) polymeric systems. Their properties such as conductivity, charge mobility and magnetism depend greatly on their width, length and edge structure. Edge states in GNRs have undergone intense theoretical scrutiny, because their coherent spin manipulation would be a milestone for spintronic and quantum computing devices. However, experimental investigations are hampered by the fact that most nanoribbons do not have the required atomic control of the edges or functionality. A series of GNRs with different structures, e.g., size and edge configuration, as well as edge doping, have been synthesized, demonstrating the possibility of fine-tuning their optoelectronic, magnetic and supramolecular (self-assembly) properties through the structural modulation from bottom-up approaches. (ref 1-3) Inspired by these spectacular properties, GNR,Äôs chemistry and physics has given a tremendous scope for next level development and applications in organic electronics, spintronic devices and quantum qubits. Recent developments and ongoing investigations on GNRs from our research group will be discussed.

Day:4-
14:00:14:30

Professor Myung-Han Yoon - GIST
ARTS CENTRE WOODS SCAWEN

Crystalline PEDOT:PSS Bioelectronic Interfaces Based on Thin Films, Fibers, 3D Fiber Networks, and Composites

In this research, we report organic bioelectronic interfaces based on highly crystalline poly(3,4-ethylenedioxythiophene):polystyrene sulfonate (PEDOT:PSS) films or microfibers to overcome the trade-off between electrical/electrochemical performance and long-term stability in water. Crystallized PEDOT:PSS exhibit excellent electrical/electrochemical/optical properties, long-term aqueous stability, and good biocompatibility for primarily cultured cardiomyocytes and neurons over several weeks. Furthermore, they are successfully employed for high-performance multi-electrode arrays to record and stimulate the electrophysiological activities of primarily cultured cardiomyocytes and chicken retinae tissues. In parallel, crystalline PEDOT:PSS microfibers and their self-fusion process are developed for single-strand wearable electrochemical transistors and 3-D microfibrillar network-based bioelectronic interfaces. Furthermore, development of various PEDOT:PSS composite materials are discussed for the purpose of electrocatalysis, gas separation membrane, and degradable/sustainable electronics.

Day:4-
14:30:14:45

DrSebastien Rochat - University of Bristol
ARTS CENTRE WOODS SCAWEN

Beyond porosity: novel applications of microporous polymers for energy harvesting and conversion

Conjugated and microporous polymers possess a unique combination of properties, the key ones being a permanent, accessible microporous structure, and a pi-conjugated system. Owing to their convenient synthetic modularity, strategies to tailor their structure and properties have been established, resulting in varied applications such as gas storage and separation, water treatment, (bio)chemical sensing, catalysis, organic electronics and energy storage. In this presentation, I will show how the optical and electronic properties of materials referred to as Polymers of Intrinsic Microporosity (PIMs) can be adapted to efficiently perform tasks related to energy conversion and storage. I will present how the electronic properties of this class of polymers can be modelled computationally using density functional theory (DFT) to pre-select materials prior to their synthesis and characterisation. Then, energy- and environment-relevant applications will be presented where the polymers are used to perform electro- and photocatalysis, where the can serve as fluorescent sensors, and as spectral converters in luminescent solar concentrator (LSCs).

Day:4- 11:00:11:30	**Dr Richard England - AstraZeneca ARTS CENTRE CINEMA**

Design and synthesis of receptor-targeted polymer drug delivery systems: working towards precision nanomedicines

To-date, the majority of polymer-drug conjugates that have entered clinic have relied on biophysical targeting mechanisms to improve the distribution of a chemotherapeutic to treat solid tumors. Unfortunately, clinical translation has been challenging for these systems, mainly owing to lack of improvement in efficacy over a given standard-of-care. This is despite benefits arising from the reduction in off-target exposure to the therapeutic and lowing Cmax values. To improve efficacy of these types of systems requires more precision, through receptor-mediated targeting with localised delivery of the therapeutic payload ideally with widespread distribution across the entire diseased tissue, maximising exposure. Here, we explore a HER-2 targeted 32-arm star polymer drug delivery system for the delivery of SN-38, a potent TOPO1 inhibitor and look at biodistribution and efficacy compared to a non-targeted system. We highlight the importance of linker design and some design considerations t

Day:4- 11:30:12:00	**Dr Severine Jeulin - L'Or√©al Research & Innovation ARTS CENTRE CINEMA**

Eco-design strategies for polymers: a cosmetic perspective.

Polymers play a pivotal role in cosmetics, owing to their varied physicochemical and mechanical properties rooted in unique macromolecular structures. Ensuring sustainable innovation while minimizing environmental impact demands the development of eco-friendly polymers without compromising cosmetic efficacy and cost competitiveness. As part of the commitments of our Group, Green Chemistry principles are actively incorporated across all facets of our polymers' life cycle ‚Äì from the origin of raw materials, to synthetic processes and their biodegradation. This presentation showcases our endeavors, featuring examples such as polymers obtained by Biotechnology or Organo-catalyzed Ring Opening Polymerization. Additionally, insights from biodegradation studies on specific examples will be shared and underscore our commitment to understanding the end-of-life challenges associated with our polymers.

Day:4- 12:00:12:30	**Dr Paul Jenkins - Unilever plc ARTS CENTRE CINEMA**

Polymers in the Beauty and Personal Care Industry. Innovations, Opportunities and Challenges.

To Follow...

Day:4- 14:00:14:30	**Dr Tim Smith - Lubrizol Ltd ARTS CENTRE CINEMA**

Polymer nanoparticles prepared via polymerization induced self-assembly deliver low friction and wear protection to next generation automotive lubricants

Polymerization-induced self-assembly (PISA) offers an attractive solution for the manufacture of self-assembled polymers. Herein we report the use of PISA to prepare stable spherical particles in mineral oil that reduce friction in lubricated contacts. Surprisingly they are also able to reduce wear, an unusual observation for polymer additives. A particularly attractive feature of dilute dispersions of spherical particles is their inherently low contribution to solution viscosity. This is advantageous for future generations of lubricants where low viscosity is a key requirement for efficiency and presents a unique strategy for delivering polymer additives without concomitant increase in viscosity. Finally, to satisfy a growing demand for research material a one-pot manufacturing process using thermally initiated reversible addition-fragmentation chain transfer (RAFT) polymerization was developed, enabling scaled production and a demonstrable pathway to commercialization.

Day:4-
14:30:14:45

Dr Antonis Gitsas - Borealis Polyolefine GmbH
ARTS CENTRE CINEMA

Halogen-free flame retardant polypropylene for sustainable Li-ion battery housing

The development and adoption of sustainable materials in electric vehicles not only contribute to the immediate goal of reducing carbon emissions, but also pave the way for a more resilient and environmentally conscious future in the field of transportation. The evolution of such polymer composites will be crucial in addressing the evolving needs of the industry. Polypropylene compounds bring about a dual benefit by contributing to both reduced vehicle weight and offering a more eco-friendly alternative to conventional plastic and metal solutions. These PP compounds accommodate high voltages and also exhibit the ability to delay fire growth in case of an accident, while enduring elevated operating temperatures for longer periods. Furthermore, the interplay between their mechanical recycling and flame retardancy will be discussed. The presented halogen-free polymer designs exhibit excellent processability, chemical resistance, and compatibility with laser welding assembly techniques.

Day:4-
11:00:11:30

Professor Dominik Konkolewicz - Miami University
OC105

Powering Polymer Transformations Using Energy

This talk will discuss the transformations possible in polymer materials using external energy sources. These can be chemical fuels/high energy compounds or light. Using these external sources of energy polymer materials with interesting responses to external stimuli can be realized in a way that goes beyond equilibrium systems. Specifically networks and bulk property changes induced through transient energy will be explored, with molecular design principles to guide the responsive systems.

Day:3-
12:00:12:30

Professor Greg Qiao - The University of Melbourne
OC105

Temporal controlled precision polymers

This presentation will describe our new activation or mediation methods for RAFT polymerization, including photo iniferter-RAFT, Sono-RAFT, Fenton-RAFT, blood catalyzed RAFT, as well as RAFT initiated by the growth of bacteria. Among these, they can exhibit temporal control. Our recent interest lies in investigating the chain end fidelity of Sono-RAFT and improving the reaction speed of iniferter-RAFT. We discovered that with controlled ultrasonic power, a high chain-end fidelity can be achieved. This is demonstrated by chain end extension (Poly. Chem. 2022, 6140), and star polymer with nearly quantitative arm-to-star conversions (J Poly Sci. 2023, 1372), Sono-RAFT under a flow reactor (Macromolecules 2023, 6920) and iniferter-RAFT with more than 50% ionic liquid in water. A high polymerization rate and chain end fidelity are crucial for creating complex polymeric architectures using robotic synthesis. Using a robot, we were able to create a 39-block copolymer with block sequence control (Chem.,ÄìA Euro J, 2023, e202301767). Facilitating different complex polymer structures control with just a click of the mouse.

Day:4-
12:30:12:45

Assistant Professor Celine Calvino - Livmats, University of Freiburg
OC105

Harnessing the photoperformance of Quinolinones for gated photo-driven cyclability and reversible photoligation

This work proposes to enhance the renewability of polymers by incorporating photoresponsive motifs into the matrix, capable of reversible formation and cleavage of covalent bonds to ultimately trigger polymerization and depolymerization on demand upon dissimilar irradiations. In this context, our research harnesses the photoperformance of the previously underexplored Quinolinone photoresponsive motif to create a covalent gated system. Through a comprehensive examination of cycloadditions and reversions, including reaction rates, conversions, and resulting products, we demonstrate the clear superiority of Quinolinones over other reported reversible responsive motifs in light-induced reactions. Furthermore, our analysis reveals a remarkable level of cyclability at both the molecular and macromolecular scale. These findings highlight quinonlinone's effectiveness in reversible photoligation for polymeric systems, opening avenues for designing innovative and sustainable materials.

Day:4-
14:30:14:45

Dr Azra Kocaarslan - Karlsruhe Institue of Technology
OC105

Polyurethane Synthesis via Non-isocyanate Photo-induced Ligation Approach

Synthetic chemistry plays an indispensable role in materials science, more specifically in the development of artificial polymer-durable materials. While the effective use of different synthetic methodologies in polymer science allows to design of polymers for an actual purpose, diverse types of bonds in polymers effect directly the physical properties of the materials. Hence, functionalization of polymers can impart polymers with differentiated features opening the avenue to orthogonality. In this regard, urethane linkage introduces paramount properties to polymers such as durability and resistance. Polyurethanes are mostly produced via isocyanate-hydroxyl chemistry. Isocyanates play a crucial role as building blocks and are usually derived from highly toxic materials. In this manner, the photo-induced rearrangement of acyl azide compound yielding the isocyanate group named Curtius reaction has potential in line with non-isocyanate methodology. Hence, we aim to the preparation of well

Day:4-
11:00:11:30

Professor Laura Hartmann - University Freiburg
OC003

Making the connection: protein-polymer conjugates from native proteins and thiol-induced light-activated controlled radical polymerization

Protein-polymer conjugates are broadly applied – from the biomedical use of PEGylated protein therapeutics to the stabilization of enzymes in biotechnological processes. This talk will present our latest results on a new approach for the direct synthesis of protein-polymer conjugates from native polymers and the recently introduced thiol-induced light-activated controlled radical polymerization (TIRP). Polymerization is performed in buffered aqueous media, ensuring high stability of the native protein structure. Furthermore, controlled features of the polymerization are maintained for both, common monomers such as N-isopropyacrylamide as well as for more complex monomers such as glycoacrylamides. Here we demonstrate the applicability of our method to derive different types of protein-(glyco)polymer conjugates and their exemplary applications e.g., in the modification of chip surfaces, the formation of defined protein-protein clusters and the formulation of drug delivery vehicles.

Day:4-
12:00:12:15

Assistant Professor Gokhan Yilmaz - University of Warwick
OC003

Multivalent Glycopolymeric Materials for Selective and Tunable Binding with Different Lectins

TBC

Day:4-
12:15:12:30

Mr Callum Johnson - Durham University
OC003

Biosensing Platforms for the Detection of Bacterial Lectins

Prompt diagnosis of infectious disease is vital in combatting the spread of infection and improving patient prognosis. Potential biomarkers for point of care (POC) testing include carbohydrate binding proteins, or lectins, that are associated with a variety of pathogens such as bacteria, viruses and fungi. Lectins bind to glycans displayed on almost all cell surfaces and play a key role in cellular recognition during pathogenesis. Inspired by the mammalian glycocalyx, the design of a biosensor for the detection of bacterial lectins is described. Eleven fluorescent glycopolymers that can interact with bacterial lectins were synthesised. This array has enabled the discrimination of genetically engineered bacteria, and clinical samples. Electrode surfaces have been functionalised with these glycopolymers with the potential to enable thermal sensing of bacteria.

Day:4-
12:30:12:45

Mr Clement Gonnot - Polymer Synthesis
OC003

Cyclic Clickable Polymer Scaffolds via Ring-Expansion Metathesis Polymerization as a Platform for Advanced Materials Design

Cyclic polymers are a unique class of macromolecules with fascinating properties, singularly different from those of linear polymers. Although their topological effects reveal potential applications, their synthesis still remains a challenge. Among the various synthetic approaches, ring-expansion metathesis polymerization (REMP) is the only method capable of producing topologically pure cyclic polyolefins. However, using this methodology only yields high molecular weight carbon-based cyclic polymers, which limits applications. Here, we report the first synthesis by REMP of a new universal cyclic polymer platform with an unprecedent length range and control over DPn, with clickable azlactone groups along the polymer chain, enabling post-modification polymerization with amino-terminated molecules without generation of by-products. The inhibitory effect of multivalent sugars-functionalized cyclic polymers was evaluated against a full range of lectins and compared to their linear analogs.

Day:4-
14:00:14:30

Professor Guosong Chen - Fudan University
OC003

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Day:4-
14:30:14:45

Ms Federica Daus - University of Bologna
OC003

Bacterial cellulose from Kombucha tea as a promising green material

Bacterial cellulose (BC) is a linear homopolysaccharide with molecular formula (C6H10O5)n. It is characterized by a 3D network of microfibrils stabilized by hydrogen bonds, which result in outstanding mechanical properties, hydrophilicity and great capacity of holding water. One of the many substrates from which BC can be obtained is Kombucha tea, a slightly alcoholic sugared beverage produced by the fermentation of tea leaves and sugar, during which a gelatinous cellulose-based biofilm called Scoby ("Symbiotic Culture of Bacteria and Yeasts") is formed. In this work, after a preliminary characterization of the so-obtained raw material and the purified BC membrane, its mechanical properties were highly improved by the addition of a plasticizing agent. The above-mentioned analyses suggested that bacterial cellulose obtained from Kombucha Scoby is a promising material that can be valuably used for many different applications.

Day:4-
11:00:11:15

Dr Daniel Keddie - University of Nottingham
ARTS CENTRE STUDIO

Sustainable approaches towards polymers with bespoke properties

Within our research group we are interested in the development of sustainable synthetic protocols for the preparation of polymeric materials with bespoke structure and properties.

Recent efforts have centred on the development of methodologies for the synthesis of polymers with structures tailored to a range of specific applications. To achieve this, we have exploited biobased monomers as polymer building blocks, whilst maintaining strong focus on sustainability throughout synthesis and post-reaction processing.

In this presentation several aspects of this work will be discussed.

Day:4-11:15:11:30

Dr Sara Velasquez - University of Twente
ARTS CENTRE STUDIO

Lignin based-AgNP nanocarriers for sustainable plant protection without chemical fungicides

Lignin nanoparticles or capsules allow controlled release of pesticides, herbicides and fertilizers. AgNP are promising agents improve agricultural crop growth and yield by enhancing seed germination, increasing water and fertilizer efficiency and providing antibacterial, antifungal, anti/inflammatory, and anti/angiogenic properties. However their shelf life and repeated need of application are a drawback, therefore we encapsulated green AgNP, produced from reduced silver nitrate by grass waste or lignin, in lignin to provide targeted on-demand delivery of sustainable agrochemicals without chemical fungicides. The effectiveness of lignin-AgNP capsule in suppressing Botryosphaeria dothidea (Bot) and Trichoderma spores was tested in vitro. Bot spores treated with AgNP showed decreased germination due to the lignin degradation when in contact with the spore.

Day:4-11:30:11:45

Ms Nikola Krivankova - KTH Royal Institute of Technology
ARTS CENTRE STUDIO

Responsive polymer gels

Stimuli-responsive polymers, or smart/intelligent polymers, are capable of changing their physical and/or chemical properties at an external trigger. This trigger could be of a very diverse nature, e.g. pH, temperature, electric or magnetic field, redox potential, etc. Due to their versatile properties, they these polymers are applicable in many different fields, such as biology and medicine, functional coatings, sensors or electronics and soft machine applications. This presentation will focus on our work on the synthesis of upper critical solution temperature (UCST) transition-exhibiting polymers, stimuli-responsive reversible bonding and debonding of microparticles, and functional surfaces that adhere to each other and debond at a trigger.

Day:4-11:45:12:00

Mr Akshay Subhash Patil - Hanyang University, Seoul.
ARTS CENTRE STUDIO

Synthesis of UV blocking carbon dots, composite with polyvinyl alcohol film: A novel smart food packaging materials

Sustainable food packaging materials are crucial for enhancing material quality and shelf life of the materials. While ZnO and TiO2 nanocomposites, common UV blockers, face limitations such as stability, white cast, and toxicity. In the last decade, carbon dots (CDs) have gained prominence in UV blocking due to their optical properties, biocompatibility, and UV-blocking capabilities. CDs in PVA (PVA@CDs) composite films offer active food monitoring, UV, and moisture barriers, along with antibacterial and antioxidant properties, enhancing the quality of packaged food.

In this work, we synthesized CDs via hydrothermal method using Tyrosine and Thiourea at optimized reaction conditions which is 12 hr. at 200°C having size 5-20nm. PVA@CDs-20 films were effectively blocked 100% of UV-C (200-280 nm), 95% of UV-B (280-320 nm), and around 60-70% of UV light blocks from the UV-A (320-400 nm) region. It extends the shelf life of strawberries and grapes to 84 hr. under UV light exposure.

Day:4-
11:45:12:00

Mr Sifan Ji - University of Bordeaux
ARTS CENTRE STUDIO

Polymeric Analogues of Green Fluorescent Protein for Cell Imaging

Green fluorescent protein (GFP), which is composed of a central chromophore surrounded by a protein cage, is a unique fluorescent probe for life science awarded the 2008 Nobel Prize in Chemistry. Recently, synthetic GFP chromophore analogues have been developed to mimic photophysical properties of GFP. However, little attention has been paid to influences of polymer backbones on the dyes. Here, we present protein-like polymers obtained via ring-opening polymerization (ROP) of N-carboxyanhydrides (NCAs) initiated by GFP chromophore analogues to study their photophysical properties. We focused on water-soluble GFP-like polypeptides with brightness and fluorescence efficacy in the range of natural protein models. Their fluorescence was influenced by polypeptide backbones and particularly switched-on by coacervation process, which was successfully used to follow the internalization of polymers in cells. This paves the way for further applications in bio-imaging and bio-sensing.

Day:4-
12:00:12:15

Mr Taha Behroozi Kohlan - KTH Royal Institute of Technology
ARTS CENTRE STUDIO

Cell instructive and self-healing dynamic covalent hydrogels based on hyaluronic acid using Schiff base chemistry

Biological microenvironments are dynamic, providing cells with biomechanical cues that regulate cell behavior. Dynamic covalent hydrogels (DCH) are potential candidates to address the limitations of static hydrogels. Here, hyaluronic acid based DCH were synthesized using Schiff base chemistry. The structure, stability, morphology, and mechanical properties of the hydrogels were correlated with the formed crosslinks of imine, hydrazone, and oxime. Moreover, obtained DCH exhibited self-healing ability, assessed both macroscopically and through shear rheology. To evaluate the cellular response, human dermal fibroblast cells were cultured on the surface (2D) and into the hydrogels (3D). The morphology, spreading, and migration of cells were analyzed considering the modulus and stress relaxation rate of DCH. The results indicated that the network dynamics and stress relaxation rates are influential in determining the cellular response in the hydrogels with similar moduli.

Day:4-
12:15:12:30

Mr Brian BarberNunez - Institut de Chimie et des Matériaux Paris-Est
ARTS CENTRE STUDIO

Versatile functionalization platform from functional doubly porous 2-methylene-1,3-dioxepane-based materials: towards bioapplications

Functional doubly porous crosslinked networks based on the free-radical copolymerization of 2-methylene-1,3-dioxepane with divinyl adipate and a functionalizable monomer containing either chloro- or azido- pending groups were prepared via a double porogen templating approach. The MDO-based materials have been prepared with two porosity levels (≈250 μm and ≈1.8 μm) while the interconnectivity of the pores was evidenced by observation of a synergic effect during water uptake experiments. Complete degradation of the scaffolds was observed under accelerated conditions (alkaline medium in solvent) in 15 min while they were stable in PBS for more than 3 months. The pore surface functionalization has been assessed with different alkyne and amine-derivatized (macro)molecules. The presence of azide or chlorine moieties at the pore surface constitutes a versatile functionalization platform for the derivatization of such biporous polymers towards antibacterial activities or tissue engineering.

Day:4-
12:30:12:45

Teagan Carr - Trent University
ARTS CENTRE STUDIO

Adsorption & Flocculation of Water Contaminants Using Polyacrylamide on Activated Carbon Surfaces for Environmental Remediation

Oil sands process-affected water (OSPW) is characterized by high alkalinity and is contaminated with organic acids and heavy metals [1]. These contaminants such as naphthenic acids (NAs) have been of interest in the oil industry since the first observation of corrosion-based damage to refineries in the

1920s [2]. Current research indicates that carbon-grafted polymers can potentially adsorb organic and inorganic waste [3-4]. To produce a more viable and cost-effective remediation method polyacrylamide is grafted onto activated carbon (AC) to create an adsorbing and flocculating material. The AC is made using petroleum coke to help recycle some of the waste produced during the oil sands process. Where the thermally treated AC is oxidation to allow for the addition of an initiator, bromo isobutyl bromide [5,6]. Next, PAM was grafted onto the AC surface via atom transfer radical polymerization (ATRP), a controlled polymerization technique compatible with both the AC substrate, acrylamide monomer, and the use of an aqueous solvent. Initial efforts demonstrate the adsorbing properties of the AC and AC-PAM; however, a more thorough understanding of the adsorption mechanism is required [6]. We have explored parameters related to the grafting percentage of initiator and polymer chains to the carbon surface to observe the effects on the contaminant's adsorption, along with variation to polymerization conditions to improve the overall flocculation. The effects of these variations have been demonstrated by XPS, Elemental analysis, and HPLC-RID. References

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Day:4- 11:00:11:30	**Professor HERMIS IATROU - NATIONAL AND KAPODISTRIAN UNIVERSITY OF ATHENS OC002**

Multi-responsive nanostructured materials as pharmaceutical vehicles for the targeted delivery to treat cancer, cardiovascular, kidney and other diseases.

Novel, multifunctional nanoparticles and hydrogels that exhibit a unique set of properties are presented. The materials are comprised of non-cytotoxic polymers. The amphiphilic hybrid materials assemble in aqueous media to form hydrogels or nanoparticles, comprised of an outer PEO corona and a pH- and redox- responsive hydrophobic layer. Doxorubicin, proteins or other drugs were efficiently encapsulated or chemically linked with a labile bond and were released that simulate the healthy and pathological tissue environment. In vivo preclinical tests revealed a highly targeted efficacy.

Hybrid-polypeptidic materials formed injectable in situ forming quickly self-healing and responsive hydrogels. Rheology, Circular Dichroism, Small-Angle Neutron Scattering and Scanning Electron

Microscopy were employed to shed light to the structure of the polymers and how it affects their efficacy. The results suggest that these biomaterials have the potential to be used in a number of bioapplications.

Day:4- 11:30:11:45	**Dr Kristyna Kolouchova - Gent University OC002**

In Vivo Biodegradation Monitoring of Hybrid Gelatin-based Hydrogels

Cross-linked gelatin-based hydrogels are highly promising cell-interactive, biocompatible, and biodegradable materials serving tissue engineering. However, in vivo monitoring of their biodegradation remains challenging. Currently, data rely on ex vivo examinations in animals, limiting clinical translation. To address this, we developed hybrid materials using photo-crosslinkable gelatin and synthetic polymers with diagnostic capabilities. Utilizing poly[N-(2,2-difluoroethyl)acrylamide] (DFEA), a 19F MRI tracer, [1] or poly[5-acrylamido-2,4,6-triiodoisophthalic acid] (ATIPA), [2] a contrast agent for radioimaging, our hydrogels are non-cytotoxic, support cell proliferation, and offer tuneable physico-chemical properties. This innovation presents a breakthrough towards non-destructive in vivo biodegradation monitoring of implants, also applicable beyond hydrogels.

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[2] Kolouchova, K. et al. Applied Engineering Materials (2023)

Day:4- 12:00:12:15	**Professor Lifeng Yan - University of Science and Technology of China OC002**

Polypeptide Nanoparticles with NIR-II Dyes for Efficient Phototheranostics

The second near-infrared IIa window (NIR-IIa, 1300nm~1400nm) enables high-resolution imaging and deep-tissue tumor treatment due to its unique low tissue scattering and autofluorescence, high temporal-spatial resolution, deep tissue penetration, and NIR-IIa fluorescence imaging-guided phototherapy ar of specific attractive. However, organic dyes and their nanoparticles for NIR-IIa phototheranostics are still scarce. Here, we have synthesized a Br- and piperazine-modified cyanine dye (FN) and its nanomicelles encapsulated by an amphiphilic polypeptide with sidechains of tertiary amine (PEA). The J-aggregates of P@FN9 with 1116 nm absorption and efficient NIR-IIa fluorescence emission hav been formed by the self-assembly of FN and PEA. P@FN9 nanoparticles (NPs) show good stability and high photothermal conversion efficiency (55.4%). In addition, the high spatial resolution and signal-to-background ratio (SBR) of P@FN9 were proven by NIR-IIa fluorescence imaging of mouse vasculature.

Day:4- 12:15:12:30	**Mr Lucas Al-Shok - University of Warwick OC002**

Synthesis of Poly(3-hydroxy butyrate) (PHB) copolymers using lactones from renewable resources and using qualitative MALDI-ToF imaging

PHB is an attractive biobased material that has long been known as an alternative to petrochemical derived commodity plastics. In order to widen its application and properties, the copolymerisation of PHB with other lactones has been investigated. The commercially available catalyst ZnEt2 was used to copolymerise β-BL with both menthide and δ-HL, respectively. MALDI-ToF MS in combination with a genetic algorithm, designed to automatically assign the mass spectra, provided a useful tool qualtitatively assess the copolymer structures and end groups. Further, Heatmap plots of the copolymer structures proved to be a valuble and easy method to monitor polymerisations and depolymerisations.

Day:4- 14:00:14:30	**Professor Yongfeng Men - Changchun Institute of Applied Chemistry, Chinese Academy of Sciences OC002**

Molecular weight and distribution dependency of crystallization and mechanical properties of polypropylene

Molecular weight and its distribution are the most important parameters in polymers that determines the processing and mechanical properties of the final products. In this talk, we present a systemic study on the effect of molecular weight and distribution in polypropylene on the formation of mesophase during quenching the samples from molten state into ice water. It turned out that there are two critical molecular weights between which the polypropylenes can hardly crystallize into mesophase. Further investigation revealed that it is the number average molecular weight that controls such crystallization habit regardless of the molecular weight distribution. This seemingly peculiar result is found to be due to the interplay between the chain radius of gyration and the crystalline lamellar spacing. When the two dimensions are close to each other, crystallization of alpha-phase is very quick so that the mesophase is suppressed. Upon stretching samples of different molecular weight and di

Day:4- 14:30:14:45	**Professor NAAR NACIRA NAAR WIFE ABDELLI - Faculty of chemistry University STHB Algiers OC002**

Effect of alkali and acid treatments on physicochemical and morphological properties on Algerian Spart cellulosic fibers destined to paper pulp industry

The pulp and paper industry has been gaining importance in recent years. Due to the growing demand for paper products, the annual world production of pulp is approximately 180 million tons , leading to intensive use of hardwood and softwood as primary source of cellulosic fibers, the major constituent of paper. L Lygeum Spartum commonly known as Spart is one of the most abun. The purpose of this study is to examine the effectiveness of different treatments on Algerian Spart fibers (Lygeum spartum) using sodium hydroxide at different concentration (8, 10,15 and 22% NaOH), and sulfuric acid for 2h at 100°C. Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD) and Scanning electron microscopy (SEM) analysis were used to characterize the microstructural changes in treated fibers. The results of FTIR confirmed the presence of cellulose in raw fibers, the crystallinity index is 49,1 %. Alkali and acid treatments leads to exposure free hydroxyl group Fourier transform

Day:4- 11:00:11:30	**Dr Nazila Kamaly - Imperial College London OC004**

Cross-linked and co-polymerised covalent nanogels via single step in situ nanopolymerisation for stimuli-responsive drug delivery

Nanogels are hydrogels within the nanometer range consisting of crosslinked porous polymer networks with the ability to retain high volumes of water or biological fluids whilst maintaining their structure. They have a wide range of chemical flexibility in their design, allowing their biophysicochemical characteristics such as size, charge, targeting, degree of porosity and degradability to be easily tuned by the choice of monomeric building blocks. This flexibility in their chemical design makes them an ideal programmable nanoplatform for the delivery of biological drugs such as proteins and nucleic acids. In this talk I will present some of our work on stimuli-responsive nanogels obtained via nanopolymerisation.

Day:4- 11:30:11:45	**Professor Iolanda Francolini - Sapienza University of Rome OC004**

Using natural phenols as building blocks for the synthesis of bio-based and bioactive polymers

The design of polymers from renewable sources or waste is one of the most intense field of research in circular bioeconomy. Phenols, terpenes, vegetable oils are eligible raw materials for the manufacture of a variety of materials, including elastomers, plastics, hydrogels, and composites [1]. Herein natural phenols, tyrosol (Ty) and eugenol (EU), were used for the synthesis of bioactive polymers. Ty is an abundant phenol in olive oil mill wastewater and EU is a phenolic monoterpenoid obtained from lignin. The phenol group confers to them antimicrobial and antioxidant activity. Both compounds were functionalized with acrylic moieties to obtain polymerizable monomers. In the case of EU, the allyl group was submitted to epoxidation and then reacted with 2-hydroxyethyl methacrylate (HEMA) to obtain EUMA monomer. The obtained polymers showed elastomeric properties and a relationship between polymer composition and bioactivity was found.

Day:4-
11:45:12:00

Mr BURHAN BEYCAN - Ankara University
OC004

Cotton Reimagined: Surface Functionalization of Cotton Fabric Using Waterborne Polyurethane/Poly(2-ethyl 2-oxazoline) Blends for Biomedical Textiles

This study investigates electrospinning waterborne polyurethane (WBPU) with poly(2-ethyl-2 oxazoline) (P2Ox) or its hydrolyzed form. The goal is to create nanofibrous coatings with biocompatible, chemically attractive surfaces. Key parameters are investigated distance, potential, and polymer blend ratios, aiming for fabrics suitable for biomedical use, such as reusable masks. P2Ox undergoes acidic hydrolysis to introduce linear poly(ethylene imine) (L-PEI), forming P2Ox-co-PEI. WBPU is blended with P2Ox or P2Ox-co-PEI to improve mechanical strength, biocompatibility, and antibacterial properties of nanofibers. These hybrid nanofibers are electrospun onto cotton, and their structural, hydrophilic, and mechanical properties are analyzed using ATR-FTIR, contact-angle measurements, SEM, tensile and air permeability tests are analyzed.This research offers insights into WBPU/P2Ox fabric textures for biomedical textiles, emphasizing functional groups interacting with biomolecules.

Day:4-
12:00:12:15

Assistant Professor Yvonne Shuen Lann Choo - Xiamen University Malaysia
OC004

Dual-Action Self-Healing in Sunlight-Actuated Shape-Memory Polymers

Light is the most convenient stimuli to enable actuation of shape-memory polymers (SMPs) because it can be easily halted and resumed on user,Äôs demand simply by rapid on-off toggling or controlling the intensity of excitation light remotely, instantly and precisely without physical contact. Besides shape-memory behaviour, light stimulated self-healing is desired to extend the lifetime of these materials in an opportune manner. Natural sunlight is an ideal alternative to infrared and ultraviolet light for shape-memory and self-healing actuation because it is an inexhaustible clean energy source that is safe for human health. However, achieving shape-memory and self-healing in SMPs using sunlight presents a challenge due to its comparatively low intensity as a light source. One prevalent strategy to address this constraint is to incorporate photothermal fillers, but the issue of poor compatibility between photothermal fillers in polymers persists. In this work, a facile approach to fabricate photothermal filler-free sunlight responsive SMPs with shape-memory and self-healing capabilities was introduced. The performance and trends observed in the fabricated series of poly(urethane methacrylate)-based SMPs were discussed, giving emphasis on the use of optical microscopic techniques to elucidate its dual-action self-healing nature.

Day:4-
12:15:12:30

Dr Spyridon Efstathiou - University of Warwick
OC004

Moisture-cured Solvent free Silylated Poly(ether-urea) Pressure Sensitive Adhesives (PSAs) for use in Transdermal Drug Delivery

Improving the adhesion and tack of PSAs remains an ongoing challenge. Polyureas often have stronger hydrogen bonding relative to polyurethanes which are common in adhesive applications. An increased adhesion reduces the requirements for additives such as tackifier resins to achieve high levels of adhesion. In this work, novel silylated polyurea moisture-curable PSAs are introduced with moisture curing silyl terminated polyether-urea prepolymer variants. Although the variants showed the same thermal properties, their adhesion and tack was tuneable exceeding the borders of the Chang’s classification windows for removable PSAs while demonstrating superior adhesion compared to commercially available transdermal adhesive products.

Day:4-12:30:12:45	**Dr Valentina Cuzzucoli Crucitti - University of Nottingham** **OC004**

Fungicides Actives-Free Based on (meth) Acrylate Polymers for Protection of Wheat Crops.

The battle against fungal infections in crops has traditionally relied heavily on fungicides, chemicals that target and eliminate fungi. Seeking a more sustainable and environmentally friendly approach, a series of homopolymers have been synthesised and investigated for their ability to prevent fungal attachment to plant surfaces, a crucial step in the infection process. By physically blocking fungal adhesion, these homopolymers can effectively hinder fungal growth and protect crops without relying on harmful chemicals. For the first time, a groundbreaking field trial assessed the efficacy of these homopolymers in protecting wheat plants from Z. tritici, a prevalent fungal pathogen. The successful field trial of these homopolymers represents a significant milestone in the pursue for eco-friendly alternatives to conventional fungicides. Field trial results reinforced the reliability of the smaller-scale laboratory assays and scale-up methodologies.

Day:4-14:00:14:15	**Dr Parvaneh Eskandari - University of Birmingham** **OC004**

Aggregation-induced-active Stimuli-responsive based Polymeric Nano-objects for Water Treatment Application

In the last years, controlling the self-assembly behavior of stimuli-responsive nano-objects, including micelles, vesicles, worm-like, etc., at different conditions is considered a pertinent challenge in the polymer community. The aim of the project was to synthesize aggregation-induced-active (AIE) stimuli-responsive polymeric nano-objects to control the self-assemblies morphologies of the prepared nano-objects. Two types of nanoobjects, micelle, and vesicles, including PDMAEMA-b-P(BzMA-co-TPEMA) [PDMAEMA: poly(N,Ndimethylaminoethyl methacrylate); P(BzMA-TPEMA): poly[benzyl methacrylate-co-tetraphenylethene methacrylate]] were synthesized by using reversible addition,àífragmentation by-transfer (RAFT)- mediated polymerization-induced self-assembly (PISA), which combines polymerization and self-assembly in a single step. Transmission electron microscope and dynamic light scattering (DLS) analysis were used to confirm the formed self-assembly morphologies. The optical properties of the prepared nano-objects were studied by UV/Vis and fluorescence spectroscopies. For responsivity investigations, the hydrodynamic diameter and Zeta-potential (Œ∂-potential) of the sample,Äôs aqueous solution were measured by DLS. Finally, the controlled self-assemblies were utilized as sensors for nitrophenolic compounds (NPCs), a type of explosive, in an aqueous solution. The fluorescence-active component of the synthesized nano-objects played a crucial role in detecting the NPCs in aqueous solutions. Additionally, the detection performance of the prepared nano-objects under different conditions of stimuli and morphologies was compared.

Day:4-14:15:14:30	**Ms Yuwen Zhang - University of Padova** **OC004**

Hemoglobin-catalyzed Atom Transfer Radical Polymerization for Surface Modification of Wound Dressing Materials

Traditional wound dressings are prone to adhering to the wound which can promote adhesion of microorganisms possibly leading to a potential risk of secondary injury. Herein, a cytocompatible hemoglobin-catalyzed atom transfer radical polymerization (ATRP) is developed to precisely modify the antibacterial activity and hydrophilicity of wound dressings’ surface. First, chitosan-based cryogels are constructed and functionalized with an ATRP initiator. These materials can serve as a scaffold to grow a variety of polymer brushes via surface initiated (SI)-ATRP, to modulate the interfacial properties of the cryogels. Thus, zwitterionic polymer brushes were grown from one side of the cryogel to achieve antimicrobial properties, while hydrophobic brushes were introduced on the opposite side, which could facilitate the removal of the dressing. Thus, a robust and cytocompatible method was developed to tailor the properties of wound dressing materials.

Day:4-
14:30:14:45

Dr Benjamin Fiedler - University College London
OC004

Sugar-coated nanoparticles: Investigating lipid-terminated glycopolymers for targeted nanoparticle delivery of nucleic acids

TBC

Day:4-
11:00:11:30

Dr Pratik Gurnani - UCL
OC104

Polymeric delivery of self-amplifying messenger RNA

Day:4-
11:30:11:45

Dr Elisa Guazzelli - University of Pisa
OC104

Single-chain folding amphiphilic random copolymers as drug delivery system for highly hydrophobic anticancer Combretastatin A4

Amphiphilic random copolymers exhibit hydrophobic interactions that may result in the formation of unimer micelles in water, through a single-chain folding mechanism. Through tailored synthesis and comprehensive characterization of their size, shape, and conformation, these materials show promise for applications in environmental chemistry, industrial catalysis, biomedicine, and drug delivery.1,2 PEGMAx-co-FAy copolymers were synthesized using ARGET-ATRP and were analyzed in water using a combination of small angle X-ray scattering (SAXS), dynamic light scattering, and diffusion-ordered NMR spectroscopy. In particular, the SAXS studies confirmed the formation of compact-globular, self-folded unimer micelles.3 The hydrophobic nanocavities formed were utilized to encapsulate Combretastatin A-4 (CA-4), an active but poorly water-soluble anticancer drug.4 The loaded unimer micelles cytotoxicity against different cancerous cell lines was tested and fluorescein-labeled copolymers were prepared and used for biodistribution assays. Funding: MIUR, project PRIN 2022 BIOCOMMON, CUP I53D23004120006, E. Martinelli. References 1. Single-Chain Polymer Nanoparticles; Pomposo, J.A., Ed.; Wiley-VCH , Germany, 2017; 2. Terashima, T. et al, J. Oleo Sci. 2020, 2020, 1,Äì10; 3. Guazzelli E., et al., Macromol Chem Phys, 2023, 224, 220036; 4. Calosi M., et al., Polymers, 2022, 14 (4), 774.

Day:4-
11:45:12:00

Mr Yingtong Luo - Eindhoven University of Technology
OC104

Polymer Vesicles with Integrated Photothermal Responsiveness

Functionalized polymer vesicles have been proven to be highly promising in biomedical applications due to their good biocompatibility, easy processability, and multifunctional responsive capacities. However, photothermal-responsive polymer vesicles triggered by near-infrared (NIR) light have not been widely reported until now. Herein, we propose a new strategy for designing NIR light-mediated photothermal polymer vesicles. The new class of functionalized polymer vesicles inherited the NIR-mediated high photothermal performance of the photothermal agent. And the photothermal properties and bilayer structure of PTA-Ps after laser irradiation were still intact, which demonstrated that they could be applied as a robust platform in photothermal therapy. Besides their photothermal performance, the loading capacity of PTA-Ps was investigated as well. These properties make this new class of functionalized polymer vesicles an interesting platform for synergistic therapy in anticancer treatment.

Day:4-
12:00:12:15

Ms Hayley Parkin - University of Victoria
OC104

Mechanism of Action and Design of Potent Antibacterial Block Copolymer Nanofibers

Self-assembled polymer nanoparticles are promising antibacterials, with non-spherical morphologies of particular interest as recent work has demonstrated enhanced activity relative to spherical counterparts. However, the reasons for this enhancement are currently unclear. Low length dispersity diblock copolymer nanofibers with a crystalline poly(fluorenetrimethylenecarbonate) core and a partially protonated poly(dimethylaminoethylmethacrylate) corona were prepared via living crystallization-driven self-assembly. Their behavior was compared to that of analogous nanospheres containing an amorphous core. Nanofibers alone were observed to cause significant bacterial damage, and drug-loading studies indicated that small nanoparticles (ca. 15 – 25 nm) were superior drug delivery vehicles. The demonstrated consequences for nanoparticle size and morphology control on antibacterial activity may inform the design of potent antibacterial agents.

Day:4- 12:15:12:30	**Ms Gokce Tidim - RWTH Aachen University OC104**

Layer-by-layer assembly of chitosan/alginate thin films containing Salmonella enterica bacteriophages for antibacterial applications

Bacteriophages are natural predators of bacteria and are promising alternatives to antibiotics. This study presents fabrication of a Salmonella enterica bacteriophage containing ultra-thin multilayer film composed of chitosan and alginate and demonstrates its potential as an antibacterial coating for food packaging applications. Chitosan/alginate film was prepared through layer-by-layer (LbL) self-assembly technique. A bacteriophage, which infects Salmonella enterica subsp. enterica serovar Enteritidis, was post-loaded into chitosan/alginate film. The LbL growth, stability, and surface morphology of chitosan/alginate film as well as phage deposition into multilayers were analysed through ellipsometry, QCM-D and AFM techniques. We showed that wrapping a Salmonella Enteritidis contaminated chicken piece with aluminium foil whose surface was modified with phage loaded chitosan/alginate multilayers decreased the number of colonies on the chicken meat.

Day:4- 12:30:12:45	**Markus Kötzsche - Friedrich Schiller University Jena OC104**

Effect of Fluorinated Indole in Guanidinium-Containing Polymethacrylamides for Gene Delivery

Cell-penetrating peptides (CPPs) have been an inspiring source for gene delivery carriers. Synthetic polymers containing guanidine in the side-chain mimic the arginine of peptides for efficient gene delivery. Incorporating hydrophobic moieties like tryptophan in CPPs could further improve the transfection ability of the polymeric carriers. An synthetic method, which is not observed in nature, is fluorination.

Here, we prepared methacrylamide terpolymers via an aqueous RAFT polymerisation containing 50 to 75 mol% guanidine as cationic group for the formulation of polyplexes with pDNA, siRNA or DNA decoys. Indole or 5/6-fluoro-substituted indole was incorporated with 5 to 23 mol% to compare the effect of fluorination of the hydrophobic side-chain. The formulated polyplexes had hydrodynamic diameters around 125 nm with zeta potentials of 40 mV for N/P ratios between 1 and 40. Transfection studies with N/P ratios 5, 10 and 20 showed in increase for fluoroindole containing polymers.

Day:4- 14:00:14:30	**Professor GENGXIN LIU - Donghua University OC104**

Dynamics of 3-dimension architectured polymers: beyond entanglements

Day:4- 14:30:14:45	**Ms XINRAN GUAN - Ghent University OC104**

Reversibly Thermoresponsive Binding of Pillar[n]arenes Utilizing Lower Critical Solution Temperature in a Poly(2-n-propyl-2-oxazoline) Host-Guest system

Two types of thermoresponsive poly(2-n-propyl-2-oxazoline) consisting of a 4,4'-bipyridinium unit (PnPox-MV) or a 5-aminopentanenitrile unit (PnPox-CN) as the end-group were prepared. The complexation between the water-soluble pillar[n]arenes (WP6 and WP5) and poly(2-n-propyl-2-oxazoline) bearing a guest-group in water was investigated. The 1:1 host-guest complexes, i.e., PnPox-MV - WP6 and PnPox-CN - WP5, were formed mainly driven by electrostatic interactions at 283.15 K with the association constants of (3.84 ± 0.25) × 105 M-1 and (0.96 ± 0.04) × 104 M−1 respectively. When heated above the cloud-point temperatures, the poly(2-n-propyl-2-oxazoline) collapses and precipitates due to the effect of lower critical solution temperature (LCST), allowing the pillar[n]arenes to reversible selective binding because of the complexation-decomplexation of the host-guest complexes. Impressively, the supramolecular complexes unveil a general approach to efficient recovery of the host and guest.

Day:4- 11:00:11:30	**Dr Patrick LACROIX-DESMAZES - Institut Charles Gerhardt Montpellier, ICGM - UMR 5253 CNRS OC106**

Polymer-assisted supercritical CO2 extraction of cobalt and lithium critical metals from cathode materials of lithium-ion batteries

Li-ion batteries (LIBs) are the mainstream power source of electric vehicles (EVs). Metals contained in LIBs (Co, Li, etc.) are becoming critical materials for many countries worldwide. Recycling these metals while restricting secondary pollution is an innovation challenge. Supercritical CO2 (scCO2) extraction assisted by complexing copolymers is a promising process to recover valuable metals from LIBs. In this study, CO2-philic gradient copolymers bearing phosphonic diacid complexing groups (poly(vinylbenzylphosphonic diacid-co-1,1,2,2-tetrahydroperfluorodecylacrylate), p(VBPDA-co-FDA)) were synthesized for the extraction of lithium and cobalt from LiCoO2 cathode material. Notably, the copolymer was able to play the triple role of leaching agent, complexing agent and surfactant. The scCO2 extraction conditions were optimized to improve the metals extraction from LiCoO2 cathode material, leading to an extraction efficiency of Li and Co up to ca. 75%.

Day:4- 11:30:11:45	**Dr Hailemichael Ayalew Assen - Academia Sinica, Taiwan OC106**

Electro-Responsive Amphiphilic Poly(3,4-Ethylenedioxythiophene) Coated Stainless Steel Mesh for Electrically Controllable Water Permeation and Oil Contaminated Water Purification

Most wettability studies on alkyl- or perfluoroalkyl-functionalized poly(3,4-ethylenedioxythiophene) (PEDOT) coatings have mainly focused on their responses to various liquids spread on the polymer surfaces. In our study, we took a step further by harnessing the electrical conducting properties of PEDOTs to fabricate electro-responsive gate membrane. Hence, amphiphilic PEDOT copolymers containing butane sulfonate (hydrophilic) and alkyl or perfluoroalkyl (hydrophobic/oleophobic) moieties were prepared through direct C-H arylation copolymerization method and coated them on stainless steel mesh. In-situ electrochemical oxidation (+1.2 V) or reduction (-0.8 V) of the coated mesh resulted hydrophobic/hydrophilic switchability that enabled precise control over water permeation and remarkable separation efficiency of oil/water mixtures (>99%) through switching the potential between 1.2 V and -0.8 V.

Day:4- 11:45:12:00	**Professor Joerg Werner - Boston University OC106**

Electrodeposition of Polymer Network Thin Films in 2D and 3D

Polymer network offer a large variety of physicochemical properties through their molecular functionality and network topology. If coated on 3D porous materials of large surface area, the functionality and response rate of polymeric networks could be significantly amplified. However, conformal deposition of polymer thin films on porous materials remains a challenge. Here, we present an electrochemical strategy to achieve conformal ultrathin coatings (10-100s nm) of polymer networks on 2D and 3D conductive substrates from pre-synthesized polymers. We introduce electrochemical crosslinks (eXlinks) that constrain the film formation to the substrate surface. The fraction of the eXlinks can be less than 1%, effectively decoupling the deposition chemistry from the overall polymer functionality. I will discuss our novel polymer network deposition paradigm in the context of ultrathin solid polymer electrolytes, as well as reactive polymer coatings that can be modified post-deposition.

Day:4-
12:00:12:15

Mr Yu-Jie Wang - National Taiwan University
OC106

Thermoset Epoxy Using Triphenylamine-Based Crosslinker for Multicolored Electrochromic Applications

A series of colorless thermoset epoxy resins were prepared from thermal curing of three arylamine-based monomers, 4,4’,4’’-triaminotriphenylamine (TPA-3NH2), N,N,N’,N’-tetrakis(4-aminophenyl)-p-phenylenediamine (TPPA-4NH2), and N,N,N’,N’-tetrakis(4-aminophenyl)benzidine (TPB-4NH2), with commercial diepoxy 1,4-butanediol diglycidyl ether (BDGE), respectively. The thermoset epoxy resin films revealed multi-electrochromic behavior which were resulting from the multiple electroactive centers. Four for TPA-3NH2_BDGE, six for TPPA-4NH2_BDGE and TPB-4NH2_BDGE. Besides, due to the electron donating characteristic of tertiary amine, the first oxidation state of epoxy films can be reached easily, 0.22, 0.20, 0.43 V for TPA-3NH2_BDGE, TPPA-4NH2_BDGE, and TPB-4NH2_BDGE in a three electrode system with Ag/AgCl as reference electrode. These results indicating low energy consuming for utilizing first oxidation state of these epoxy resin films for anodically electrochromic applications.

Day:4-
12:15:12:30

Mr Noah Al-Shamery - University of Warwick
OC106

Melanin and polypyrrole ,Äì synergistic conducting polymers analysed from macro- to micro-scale

Melanin is emerging as a biocompatible proton-conducting polymer for sensing and energy storage. While challenges like limited solubility in water and poor electronic conductivity are present, blending melanin and polypyrrole (PPy) into a cellulose nanofibril-based hydrogel can solve these issues. This integration enhances melanin's redox center accessibility via conductive PPy pathways within the hydrogel, resulting in superior electrochemical performance compared to single-polymer samples for pH-/metal ion-sensing and energy storage applications. In addition to macroscopic characterization, we investigated the microscale properties of these hydrogels. Using scanning electrochemical cell microscopy (SECCM), we can achieve precise fabrication control, facilitating synthesis and characterization of small melanin and PPy deposits. Our research bridges macroscopic and microscopic analyses, unveiling differences in electrochemical behavior between bulk composites and small-scale deposits.

Day:4-
12:30:12:45

Mr Dhruba Babu Subedi - Tribhuvan University, Nepal
OC106

Corrosion Evolution Process of Stainless Steel and the Effect of Alloy Elements on the Characterization of Passive Film of Rebar in Chlorinated Environments

This research intends to explore physiochemical characterization of passive films correlated with effect of alloy elements of metal an corrosion resistance behavior on stainles steel in simulated alkaline concrete solution (SPS) containing critical chloride concentration up to 1M towards aggressive environment by electrochemical measurement. Electrochemical properties of stainless steel wer investigated by using different electrochemical methods. Initial microstructure and Passive firmware characterized by energy back scattered diffraction (EBSD), scanning electronic microscopy (SEM), and energy dispersive X-ray spectroscopy (EDX).Although the passive film on the metal surface could enhance the corrosion resistance for both investigated steels, it was found that AISI 304 ASS exhibits slightly lower pitting corrosion resistance than HNSS toward severe environments. Comparatively passive behavior of HNSS was higher for SCPS hence it may be recommend such a severe environment.

Day:4-
14:00:14:30

Dr Guadalupe Rivero - Institute of Materials Science and Technology Research (INTEMA), Argentina
OC106

Electrohydrodynamic techniques: scaffolds, drug carriers and templates for non-traditional vesicle fabrication

In the biomedical field, traditional applications of electrohydrodynamic techniques have focused on the development of polymer scaffolds and drug immobilization within submicrometer fibers or particles. However, untapped potential lies in using electrospun amphiphilic structures as precursor templates for in situ vesicle self-assembly. This work demonstrates how the "top-down" electrospinning technique produces fibers that, upon contact with water, "bottom-up" self-assemble into supramolecular structures with tunable features. By varying the phospholipid source and processing parameters, we were able to precisely control the size, polydispersity, and bilayer properties of the vesicles, further assessed using molecular probes. The unconventional use of solid precursor templates simplify the manufacture, storage, and administration, ultimately benefiting the functionality, stability, and bioaccessibility of the resulting vesicles as bioagent carriers.

Day:4- 14:30:14:45	**Assistant Professor Angela Mutschler - CNRS OC106**

Controlling PEG-b-PTMC Polymersome Size through Microfluidic-Assisted Self-Assembly: Advancing the Understanding of Polymersomes Self-Assembly Mechanisms.

Polymersomes, with their thicker membrane and adjustable properties, are more stable in biological environments than liposomes. The self-assembly of poly(ethylene glycol)-block-poly(trimethylene carbonate) copolymers into vesicles was studied using a microfluidic system and solvent displacement method. The impact of microfluidic parameters, solvent selection, and copolymer concentration on vesicle size was explored. Microfluidic-assisted self-assembly proved highly reproducible, yielding monodisperse polymersomes. Characterization via multi-angle light scattering and cryo-TEM confirmed vesicle formation. Investigating the self-assembly mechanism revealed a liquid-liquid phase separation leading to coacervate droplets, which, upon solvent removal, formed vesicles detached from the coacervate surface. This study aims to enhance drug encapsulation predictions by understanding and precisely controlling polymer vesicle morphology and size through microfluidic systems.

Day:4- 11:00:11:15	**Professor Adem Levend Demirel - Koç University OC109**

Polymer Nanocomposite Coatings & Thin Films

Various design criteria for nanoparticle filled functional polymer composite coatings/thin films and potential applications as water-repellent surfaces, anti-icing surfaces, antimicrobial surfaces and polymer electrolytes will be presented. The synergistic effects of the addition of ionic salts in mesoporous silica particles (MSP) into a hydrophobic polymer matrix for release-based applications and ionic conductivity in hydrophilic polymer matrix will be discussed. In anti-icing coatings, the high specific surface area of MSP resulted in enhanced loading of PEG as the anti-icing agent into Styrene-Butadiene-Styrene (SBS) matrix while smaller pore sizes contributed to the controlled release. MSP/SBS composite coatings maintained their low ice adhesion strength for consecutive icing/de-icing cycles and exhibited the advantage of continuing anti-icing functionality upon wear and scratches in time. The possibility of refilling improves the lifetime of the release-based anti-icing coatings significantly.

Day:4- 11:30:11:45	**Ms Hiba Kassem - UGent OC109**

Reprocessable Polyurethane Foams using Acetoacetyl Formed Amides

Due to their outstanding physical and chemical properties, polyurethanes are versatile materials used in many day-to-day applications such as coatings and foams (automotives, seatings, bedding, insulation). Like any other thermosetting material, polyurethane foams (PUFs) contain permanent crosslinks that hinder their reprocessability and make their recyclability a tedious and environmentally unfriendly process. In this study we introduce acetoacetyl formed amides, formed by the reaction of isocyanates with acetoacetate groups, as dynamic units in the backbone of PUFs. By extensive variation of the foam composition, optimum parameters have been found to produce malleable foams above temperatures of 130 °C, without the requirement of any solvent during the foaming process. This study will show how PUFs can be transformed from materials generating large volumes of waste, into sustainable materials that can be recycled and transformed into valuable products at their "end-life".

Day:4-
11:45:12:00

Mr Florent Monie - LCPO, University of Bordeaux
OC109

A sip of water in your thermoset: The dramatic impact of H2O on the sol-gel transition of polyhydroxyurethane networks

Worldwide regulations are restraining the use of isocyanates, the key component of conventional polyurethane materials. Among the existing isocyanate-free alternatives, the aminolysis of CO2-sourced 5-membered cyclic carbonates, leading to polyhydroxyurethanes (PHU), is the most investigated one. With applications in coatings, adhesives or foams, many efforts aim at studying the advantages and limitations of PHUs. However, the impact of water on the course of PHU synthesis has never been thoroughly studied. This work reports the curing of a thermosetting PHU formulation and the first in-depth investigation of the impact of water on the sol-gel transition. Rheology tools allowed to fully characterize the critical gels of PHU, indicating that a small water content (2-5 wt%) has a spectacular impact on the gel times. They also suggest a structural impact of water on the critical gel. These unprecedented results will help to define new curing strategies of PHUs in ambient conditions.

Day:4-
12:00:12:15

Ms Marie KLEIN - LCPO, University of Bordeaux
OC109

A Biosourced Precursor of Epoxy Thermosets containing both Epoxy and Anhydride Functions: Self-Crosslinking versus Copolymerization Reactions

Thermosetting epoxy resins are widely used as adhesives, coatings or composite matrices. Diglycidylether of bisphenol-A (DGEBA) is the most used precursor. However, it is derived from bisphenol-A and epichlorohydrin, both petroleum-based reagents associated to multiple hazards. Thus, the design of safer and biobased DGEBA substitutes is highly anticipated. In this work, a new biobased self-crosslinkable monomer containing both anhydride and epoxy moieties was successfully synthesized in high yield from abietic and fatty acids. This precursor can be stored at room temperature and its self-crosslinking reaction is initiated at temperatures > 130°C in the presence of an appropriate initiator. The latter was further copolymerized with commercially available biobased epoxy monomers to obtain thermosets that can compete with DGEBA-based materials and whose bio-sourced contents are up to 70%.

Day:4-
12:15:12:30

None Sabrina Curley - Michigan State University
OC109

Intersection Between Photoinduced Phase Separation and Surface Wrinkling Phenomena: Harnessing Simple Resins for Complex Interfacial Patterning

Generating surface roughness using photoinduced phase separation (PIPS) is intriguing as it leverages both classic wrinkling phenomenon and patterning from phase separation. This work investigates resins of vinyl acetate, 1,6 hexanediol diacrylate and poly(dimethyl siloxane) that are engineered to undergo PIPS during a single-step polymerization when bonded to glass substrates. In situ polymerization of this resin forms wrinkled surfaces when applied at a wide range of thicknesses. Chemical distribution of phase domains and mechanical property gradients in the sample depth contribute to stresses responsible for wrinkling and can be linked to surface performance (e.g., wettability). Contact angle analyses show increased hydrophobicity for PIPS resins over comonomer-only counterparts at same thicknesses. The interconnected factors of resin chemistry, thickness, and substrate compatibility emphasize the potential of PIPS for informed coating design in rapid, single-step surface patterning

Day:4-
12:30:12:45

Dr Siriporn Chaimueangchuen - Aston University, UK
OC109

Surface Hybridization Chain Reaction of Binary Mixture DNA-PEG Corona Nanostructures

DNA nanotechnology has seen significant development recently. Over the past few decades, DNA-polymer hybrids have been attracting interest as adaptable functional materials in various bio-related applications. However, the conjugation of hydrophilic DNA with hydrophobic polymers remains challenging. In recent years, polymerization-induced self-assembly (PISA) has attracted significant attention for constructing nano-objects of various morphologies owing to the one-step nature of the process leading to a beneficial method for the creation of amphiphilic DNA-polymer nanostructures. One of the most intriguing phenomena of DNA is hybridization as it is a key to control the function of DNA-based materials in nanoscience. However, hybridization on DNA corona could cause unstability of DNA-polymer nanoparticles due to repulsive force on DNA corona. In this work, we initially adjusted the DNA volume fraction on the particle coronas with poly(ethylene glycol) (PEG) in PISA reaction to create various morphologies i.e. spherical micelles, worms, and vesicles. The increased PEG mole fraction on particle coronas provided that particles are more stable under hybridization condition. Additionally, hybridization chain reaction (HCR) was firstly applied as a tool to enhance the amount of DNA on DNA-based nano-object without disturbing particle morphologies, these could address the development of DNA nanotechnology and polymer nanostructuring.

Day:4-
14:00:14:15

Professor Scott Renneckar - University of British Columbia
OC109

Where are we in understanding lignin-based polymer structure-property relationships?

Renewable and biobased polymers can contribute towards the sustainable materials in society. However, natural variability creates difficulties for the incorporation of these materials into commercial products. Further, isolation and recovery of these natural polymers can create significant changes to the native structure. Lignin, derived from the cell wall of terrestrial plants, has been a polymer that embodies the complexities of working with natural materials. In order to address these issues, our group has carefully used fractionation of different lignins and developed unique chemical modification routes to shed light into structure-property relationships of a variety of lignin-based materials useful as building blocks in thermosets and blends with thermoplastics. This talk will highlight the structure of isolated lignin and modification into highly uniform functional polymers with altered chemical functionality, solubility, and thermal properties.

Day:4-
14:15:14:30

Associate Professor Katrien Bernaerts - Maastricht University
OC109

Lignin based covalent adaptable networks for on-demand removable adhesives

The European Green Deal aims to transform the European economy into a sustainable, climate-neutral, and circular economy by 2050, driving research in polymer science. Beyond substituting fossil raw materials with biobased ones to reduce polymer material carbon footprints, attention shifts to thermoset circularity. Covalent adaptable networks (CANs) mark a vital development, incorporating reversible chemical bonds to merge the rapid processing advantages of thermoplastics with the durability and resistance inherent to thermosets.

This study focuses on the development of sustainable CANs utilizing biomass-derived components, more specific lignin as the hard segment and fatty acid as the soft segment. Two types of catalyst-free reversible bond chemistries for these biobased CANs will be compared: associative vinylogous urethanes vs. dissociative phthalate monoesters.

The resulting biobased CANs offer potential as on-demand removable adhesives, contributing to the Green Deal's goals.

Day:4-
14:30:14:45

Dr Sathiyaraj Subramaniyan - KTH Royal Institute of Technology
OC109

DESIGNING FROM BIO-BASED TO CIRCULARITY: LINEAR AND CROSS-LINKED POLYAMIDE-IMINES

Plastics are significant materials for maintaining current standard of living and they greatly contribute to sustainable development goals. Still, there is an urgent need to develop plastics that better fit the circular economy to avoid waste accumulation and negative environmental impacts. Plastics should be designed for sustainable end-of-life, keeping the materials in the cycle through chemical and mechanical recycling under mild conditions. Here we present, the synthesis and characterisation of biobased circular polyamide-imines. We utilized lignin-derivable monomers and different diamines and triamines to yield corresponding linear and cross-linked polyamide-imines. All the monomers and polymers were in detail characterized for their chemical structure and thermal properties. In addition, stress-relaxation, shape memory, self-healing, mechanical reprocessability and chemical recyclability of the polyamide-imines was demonstrated revealing a fascinating set of properties.

Day:4- 11:00:11:30	**Professor Brigitte Voit - Leibniz-Institut fuer Polymerforschung Dresden e.V. (IPF) FAB003**

Sustainable polyesters: combining bio-based resources with function integration

The incorporation of biobased monomers into polymer structures offers the possibility to develop materials with a lower carbon footprint, but also to integrate specific functions. E.g. liquid crystalline polyesters with bio-based vanillic acid units were prepared allowing blending with lignin fractions. The resulting melt-spun fibers are excellent precursor fibers for carbon fibers. Incorporation of unsaturated ferulic acid units allows stabilization of fibers by electron beam irradiation. In addition, we prepared novel polyester extrusion foams from dilinoleic derivatives. The synthesis of the copolyesters was performed successfully to high molar masses by transesterification polymerization in the melt. Introduction of long alkyl chains as side chains into the polyester basic PBT or fully bio-based polybutylenefuranoate structure resulted into strain hardening with strong positive influence on the properties of the resulting foam (density, morphology, cell density, weldability).

Day:4- 11:30:11:45	**Professor Felix Schacher - Friedrich-Schiller-Universität Jena FAB003**

Can polymers do magic? – The role(s) of polymeric templates in light-driven catalysis

Polymers are a versatile class of materials and in combination with a widely tunable solubility has enabled quite a range of examples where building blocks for light-driven catalysis (i.e., photosensitizers and catalysts) are immobilized using either covalent anchoring or non-covalent interactions. This includes soft matter matrices for either light-driven hydrogen evolution (HER) or water oxidation (WOC) based on unimolecular graft copolymers, block copolymer micelles, hydrogels, or nanoporous block copolymer membranes. In all cases, close proximity of the immobilized building blocks facilitated light-driven reactivity, but we also observed additional effects during our studies, such as prolonged lifetime of photosensitizers, altered degradation pathways, or the possibility to repair / exchange catalysts or sensitizers.

Day:4- 11:45:12:00	**Professor Andre Groeschel - University of Bayreuth FAB003**

Polymer Cubosomes: Self-assembled high surface area microparticles

While block copolymers are known to form micelles in shape of spheres, cylinders and vesicles, their self-assembly into microparticles with an inner morphology of highly ordered channel systems was only recently reported. These channel systems adopt triply periodic minimal surfaces with cubic, double diamond, and gyroid lattice – termed cubosomes, or inverse hexagonal phases as the organic analogue to mesoporous silica – termed hexosomes. In this presentation, I will summarize recent progress from us and others to understand the formation of these inverse morphologies and how to introduce specific functionalities through block chemistry, e.g. for carbonization for energy conversion, biodegradation for drug release, and fluorescens for bioimaging.

Day:4- 12:00:12:15	**Ms Saye NIANG - Lorraine University FAB003**

Bis-hydrophilic copolymers to stabilize W/W emulsion

Oil-in-water (O/W) or water-in-oil (W/O) emulsions are the best known because of their ability to encapsulate hydrophobic or hydrophilic molecules, respectively, in the dispersed droplets. An alternative method to encapsulate hydrophilic molecules and avoid the use of organic solvents is to use a water-in-water (W/W) emulsion. This emulsion is composed of two aqueous phases containing incompatible hydrophilic polymers. In contrast to O/W and W/O emulsions, the W/W interface cannot be simply stabilized by molecular surfactants. This study aims to prepare novel copolymers with an combination of a natural polysaccharide (Dextran, Dex) and synthetic POE-phile polymer. These copolymers with various macromolecular parameters were produced by RAFT controlled radical photopolymerization, using multi- or monofunctional macromolecular transfer agents derived from dextran. Finally, these copolymers were labeled with a fluorescent probe to better visualize their location in the Dex/POE emulsion.

Day:4-
12:30:12:45

Dr Jan Warfsmann - Helmut-Schmidt Universität
FAB003

Improvement of metal alloys for hydrogen storage by polymer coatings

In a post-fossil future, hydrogen can act as an universal energy vector and be produced climate neutral by electrolysis with renewable energy. However, the efficient long-term storage is still a problem. The common methods (high-pressure storage or liquid storage) suffer from safety issues and large energy penalties. The storage in solid form as hydrides of metal alloys is an promising alternative. They have the advantage of high volumetric capacity and storage at comparable moderate temperature (<100°C) and pressure (<50bar), but there are also challenges to overcome. One is the intrinsic volume expansion of the material during hydrogen absorption. Not taking this into account might rupture a storage tank. For compensation, free space is often left in the tank, reducing the storage density. As an alternative approach, we have investigated the performance of coating with varying polymers and auxiliary materials to counteract the expansion stress of the hydrogen storage material.

Day:4-
12:30:12:45

Professor David Fengwei Xie - University of Bath
FAB003

Developing biopolymer-based composite inks for cost-effective and versatile 3D printing to create functional materials

The growing interest in biopolymer 3D printing stems from its ability to meticulously craft intricate structures, while leveraging the inherent advantages of biopolymers,Äîrenewability, biosafety, and biofunctionality. However, the availability of cost-effective and versatile 3D-printable biopolymer-based inks remains limited. This presentation introduces biopolymer-based inks for direct-ink-writing 3D printing, notable for their simple preparation and excellent printability and material properties. These inks utilise polysaccharides like chitosan and alginate, combined with organic and inorganic fillers. The chitosan-based electroconductive ink exhibits exceptional printability, enabling the printing of complex geometries without the need for chemical or photoinitiated reactions or support baths. Additionally, the printed materials demonstrate strain sensitivity and effective EMI shielding. Furthermore, the alginate-based ink shows promise for actuation applications, capable of printing materials with morphing behaviour.

Day:4-
14:00:14:30

Professor Guido Raos - Politecnico di Milano
FAB003

Molecular models of the ultimate mechanical properties of polymer chains and adhesives

The mechanical properties of individual polymer chains have an impact on the elasticity and fracture properties of bulk polymers, networks, gels and adhesives. I will describe our efforts to simulate the transition from entropic to enthalpic elasticity and the scission of highly stretched polymers chains, based of atomistic models capable of capturing specific chemical and stereochemical features of polyolefin chains. We have also been using generic coarse-grained models to gain insights into the relative roles of cross-linking, grafting and energy dissipation in the breakup of adhesive polymer layers. In both cases, the simulations offer thought-provoking insights that may hopefully stimulate further experiments and applications.

Day:4- 14:30:14:45	**Assistant Professor Michael Schulz - Virginia Tech FAB003**

Investigating structure–property relationships in metal-chelating polymers for extracting rare-earth elements

Rare-earth elements (REEs: La–Lu, Y, and Sc) are integral to modern technology, but world demand for these metals increasingly outpaces supply. Consequently, sustainable sources are needed. Metal-chelating polymers have great potential in REE extraction and separation applications, but tuning the interaction between the polymer and metal is often challenging. To investigate the interplay between polymer structure and metal chelation, we synthesized metal-chelating polymers with systematic variations in structure. We then used isothermal titration calorimetry to directly measure the binding affinity, enthalpy changes, and stoichiometry of the interactions between a series of REEs in solution and these metal-chelating polymers. These measurements enabled us to characterize the complete thermodynamic profile of these polymer–metal interactions. Ultimately, this structure–function information will be used to design new materials that are more effective for REE extraction and separation.

Day:4- 11:30:12:00	**Professor Wei You - UNC Chapel Hill FAB008**

RAFT Step-Growth Polymerization

Reversible-Addition Fragmentation Chain Transfer (RAFT) polymerization has become one of the most widely exploited platforms for controlled chain-growth polymerization. However, the choice of polymer backbones for RAFT polymers is very limited to inert carbon-carbon bonds by the nature of the chain growth mechanism of RAFT polymerization. On the one hand, step-growth polymerizations are widely used as they offer great versatility in the design of polymer backbone for many applications. These two main categories of polymerization methods, step-growth and chain-growth are distinctively different in many aspects and have been essentially viewed as ‘mutually exclusive’.

We recently discovered RAFT step-growth polymerization that synergistically combines benefits of RAFT polymerization (functional group and user-friendly nature) and step-growth polymerization (versatility of the polymer backbone). Details will be discussed in this talk.

Day:4- 12:00:12:15	**Professor Valerie Nassiet - UTTOP - UNIVERSITY OF TECHNOLOGY TARBES OCCITANIE PYRÉNÉES FAB008**

Tack Properties of Nanostructured Epoxy−Amine Resins on Plasma Treated Glass Substrates

A probe tack test, coupled with in situ imaging, was used to evaluate the influence of an air plasma treatment on glass substrates on the fracture energy of nanostructured epoxy−amine resins at different stages of gelation. Nanostructuration was induced by phase separation of two kinds of triblock copolymers in an epoxy adhesive. The influence of the surface treatment was assessed by splitting the fracture energy (tack energy) into three main contributions (cavitation, viscous flow, and stretch). We showed that before gelation, the interfacial strength depended on the nature of the copolymers and on their interaction with grafted functions (R−COOH and R−C=O) by air plasma treatment. The latter also influenced the cohesion of the resins, impacting the copolymers’ phase separation and conversion rate. The tack test, coupled with rheology and thermal measurements, was relevant to explain how the balance of interactions contributed to the fracture energy up to the gel point.

Day:4- 12:15:12:30	**Dr Glen Jones - ETH Zurich FAB008**

Reversing Controlled Polymerization: Depolymerization from Well-Defined Polymers to Monomers

Converting polymers back to pure monomers by depolymerization is a potential solution to the environmental and ecological concerns associated with the ultimate fate of polymers. The high end-group fidelity and/or functionality inherent in many controlled polymerization techniques can enable new routes to depolymerization under relatively mild conditions. The development and some applications of these new depolymerization techniques will be discussed.

Day:4- 12:30:12:45	**Dr Natalia Vieira Reis - University of Birmingham FAB008**

Dual organocatalyst system applied in the synthesis of semi-crystalline PLA from rac-lactide

A polymer's tacticity can significantly impact its crystallinity - Controlling this microstructure, however, allows researchers to manipulate the physical and mechanical properties of the resulting material. Therefore, extensive research has been focused on the stereocontrolled ring-opening polymerisation of rac-lactide, a biobased and renewable monomer. Among the reported catalysts, organocatalysts offer the additional advantage of being more tolerant to water and oxygen and the resulting polymer does not contain residual metallic contaminants. One drawback of organocatalytic polymerisation is that isotactic PLA from ROP is usually only achieved at low temperatures. Here, we report thiourea and bispidine dual-organocatalysts that are easily accessible and tuneable for the stereocontrolled ROP of rac-LA to produce highly isotactic semi-crystalline polylactide at room temperature.

Day:4- 14:00:14:15	**Benedetta Brugnoli - Sapienza University of Rome FAB008**

Development of Renewable Polyol-Based Branched Poly-L-Lactide Nanoparticles for Drug Delivery Applications

Branched polymers have emerged as promising carriers for drug delivery. The branching architecture can be also engineered to control the release kinetics of drugs by modifying the branching or the composition and length of branches. Herein, the synthesis of branched poly L-lactide (PLLA) was synthesised by using renewable polyols, glycerol (Gly) and diglycerol (DGly) as initiators, at different L-lactide (L-LA)/OH molar ratios (8, 16 and 24).

Polymers with molecular weight (MW) between 4100 and 20000 g/mol were obtained. An increase in polymer MW and gyration radius was observed with increasing L-LA/OH molar ratio. Polymers were all amorphous, except for the one with the longest branches (DGly24-PLLA), and able to self-assemble in water giving 200 nm in size nanosystems. Usnic acid (UA), a hydrophobic, antimicrobial and anticancer natural compound, was encapsulated in the nanoaggregates. A significant increase in UA apparent solubility in water together with a reduced toxicity in vitro was observed, highlighting the potentialities of the synthesised nanocarriers for drug delivery.

Day:4- 14:15:14:30	**Professor Stefanie Sydlik - Carnegie Mellon University FAB008**

Polysaccharide-based macromolecules as safer chelation solutions for heavy metal exposure

Heavy metal poisoning remains a public health crisis. To create a safer chelation therapy, we designed a class of polysaccharide-based macromolecular chelators by chemically linking biocompatible polysaccharides with known metal chelators. The polysaccharide backbone increases compatibility, bioavailability, and renal clearance. The chelator component retains its metal-binding ability while being sequestered, preventing toxicity. Initially, we have targeted two specific heavy metals for in vivo treatment—cobalt and lead. Preliminary in vivo tests demonstrated the ability to accelerate clearance of heavy metals from the body with 10-fold faster and 2-fold larger renal clearance. Similarly, we have used these polysaccharide-based chelators to create a “BioBinder Spoon” that allows consumers to remove toxic heavy metals (lead, cobalt, chromium, mercury, arsenic) from food during preparation. These polysaccharide-based chelators are poised to address heavy metal exposure globally.

Day:4- 14:30:14:45	**Professor Diego Alzate-Sanchez - Northeastern University FAB008**

Frontal Polymerization in the Synthesis of Porous Structures

Society grapples with the repercussions of excessive plastic consumption, recognizing not only environmental contamination but also the overlooked issue of high-energy consumption in plastic production. To foster a sustainable future, innovative, low-energy plastic production methods are required. Herein, we demonstrate how the physicochemical properties and cellular structure of macroporous materials can be modified through a low-energy consumption method called frontal polymerization. We explored the frontal polymerization of dicyclopentadiene using a second-generation Grubbs’ catalyst and tributyl phosphite with various foaming agents, adjusting the concentration and viscosity to control the foam properties. We used an experimental combination of parameters, together with machine learning, to evaluate the correlation between the input and output parameters. Finally, we demonstrate that the new foams can be used in diverse applications. For instance, we deposited Pd nanoparticles on

Day:4- 11:00:12:30	**Professor Hua Lu - Peking University S021**

Robust and Precision Synthesis of Polypeptides and Protein Conjugates for Biomedical Applications

Day:4- 11:30:11:45	**Professor Martin Wills - University of Warwick S021**

Polymer - supported asymmetric catalysts and click reaction with a strained dialkyne

I will describe some of our work on supporting asymmetric transfer hydrogenation and the challenges involved. A preliminary result from the combination of a diazide with a strained dialkyne will also be discussed.

Day:4- 11:45:12:00	**Associate Professor Anders Daugaard - Danish Polymer Centre S021**

Selective Modification of Depolymerized Lignin Using Aza-silanes and Enzymes for the Preparation of Functional Aromatics

Lignin is typically not well-compatible with organic solvents and classical curing agents. In a two-step reaction, Kraft lignin was first fractionated using common solvents and depolymerized into liquid lignin aromatic building blocks of low molar mass, improved solvent compatibility, and higher functionality. This mixture was exploited to prepare functional aromatic building blocks by selective modification through aza-silane ring-opening and enzymatic esterification. Aza-silane ring-opening reactions are selective for alcohols over phenols and provide an attractive pathway to new amine-curing agents that were evaluated for epoxy/amine curing. Similarly, green solvents in the form of Cyrene and Cygnet were compared to diphenyl ether as solvents for enzymatic esterification using lipases, demonstrating a benign approach for functional lignin-based aromatic curing components in the form of acrylics, vinyl, and epoxy functionalities.

Day:4- 12:00:12:15	**Associate Professor Elena Govorun - ESPCI Paris - PSL S021**

Solution morphology of hydrophobic-amphiphilic diblock copolymers

Aggregation of thermoresponsive polymers, in particular biocompatible, is thoroughly studied for the ability of micelles to bind and release different types of useful cargo. Tuning the type and length of polymer blocks allows control of copolymer aggregation. We consider theoretically the solution morphology of diblock copolymers with hydrophobic and amphiphilic blocks. Amphiphilic (thermoresponsive) blocks contain both hydrophobic and polar moieties that provide them with surface activity to control the aggregate sizes.

Morphological diagrams of the diblock copolymer solution and the micelle sizes are calculated depending on the block ratio, the length and volume of the side polar pendants, and solvent quality. The individual micelles of different shapes (mesoglobules), complex/compound micelles, and structured condensed polymers can be formed, where the polymer condensation corresponds to the formation of large structured agglomerates or to precipitation.

Day:4-12:15:12:30	**None Alana Gudinas - Stanford University** **S021**

Metal sequestration with repetitive ion-binding proteins

Materials with high ion affinity and specificity are needed to address challenges in human health and the environment. For example, industrial waste includes toxic metals that can accumulate in organisms. Proteins with innate specificity for metal ions pose an exciting materials platform for metal sequestration. Inspired by families of ion-binding proteins with similar structures but different metal ion affinities, we explore the metal ion affinity of a repetitive Ca2+-binding protein that has promiscuous interactions with other ions. These repetitive proteins undergo drastic conformational changes from random coils to ion-loaded structures upon binding to ions. We quantify ion-induced conformational changes in response to heavy metal and lanthanide ions using circular dichroism and Förster Resonance Energy Transfer. Metal-containing protein solutions exhibit dynamic increases in turbidity, suggesting ion-dependent phase separation that can be harnessed for metal ion sequestration.

Day:4-12:30:12:45	**Ms Lejla Jahic - MeltPrep** **S021**

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Day:4-11:00:11:30	**Dr Matthias Hartlieb - University of Potsdam** **S020**

New Aspects in Antimicrobial Polymers

Steadily increasing levels of antimicrobial resistance (AMR), are continuously endangering our healthcare system. As the antibiotic pipeline is running dry, the need for new antimicrobials is urgent. Antimicrobial polymers (APs) are a promising solution, as their mode of action is unsusceptible toward AMR. However, their selectivity between bacterial and host cells is still insufficient.

To improve activity and selectivity of APs, a plethora of parameters, such as amphiphilic balance, molecular weight, or type of charge can be altered. One important aspect in this context is the polymer architecture, as it fundamentally changes the physico-chemical properties of APs. Using bottle brush polymers as platform for APs, we could show that confinement and multivalence in such structures has profound impact on their biological activity. Indeed, optimizing structural parameters yields highly selective APs featuring increased antimicrobial activity and markedly different membrane interaction.

Day:4-11:30:11:45	**Dr Joe Homer - Aston University** **S020**

Electrospun polymer nanofibers in organotypic brain slice culture

In recent decades animal testing has come under increasing scrutiny, with substantial social pressure to move away from the practice based on ethical concerns. The 3Rs (Replace, reduce, and refine) seeks to encapsulate a set of criteria through which the use of animal subjects can be minimised. Existing membrane slice culture allows for limited data collection per sample for a limited time but does not currently facilitate the recording of intercellular signalling. This work outlines the development of a platform for substantially enhancing the understanding of biological signalling, by using electrospun nanofibers as an alternative substrate for brain slice culture. Through management of fibre alignment and material composition, culture inserts can be created with the potential to monitor intercellular electrical signalling in-situ in brain slice culture for future drug screening platforms, whilst also reducing and refining the use of animal subjects.

Day:4-
11:45:12:00

Dr Klara Saller - Johannes Kepler University Linz
S020

Highly Hydrophilic Polyester Systems – The Chance for More Sustainable Products?

Although certain polyesters like poly(ethylene terephthalate) (PET) have been excessively studied and are industrially produced in large scale, research on sustainable polyester systems booms in various fields of application. Reasons include the abundancy of several monomers in nature or feasible production routes starting from biobased sources as well as good examples for well recyclable and/or biodegradable products. The synthesis of highly hydrophilic polyesters, however, turns out to be challenging due to several possible side reactions which occur during the technologically relevant mass polycondensation of multifunctional monomers. We have investigated dimethylolpropionic acid and similar monomers to form mostly linear polyester species with pendant COOH groups. These additional functional groups significantly increase hydrophilicity and allow further functionalization for replacing conventional fossil-based, non-recyclable and non-degradable special products.

Day:4-
12:00:12:15

Mr Nicolas Deroose - Ghent University
S020

Silk sericin: from waste product to hydrogel-based biomaterials

Over the past decade, silk sericin (SS) has received increasing attention to develop crosslinked hydrogels for several biomedical applications ranging from tissue engineering and wound healing to drug delivery. In this work, several novel SS derivatives, including (meth)acrylate and (meth)acrylamide, have been synthesized by modification of lysine, serine, glutamic - and aspartic acid targeting varying degrees of substitution (15 – 94 %). An in-depth characterization proved the large range in material properties that can be obtained in terms of chemical structure, in situ crosslinking kinetics (ranging from 0.81 – 4.36 s after exposure to UV-A), swelling behavior (311 – 3381 %), gel fraction (64.7 – 96.7 %) and mechanical properties (compressive E-modulus ranging between 10.6 and 135.8 kPa). Finally, the influence of the SS source and thus the chemical structure of the hydrogel precursor, was studied both on antioxidant behavior, as well as in vitro cell biocompatibility (all > 80%).

Day:4-
12:15:12:30

Dr Nikita Sedush - Enikolopov Institute of Synthetic Polymeric Materials
S020

Functional biodegradable polymers based on L-lactide and e-caprolactone with tailored microstructure and architecture for "smart" medical devices and drug delivery systems

Technologies of modern medicine involve minimally invasive procedures, the use of “smart” and personalized implants, development of targeted drug delivery systems and more. “Leave nothing behind” principle in relation to implants requires that a material completely degrade inside the body after performing its function. Thus, the development of new functional biodegradable materials with functional properties and controlled degradation is an urgent issue. The lecture will cover the results of our research focused on the synthesis and modification of lactide-based biodegradable polymers with well-defined molecular microstructure and composition. The developed UV-curable materials, shape-memory implants and novel nanoformulations of anticancer drugs will be discussed.

Day:4-12:30:12:45	**Mr Muhammad Bilal Hassan Mahboob - Monash University, Melbourne, Australia.** **S020**

Cholesterol-terminated cationic lipidated oligomers (CLOs) as a new class of antifungals

Infections produced by fungal biofilms with rapidly growing resistance to antifungal medicines are difficult to treat. Recently WHO has published the first-ever fungal priority pathogens list (FPPL) to systematically prioritize fungal diseases. In this study, cholesterol-terminated cationic lipidated oligomers (CLOs) using azlactone functional handles were screened for their antifungal activity against planktonic and mature fungal biofilms. Specifically, Chol-DMEN-25 and Chol-BEDA-10 exhibited remarkable inhibitory effects on the hyphal growth of C. albicans, C tropicalis, C. neoformans and C. gattii thus preventing biofilm formation and removing existing mature biofilms. Co-delivery of these CLOs with fluconazole (Flu) showed synergistic effects. Furthermore, CLOs-drug combinations increased Flu antibiofilm activity against dual-species biofilms. The mechanistic studies demonstrated that these CLOs disrupted the integrity of cell membranes of all the fungal strains.

Day:4-14:00:14:15	**Mr Meng-Chang Hou - National Taiwan University** **S020**

From Blue to Red Emission: Arylamine-Based Wholly Aromatic Polyimides for Panchromatic Spectrum Emission

Designing wholly aromatic polyimides (Ar-PIs) with high fluorescence quantum efficiency and red-shifted emission is still challenging due to the charge-transfer complex (CTC) effect. According to the previous study reported by our group, incorporating the twisted units into the polyimide backbone could effectively preserve the quantum efficiency of the luminophore. Therefore, in this work, we designed and synthesized a series of arylamine-based diimides and dianhydrides with various electron-donating or withdrawing pendant groups, including aggregation-induced emission luminogens (AIEgens), to tune and elucidate the emissive behaviors of the diimide compounds and their related Ar-PIs, respectively. In particular, PI-TPA-OMe-4Me and PI-TPPA-diOMe-4Me exhibit a significant redshift in emission due to the strong electron donor, Furthermore, PI-TPE-4Me with TPE AIEgen exhibited the highest ΦPL of 47.2% in the film state at the emission peak of wavelength 539 nm.

Day:4-14:15:14:30	**Mr Johannes von Szczepanski - Empa / ETH Zürich** **S020**

High-permittivity Polysiloxanes for Bright, Stretchable Electroluminescent Devices

Stretchable alternating current electroluminescent (ACEL) devices have a bright future in wearable electronics and soft robotics. Still, their market application is hindered by high operating voltages. The voltage can be reduced by increasing the relative permittivity of the dielectric elastomer in the emissive layer. Here, a fluorine-free high-permittivity silicone elastomer functionalized with cyanopropyl side groups is introduced. The polar silicone elastomer exhibits excellent mechanical properties and a dielectric permittivity four times higher than commercial PDMS. Light-emitting devices based on the polar elastomer reach 7.5 times higher maximum luminance at the same electric field than PDMS-based devices and turn on at a 50% lower electric field. Stretchable ACEL devices were built from the polar elastomer, which show bright and uniform light emission and can be operated up to 50% strain.

Day:4-14:30:14:45	**Mr N'GANDI YVES RODRIGUE JOSSELIN N'GAZA - IMP/INSA-LYON** **S020**

Synthesis and study of aromatic and heterocyclic luminescent compounds and polymers.

he development of new OLEDs, which are now widely used in products like televisions, phones, and lighting, faces a challenge in thermal stability. We are working on designing, synthesizing, and characterizing new aromatic and heterocyclic compounds that are thermostable, fluorescent, and exhibit high quantum yields. The study focuses on chromophores based on complex pyridinic scaffolds synthesized by Hantzsch multi-component reaction. Several organic compounds were characterized to establish relationships between their structures and properties. Different substituents were studied to determine their impact on fluorescence properties. The goal was to incorporate these structures into a thermostable polymer. A chromophore-containing precursor was synthesized and incorporated into the final chain, resulting in a series of polymers with varying amounts of chromophore. The physico-chemical and optical properties of these polymers were investigated.

Day:4- 11:00:11:30	**Professor Igor Lacik - Polymer Institute of the Slovak Academy of Sciences S019**

Solvent effects on propagation rate coefficient of water-soluble monomers

The effect of solvents on the propagation step in radical polymerization was described for the first time in the sixties of the last century. Since then, solvents are used to tune the reactivity of monomers and growing radicals involved in propagation step. The solvent effects on propagation rate coefficient, kp, have been described for a number of monomers polymerized in different solvents. Nevertheless, there is still a room for improved generalized understanding combining all the existing knowledge. This is the subject of this contribution.

We determined kp values for (meth)acrylic monomers in both organic and aqueous environments by pulsed-laser polymerization in combination with size-exclusion chromatography. Summarizing both the to-date published kp values and the results obtained in this study, we propose that the effects of solvents on propagation kinetics of a monomer can be predicted in advance based on the presence or absence of H-bonds.

Day:4- 11:30:11:45	**Dr Marianne (Marion) Gaborieau - Karlsruhe Institute of Technology (KIT) S019**

Molecular characterization of polymers with separation and spectroscopy: from combination to coupling

In-depth molecular characterization of polymers is usually carried out by combining information from spectroscopy and separation techniques. NMR or IR spectroscopy gives access to average values of chemical composition, molar mass, or degree of branching. Chromatography (especially SEC/GPC) or capillary electrophoresis yields information on sample heterogeneity, in terms of chemical composition, molar mass, or branching density. This will be demonstrated through the determination of distributions of compositions of chitosans and the assessment of branching heterogeneity in polyacrylates.

A more advanced approach consists in coupling spectroscopy to chromatography by using IR or NMR spectroscopy as a detector for chromatography to obtain information on functional groups at each elution slice of the chromatogram. This will be demonstrated through the comprehensive characterization of chemical composition in block copolymers (by SEC-IR, SEC-NMR) and of polymer additives (HPLC-NMR).

Day:4- 11:45:12:00	**Dr Peter Gilhooly-Finn - University College London S019**

Will it Blend? A miscibility study of P3HT-polyborosiloxane blends towards flexible electronic materials

Rising demand for flexible electronic materials is driven by their integration into wearable devices for bioelectronic monitoring and sensing. Organic semiconductors (OSCs), known for inherent flexibility, dominate as the active electronic layer in these devices. To enhance skin compatibility, reducing toughness is essential. A proven approach involves blending OSC polymers with flexible elastomers yet, the intricate miscibility between OSCs and elastomers with supramolecular chemistry remains understudied. This study investigates the impact of blending the OSC poly(3-hexylthiophene) (P3HT) with the elastomer polyborosiloxane (PBS). PBS, featuring a polysiloxane backbone with borate ester crosslinks, facilitates supramolecular interactions through dynamic bonding chemistry. Combining P3HT with PBS induces changes in properties, influenced by increasing polymer entanglement and crosslinking density offering insight into polymer compatibility for flexible electronics.

Day:4-12:00:12:15

Ms Bhavya Parameswaran - IIT Kharagpur
S019

Vitrimer-like Material based on Epoxy Functionalized Elastomer by dual dynamic crosslinker

Vitrimers are an attractive subset of covalent adaptive networks(CANs) because associative cross-link exchange mechanisms maintain the original cross-link density of the network throughout the exchange process. Herein, we utilized the epoxy functionalized elastomers, like poly(ethylene-co-vinyl acetate-co-glycidyl methacrylate) for designing a dual dynamic crosslink network based on the β-hydroxyl ester linkage and disulfide metathesis reaction which are enabled by a crosslinker. These linkages can undergo exchange reactions at elevated temperatures which can rearrange the network topology and exhibit vitrimer-like behaviour with better mechanical and thermal properties. Interestingly, the crosslinked elastomer also exhibits fluorescence behaviour which is attributed to the emission by the fluorogenic ring moieties of the aromatic peptide linkages. The material may be a promising candidate in optoelectronic devices like sensors or flexible display lights.

Day:4-12:15:12:30

Dr Amit Kumar Sarkar - Marie Curie Research Fellow
S019

Ionic Liquid-Induced Block Copolymer Self-Assembly for Next-Generation Data Storage

Amit Kumar Sarkar, Paul D. Topham, & Matthew J. Derry

Between 2018-2025, the global datasphere is projected to increase by 530% to 175 zettabytes and this astronomical growth shows no sign of slowing down. Thus, improved data storage solutions are needed. Current lithographic techniques used in the manufacture of data storage devices are often complex and low throughput. In this context, block copolymer nanotechnology may provide an alternative solution to replace traditional lithography methods. Self-assembled BCP thin films offer convenient nanopatterning templates and can form sub-5 nm channels that have the potential to vastly increase the areal density of future devices, maximising our data storage capacity. We present block copolymer-ionic liquid (BCP-IL) composite materials towards new nanolithography template materials. Using X-ray scattering, we uncover design rules for controlling nanomorphologies and length scales in BCP-IL thin films for next-generation data storage applications.

Day:4-12:30:12:45

Associate Professor Kiattikhun Manokruang - Department of Chemistry, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand
S019

FROM SOL-GEL INTELLIGENCE TO INJECTABLE HYDROGELS DERIVED FROM NATURE-INSPIRED BIOPOLYMERS

Injectable hydrogels are alternative materials for drug and protein delivery, which potentially eliminate the need of surgical implantation in the treatment procedures. Although a number of biopolymers exhibit a reversible sol-gel phase transition triggered by temperature and pH of the environment and, hence, facilitate the injectability of such macromolecules, the phase transition of these biopolymers usually occurs at extreme conditions (such as strong alkaline pH for chitosan, strong acidic pH for pectin and high temperature for albumin), which limits the breadth of utilization of these biopolymer gels in biorelated applications. Our sol-gel intelligent polymers were developed and used to tune the transition behavior of the aforementioned biopolymer gels to exhibit the predetermined sol-gol phase transition while the intrinsic biocompatibility remained to be ensured.

Day:4-14:00:14:15

Professor Peter Mallon - Stellenbosch University
S019

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Day:4-14:14:14:30

Dr ELIEZER VELASQUEZ - University of Santiago of Chile
S019

Barrier and antioxidant bilayers based on flexible recycled polypropylene for potential use in food packaging

Recycled flexible polypropylene (RPP) was valorized by developing active barrier and antioxidant bilayers for food packaging. A layer of virgin PP (VPP), RPP, and nanosilica was prepared by extrusion and then coated with an ethylene-co-vinyl alcohol (EVOH) solution containing curcumin (Cur). The films were analyzed by ATR-FTIR, optical microscopy, DSC/TGA, tensile test, seal strength, oxygen permeability, overall migration (OM), and antioxidant capacity. The active coating increased the stiffness and tensile strength of the film, while the nanosilica increased its seal strength. RPP presented a deteriorated oxygen barrier but the coating drastically diminished the oxygen permeability. The OM of RPP to isooctane was above the allowed limit of 10 mg dm-2 for direct food contact but the VPP/RPP 80/20 film complied. The bilayer bag (1 wt% Cur) had the highest antioxidant activity with a hydroxylation 50% lower than the non-active bag tested in a hydroxyl-radical-quenching reaction line.

Day:4-14:30:14:45

Professor Cesar Sierra - professor
S019

Biodegradable polymers for the export of tropical fruits

In response to growing global restrictions on the use of non-biodegradable or toxic plastics and additives of petrochemical origin, technologies must be developed that allow agribusiness to continue providing food to the world and remain an essential economic sector in many developing countries. For the specific case of polyethylene and its additives, used as packaging in crops and post-harvest of tropical fruits, any material that aims to replace them, in addition to considering the physicochemical and mechanical properties, must analyze aspects such as biodegradability, toxicity, consumer acceptance, and scalability of its production, among others. Therefore, in this work we will show: A) the development of packaging based on PHB/PLA as a replacement for polyethylene for the post-harvest handling of tropical fruits and cocoa; B) The search for additives of natural origin, based on computational calculations, and in vitro and in vivo studies, as a replacement for toxic pesticides in b

Day:4-11:00:11:30

Dr Michael Cook - UCL
S018

Thermoreversible gels across length scales: Nano-, micro-, and macro- assembly.

Thermoreversible gels switch from a gel to a liquid state upon temperature change. This can be achieved with polymers exhibiting "lower critical solution temperatures", whereby the polymer becomes relatively solvophobic above a characteristic temperature. Research in the Cook group has focussed on structure-function relationships in these thermoreversible gels including copolymer solutions and polymer-stabilised emulsions. Small-Angle Neutron Scattering is employed to probe mechanisms of gelation in these systems, which unveils hierarchical processes stemming from nanoparticle formation and supracolloidal assembly, ultimately dictating bulk rheological responses. These materials are exploited in healthcare applications, particularly where low viscosity Newtonian fluids may be formed at room temperature, enabling spray formation, followed by transition to a retentive gel state at body temperature. This gives a platform for delivery of actives to regions such as the nasal mucosa.

Day:4-11:30:11:45

Professor Dirk Kuckling - Paderborn University
S018

Dually Cross-linked Stimuli-sensitive Gels for Biomarker Detection

In the last few years particular attention has been focused on stimuli-responsive polymers. This group of materials is of interest due to their ability to respond to internal and/or external chemico-physical stimuli that is often manifested by large macroscopic responses. To increase the scope of such hydrogels a novel dual cross-linking system combining photo cross-linkable covalent bonding with special molecular recognitions sites was introduced. When the noncovalent bond was broken or formed, the swelling ratio of the polymer gel will be changed significantly. A new dually cross-linked supramolecular hydrogel (DCSH) was developed by introducing a photo cross-linker for permanent crosslinking and a host-guest recognition pair. A reversible sensor was developed for specific small molecule detection of small molecules by using a combination of surface plasmon resonance and optical waveguide spectroscopy. The DCSH is further used as a SPR biosensor for cancer biomarkers detection.

Day:4-
11:45:12:00

Ms Lena Dalal - University of Warwick
S018

Design of antimicrobial polyacrylamides via RAFT polymerisation, a steppingstone against resistance

The worldwide spread of antibiotic resistance urges the need for novel antibiotics that are less prone to resistance. Inspired by innate immunity, synthetic antimicrobial polymers (SAMPs) were investigated as mimics for antimicrobial peptides (AMPs). AMPs activity and selectivity towards microorganisms are both attributed to their amphiphilic structure. Hence, SAMPs were designed to exhibit similar amphiphilic properties and interact with the negatively charged bacteria cells membrane accordingly.

However, AMPs instability and high production costs hindered their clinical prospects, SAMPs were introduced as promising alternative. In this work, polyacrylamides were engineered via RAFT polymerisation, and multiple factors varied to optimize their activity and selectivity towards microbial cells. The polymers minimum inhibitory concentrations (MICs) were recorded against resistant gram-positive and -negative bacteria strains. The results emphasised the importance of the cationic charge for potency, whether it is the type of charge, number of cationic moieties or the cationic ratio.

Day:4-
12:00:12:15

Dr Pavla Hajovska - Polymer Institute, Slovak Academy of Sciences
S018

Factors influencing the bioprinting application of GelMA/alginate bioinks

3D bioprinting has emerged as a promising tissue engineering approach based on layer-by-layer deposition of cell-loaded bioinks. Multiple studies have highlighted the general correlations between polymer properties and the bioink rheological behavior, printability, hydrogel properties and viability of loaded cells. In our work, we focused on characterization of bioinks based on combination of gelatin methacryloyl (GelMA) and sodium alginate (SA). Current studies employing GelMA/SA systems for 3D bioprinting focus on their potential use for specific tissue engineering applications, however, the characterization of bioinks or its components has been scarce. Our contribution will deal with description of the GelMA/SA bioink system from polymer characteristics, through processing conditions to cell cultivation.

Day:4-
12:15:12:30

Dr Thom McGuire - DH001
S018

The Catalytic Chemical Recycling of Waste Oxygenated Plastics

The chemical recycling of polymers to monomers (CRM) is important to realizing a truly circular, plastic economy. However, significant improvements in recycling catalysis are required for broader implementation. Here, a range of catalysts, operated in neat polymer films, are presented for the CRM of various bio-derived polyesters and CO2-derived polycarbonates, including commercial materials. These catalytic processes deploy earth-abundant metals and operate at accessible reaction temperatures (<160 °C). The depolymerizations show outstanding rates and excellent monomer selectivity (>99%), with catalytic activity reaching up to 26,000 h-1. This research shows that next-generation, oxygenated polymers can be efficiently and selectively recycled, offering potential benefits for sectors such as packaging, consumer goods and the automotive industry.

Day:4-
14:00:14:15

Dr Yaroslav Kudryavtsev - ESPCI PARIS - PSL
S018

Design of cyclooctene-based amphiphilic copolymers with ethylene glycol side chains

Controlled PEGylation of polyalkenamers still presents a synthetic challenge. In this study, we explore different ways of obtaining polyoctenamer with ethylene glycol side chains. The best method, which allows us to achieve 97% degree of grafting, includes metathesis polymerization of cyclooctene functionalized at 5th position with a tosyl or mesyl group through an oxymethylene bridge, followed by nucleophilic substitution of the tosyl or mesyl with a monofunctionalized oligoethylene glycol. Owing to the presence of double C=C bonds in the backbone, the resulting polymers can be further modified via polymer-analogous reactions or converted into multiblock copolymers by macromolecular cross-metathesis with unsubstituted polyalkenamers. Amphiphilic properties of the synthesized copolymers are characterized by water contact angle and their self-assembly behavior in solution is compared with that of statistical copolymers obtained by metathesis copolymerization.

Day:4- 14:15:14:30	**Dr Valentin Beyer - Warwick University S018**

Synthesis of Cationic Polymeric Flocculants for Microalgae Harvesting by RAFT Polymerisation

Microalgae are a promising CO2-fixing feedstock which is gaining growing attention for the production of biofuel, the extraction of valuable fatty acids, and other high value chemicals. Despite the great potential of microalgae, their production and especially the isolation of the biomass remains economically unsustainable due to the high energy cost for harvesting. Since microalgae carry an overall negative surface charge, sedimentation can be induced by addition of cationic flocculants, which is a common harvesting technique. The presented work will investigate the structural impact of polymeric flocculants by assessing different macromolecular architectures, namely linear, branched, and core-crosslinked polymers. RAFT copolymerisation of commercially available 2-(dimethylamino)ethyl methacrylate (DMAEMA) and a dimethacrylate crosslinker is demonstrated to be a suitable technique for the synthesis of all three target architectures with different compositions. The polymer library is thoroughly analysed in order to confirm their absolute structure, molecular weight and solution properties. Furthermore, the results of flocculation tests on freshwater algae under various conditions are presented and a relationship between polymer architecture and flocculation efficiency is assessed. The findings are complemented with titration, surface charge measurements, and atomic force microscopy to give mechanistic insights in the flocculation behaviour of the synthesised polymers.

Day:4- 14:30:14:45	**Ms Madeleine Smith - University of Oxford S018**

Evaluating Heterodinuclear Mg(II)M(II) (M = Mn, Fe Ni, Cu, and Zn) Catalysts for the Chemical Recycling of Poly(cyclohexene carbonate)

Chemical recycling to monomers decreases the need for virgin materials, reduces further emissions related to polymer production, and avoids the material degradation associated with mechanical recycling. Here, a series of M(II)Mg(II) heterodinuclear catalysts, where M = Mn, Fe, Co, Ni, Cu and Zn, are investigated in the catalytic chemical recycling of poly(cyclohexene carbonate) with the goal of understanding the criteria for effective depolymerization catalysis. The depolymerizations are conducted in the solid-state (140 °C) and show excellent monomer selectivity (>99% CHO) and rates (TOF of up to 8100 h-1). Kinetic studies using the leading Co(II)Mg(II) catalyst reveal an overall second order rate law which is dependent on catalyst and polymer concentration. Comparing the activity of the catalysts for polymerization and depolymerization reveals broadly similar trends. This data provides insight into catalyst structure-performance criteria for both making and recycling these polymers.

Day:4- 11:00:11:30	**Dr Adriana Šturcová - Institute of Macromolecular Chemistry CAS, v. v. i. S013**

Physics and Physical Chemistry Concepts Relevant to Polymer Dissolution: The Role Molecular Motion, Molecular Packing, Hydrogen Bonding, Solvophobic Effect and Capillarity Play in Solution Behaviour of Cellulose and Pluronics®

Dissolution of polymers is important for their further processing into sophisticated materials or functional devices. However, the process of polymer dissolution is not understood satisfactorily. In my talk, I will address several concepts of polymer physics and physical chemistry that have to be considered when one attempts to understand and optimize the process of polymer dissolution. In order to demonstrate the role molecular motion, interactions, solvophobic effect and other physical phenomena play in polymer dissolution, I will report on behaviour of two very different polymers – cellulose and Pluronics.

Cellulose is biosynthesized mostly in plant cell walls and is an example of a semicrystalline polymer that contains highly organised crystalline domains, dissolution of which is not favoured energetically. As a result, harsh treatments that are costly and environmentally damaging are necessary to dissolve these structures. We used vibrational spectroscopy and X-ray diffraction to study the behaviour of cellulose dissolved in two different solvent systems: (1) the mixture of N,N–dimethylacetamide with lithium chloride (DMAc-LiCl) and (2) an ionic liquid 1-butyl-3-methylimidazolium chloride (bmimCl). We obtained indirect evidence of possible stacking between cellulose D-glucose units and ionic liquid aromatic imidazolium rings. We also followed temperature-induced structural transitions in cellulose/bmimCl mixtures and demonstrated the impact that the capillarity and the presence of cellulose chains have on hydrodynamic flow in these mixtures.

Pluronic® is a commercial name for a group of non-ionic macromolecular surfactants composed of polypropylene oxide (PPO) and polyethylene oxide (PEO) with the PEO-b-PPO-b-PEO block copolymer structure. Pluronics® are amorphous polymers soluble in many polar and non-polar solvent showing rich phase behaviour. Temperature-induced association of Pluronics® in aqueous solutions can lead to nanoscale effects such as conformational and hydration changes, further to mesoscale effects such as micellisation and to macroscale phenomena such as gelation. We used vibrational spectroscopy, X-ray scattering, dynamical mechanical analysis, density functional theory, and pH determination to investigate the relationships between the phenomena at all of these three levels of spatial organisation.

Day:4- 11:30:11:45	Professor Christopher Fellows - The University of New England S013

What does the desalination industry need from polymer scientists?

Membrane-based processes for desalination are significantly more energy-efficient than other desalination processes and have been dropping in cost steadily for several decades. Over this time their commercial development has grown rapidly and they are now the main source of potable water for tens of milliosn of people. The success of these membrane-based desalination processes is based on the properties of polymer composite materials, so ultimately on the hard work of polymer scientists. What are the current challenges for membrane-based desalination? What materials properties are needed to meet these challenges? Are academic researchers in this area still researching the materials required to meet the challenges of 20 years ago? This presentation will attempt to answer these questions and give an overview of current collaborative projects in membrane synthesis funded by Saudi Arabia's Saline Water Conversion Corporation.

Day:4- 11:45:12:00	Professor Albena Lederer - IPF Dresden & Stellenbosch University S013

The separation of inseparable distributions: Recent advances in field flow fractionation in a nutshell

Too small for size detection? Too large for a separation without decomposition? Too complex nanoparticle shapes?

The recent developments in field flow fractionation make the separation and full characterization of complicated macromolecular structures and their hybrids possible. Novel combinations of asymmetrical flow (AF4) and thermal field flow fractionation (ThFFF) techniques as well as their design advancement to aqueous and high-temperature (HT) conditions give insights into new levels of structural distributions.

Multifunctional metallic nanostructures are essential in the architecture of modern technology, notwithstanding the multiple challenges associated with their characterization. ThFFF and localized surface plasmon resonance (LSPR) of Au NPs are both dependent on size, shape, and composition, thus synergistically correlating for the advanced analysis of 3D UV-Vis spectra. The combination of both techniques leads to a novel and highly sensitive detection approach for the characterization of acrylic polymers coupled to gold nanoparticles. Using three-dimensional correlation ThFFF (3DCoThFFF) multiple sizes, shapes, compositions, and their respective distributions are synchronously correlated using time-resolved LSPR, as derived from multiple 2D UV-Vis spectra per unit ThFFF-retention time. [1]

3DCoThFFF is further combined with the Temperature-Gradient-Elution (TGE-3DCoThFFF) to integrate time- and temperature-dependent correlations from multiple detectors within a 3D framework. TGE-3DCoThFFF offers higher resolution investigations into the composition and microstructure of artificial polymer organelles as model analytes for mimicking cell communication. Utilizing a comprehensive combination of detectors including UV-Vis photo-spectroscopy, multiangle static and dynamic light scattering, and viscometry, we demonstrate the versatility and robustness of this analytical strategy.

Compared to ThFFF, AF4 is well known for the characterization of carrier systems for drugs or enzymes based on lipid nanoparticles or polymer vesicles, though limited in terms of detection to sizes larger than 20 nm. [2] Distribution of multiple parameters such as small micelles, and thickness of polymersome membranes in combination with their stability, loading, and release properties are difficult to interpret even with multiple light scattering or viscosity detectors. A coupling of AF4 with powerful scattering techniques, such as SAXS opens new avenues to characterize such small structural dimensions and their distributions and understand their role in new biomacromolecular systems.

Even chemically simple polyolefins are challenging to characterize when it comes to ultra-high molecular weights or extreme long chain branches in combination with low solubility at ambient temperatures. Classical HT-chromatography is limited in its ability to provide a sophisticated analysis due to shear degradation, or coelution of differently branched fractions. [3] HT-ThFFF instead may overcome this limitation because its separation mechanism is gentle and intrinsically sensitive to branching separation. A novel design to achieve stable ThFFF separation in an HT environment enables the effective separation of highly complex polyolefins.

Day:4-12:00:12:15	**Professor Ping Tang - Fudan University** **S013**

Network Homogeneity on Viscoelasticity of Polyethylene Terephthalate Vitrimers

We created PET vitrimers with different crosslinking density and network homogeneity by using precursors and branching agents with varying molecular weights. Our findings reveal that the dynamic network formed by the propane-type branching agent, 1,3-bis[tris(hydroxymethyl) methylamino] propane, exhibits a more uniform structure due to steric hindrance compared to 2,2-Bis(hydroxymethyl)-2,2',2"-nitrilotriethanol. The linear viscoelasticity (LVE) region of PET vitrimers exhibits characteristic pseudo-master curves that are influenced by two distinct relaxation mechanisms: Rouse-type relaxation of strands and terminal relaxation of the network. We also investigated the nonlinear rheology of PET vitrimers under extensional flow. Our findings indicate that PET vitrimers show significant strain hardening behavior but exhibit different stretching trends, corresponding to the ductility of polymer melts.

Day:4-12:15:12:30	**Professor Naum Naveh - Shenkar Engineering. Design. Art** **S013**

Rheology and Mechanical behavior of a Polyolefin/Polyester Vitrimer

The rheology of vitrimers depends on the kinetics of the reversible reactions. Viscosity can be controlled by the stoichiometry and the catalyst choice for a given polymer system, aside the temperature and shear rate for melt processable materials. Such materials can be injection molded or extruded to make recyclable parts with thermoset-thermoplastic dual behavior.

The structure-property relationships of a polyolefin/polyester vitrimer were investigated. The reaction takes place in the molten state. Zinc, tin and cobalt-based catalysts were used to facilitate the reaction between poly(ethylene-co-glycidyl methacrylate) and an anhydride. Characterization methods include

FTIR and NMR, swelling tests, thermal analysis (DSC and mDSC), thermo-mechanical analysis (DMA) and parallel plate viscometry. The low Tg and Tv values indicate these polymers can be processed at relatively low temperatures, allowing their incorporation into thermoplastic blends for various applications.

Day:4- 12:30:12:45	**Dr Mariana Cristea - "Petru Poni" Institute of Macromolecular Chemistry S013**

Molecular mobility phenomena in cyclodextrin-based polyurethane networks studied by dynamic mechanical analysis

Cyclodextrin-based polyurethane hydrogels have been designed to incorporate blocks with specific functions: the ability to form networks (beta-cyclodextrin, CD); a physical spacer with hydrolytic degradation properties (lactide oligomer, LA); a flexible hydrophilic block (polyethylene glycol, PEG). The thermo-viscoelastic behaviour is tuned by the presence of the LA spacer (CD-PEG, CD-LA-PEG) and/or through the molar ratio CD/PEG prepolymer. Each pattern is explained in terms of secondary/primary relaxations of the polymeric segments evidenced by dynamic mechanical analysis (DMA). The overall features of the structures are influenced by the distinct behavior of LA and by the tightness of the hydrogen bonding network. The complexity of the structures makes the various phenomena (melting, crystallization, completion of reaction) to overlap the main relaxations. Therefore, specific approaches were used to discern between kinetic/non-kinetic phenomena, as modulated DSC and multiplex DMA.

Day:4- 14:00:14:15	**Professor Taeshik Earmme - Hongik University S013**

Development of Solid Polymer Electrolyte Using High-Energy Electron Beam Irradiation

Currently, commercialized LIBs typically employ a liquid electrolyte that utilizes carbonate-based organic solvents. When an exothermal reaction is triggered by overcharge or external shock, the thermally unstable organic solvent can generate flammable gases that can lead to ignition, ultimately causing a thermal runaway in LIBs. Due to the safety concerns associated with liquid electrolytes, research has been conducted on solid electrolytes (SEs) as an alternative to liquid electrolytes (LEs). In this study, solid polymer electrolytes (SPEs) are prepared using high-energy electron beam irradiation. Optimized SPEs exhibit an average ionic conductivity of 0.54 mS/cm, a lithium transfer number (tLi+) of 0.69, a wide electrochemical window exceeding 5 V, and excellent properties in suppressing the growth of lithium dendrites. A discharge capacity of 138 mAh g-1 (0.1 C, 25 ℃) is achieved with 80% capacity retention after 200 cycles which demonstrates the potential of developed SPEs.

Day:4- 14:15:14:30	**Professor Chain-Shu Hsu Hsu - National Yang Ming Chiao Tung University S013**

Polymer solar cells over 18% efficiency based on carbazole-based non-fullerene acceptors

Elegant design of polymer donors, non-fullerene acceptors (NFAs) and interfacial materials have facilitate the development of polymer solar cells (PSCs). For example, a cross-linkable fullerene derivative c-PCBSD, is applied as an interfacial modification layer on the surface of zinc oxide in the PBDB-TF:Y6-based OPV cells to enhance photovoltaic performance and long-term stability. The PCE of the OPV cells increased from 15.1 to 16.1%. In particular, such OPV cells exhibited much better stability under both thermal and air conditions because of the decreased number of interfacial defects and stable interfacial and active layer morphologies. Also, ternary device is a robust approach to further elevate the PCE. Sensible selection of host blends and the third component is crucial to give full play to the advantages of the ternary strategy for achieving high PCE. In this contribution, PM6:BTP-BO-4Cl binary system and non-fullerene acceptor DTTC-4ClC9 with dithienocyclopentacarbazole (DTC

Day:4-
14:30:14:45

Ms Laura Hetjens - DWI-Leibniz Institute for Interactive Materials, RWTH Aachen University
S013

Synthesis of polyphenolic polyphosphazene colloids for bio-based flame retardant finishes

The development of new bio-based and environmentally friendly flame retardants (FR) is of great importance, based on updated safety and environmental regulations in the EU. Therefore, the development of new halogen-free FRs is of current interest for the reduction of environmental and health impacts.

The present work is concerned with the development of sustainable halogen-free cyclomatrix polyphosphazene coatings for cellulose-based matrices. Precipitation polycondensation of the phosphornitrilic chloride trimer (HCCP) with bio-based polyphenols is used to achieve this. This new FR material promises high thermal stability, low degradation and high charring effect achieved by the high phosphorus and nitrogen content. Therefore, this is a new proposal for a novel synthesis of polyphenol-polyphosphazene colloids with innovative reaction conditions.

Day:4-
11:00:11:30

Dr Valentin Victor Jerca - “Costin D. Nenitzescu” Institute of Organic and Supramolecular Chemistry, Romanian Academy,
S011

Engineering Functional Monomers: En Route to Advanced Materials

Functional polymers have made the leap from scientific curiosity to real-life applications in many modern science and technology fields. They are mainly obtained by (co)polymerization of functional monomers, which in turn are obtained by introducing a polymerizable bond in the structure of the functional organic molecules. In this respect, 2-isopropenyl-2-oxazoline (iPOx) represents a viable candidate for the synthesis of functional monomers due to the high reactivity of iPOx units towards carboxylic acids, and absence of by-products generated during the reaction. Therefore, an oversimplified bottom-up synthetic procedure to design functional monomers with both reactive polymerizable groups and stimuli responsive groups was developed from iPOx. Monomers containing specific responsive units such as azobenzene, terpyridine, pyrene, indomethacin, and others were obtained and characterized, while their responsive properties regarding different stimuli were investigated.

Day:4-
11:30:11:45

Dr Matthieu LANDA - CEA
S011

Strategies for the synthesis of polycarbonate-based-graft-copolymers and their use as Solid Polymer Electrolyte for all-solid-state Lithium battery

Replacing liquid electrolytes with solid electrolytes is the main way to make energy storage devices safer and more efficient in terms of energy density and lifespan. While Solid Polymer Electrolyte (SPE), predominantly represented by Poly(ethylene oxide) (PEO), exhibit attractive conductivities, their use is hindered by poor mechanical properties at operating temperature. Copolymers synthesis emerges as key strategy to mitigate this challenge.

Within this conference, we present our recent work focusing on the synthesis of graft-copolymers based on polycarbonates, described as emerging polymer classes capable to replace PEO in SPE applications. The main chain is formed of a rigid polymer to enhance mechanical properties while the pending chains are composed of polycarbonate, providing the necessary electrochemical properties of the SPEs. Using grafting from and onto methods, we discuss on the structural distinctions of copolymers resulting from the diverse synthesis methods employed.

Day:4-
11:45:12:00

Dr Ryan Kerr - University of Oxford
S011

Cyclic Anhydride (A) and Ether (B) Ring Opening Copolymerizations Delivering New ABB Sequences in Poly(Ester-alt-Ethers)

Poly(ester-alt-ethers) are interesting as they combine ester linkage degradability/hydrolysis with ether linkage flexibility but can be hard to synthesise. Here, a new generally applicable and controlled polymerization yielding these polymers from commercial monomers is presented. The ring-opening copolymerization of cyclic anhydrides (A), and cyclic ethers (B), including epoxides, oxetanes and THF is catalyzed by a Zr(IV) complex, yielding rare ABB sequence polymers. The systematic series of new polymers, with DP = 25 and Mn values from 4-11 kg mol-1, featuring aromatic, aliphatic, alkene or ether functionality, are all amorphous, show reasonable high temperature stability (Td,5% = 270-344 °C) and controllable glass transition temperatures (Tg = -50- 48 °C). Finally, the copolymerization kinetics and proposed mechanism are presented alongside initial degradation experiments which indicate the ABB polymers degrade faster, under aqueous conditions, than the AB polyester analogues.

Day:4- 12:00:12:15	**Dr Cansu Aydogan - University of Warwick S011**

Anionic Polymerisation of Dienes Using Flow Chemistry

Anionic polymerization has emerged as a powerful tool for the synthesis of well-defined polymers, offering control over chain structure and functionalization. This study explores the novel use of anionic polymerization in continuous flow systems, with a specific focus on end-functionalisation. Flow reactors provide enhanced reproducibility and scalability while minimising undesired side reactions. The research investigates the controlled anionic polymerization of dienes in flow reactors, ensuring precision in chain growth and facilitating the incorporation of desired end-group functionalities. Additionally, we employ the innovative approach by integrating online NMR monitoring for real time analysis of polymerizations conducted in flow reactors.

Day:4- 12:15:12:30	**Ms Emanuella Fiandra - Durham University S011**

The Redesign of Soil-Release Polymers Using Biosourced Monomers

With the increasing presence of synthetic fibers in fabrics, soil release polymers (SRPs) have become a highly desired polymer additive found in fabric care formulations. SRPs enhance the cleaning efficiency by modifying the fabric surface to prevent adsorption of soil in the subsequent wear phase. To complement the structure of polyester fabrics, conventional SRPs contain a poly(ethylene terephthalate) subunit capped by a hydrophilic methoxy-poly(ethylene glycol) unit to aid in the dispersal of the polymer in the solution whilst preventing the redeposition of the soil onto the fabric surface. To improve their environmental footprint, a novel class of SRPs have been synthesised using biosourced monomers in a one-pot multi-step polycondensation reaction. The potential viability as potential replacements to current commercialised SRPs were assessed through performance testing to determine the stain removal index and whiteness maintenance of the fabric samples.

Day:4- 12:30:12:45	**Mr Kai Rist - Ivoclar Vivadent AG S011**

Self-Assembly of Block Copolymers for Toughening UV-Curable (Meth)Acrylic Resins

Additive manufacturing is on the verge of replacing established processes in dentistry as individual parts can be manufactured simply and cost-effectively by stereolithographic methods which are currently emphasised due to their high precision and versatility. However, the intrinsic brittleness of the multifunctional acrylic monomers used, remains a major challenge. Recently, it was shown that high fracture toughness, whilst retaining high flexural strength, can be achieved through self-assembly of block copolymers in low crosslink density resins. The small size of these assemblies results in minimal impact on viscosity and transparency, ensuring highly efficient 3D printing and curing. By varying chemistry, ratio and length of the copolymer blocks, we could adjust the properties to suit different resins. Obtained nanostructures were characterized by TEM and SEM, and mechanical properties by dynamic mechanical analysis, flexural testing, and fracture toughness measurements.

Day:4- 14:00:14:15	**Dr Patrick Knaack - TU Wien S011**

Radical Induced Cationic Frontal Polymerization

Cationic Frontal polymerization is an elegant curing method known to the academic research since several decades. It is a polymerization process in which polymerization occurs directionally in a localized reaction zone utilizing the liberated reaction heat to start the curing of next part. To transfer this (orders of magnitudes more energy efficient and faster) process from the laboratory towards industrial production is an ongoing challenge.

To discuss these challenges and present already found solutions and ideas to solve the remaining issues will be the focus of this talk. Particular emphasis will be laid on particle filled composites (up to kneadable formulations), fiber reinforced polymer composites made via vacuum assisted resin transfer molding or frontally polymerizable carbon fiber prepregs and wet filament winding.

Day:4- 14:15:14:30	**Mr Billy Shu Hieng Tie - Technological University of the Shannon: Midlands Midwest S011**

The Development of Nanoclay-incorporated N-Vinylcaprolactam/N-Isopropylacrylamide-Based Copolymers in the Shapeshifting Applications

Poly(N-Vinylcaprolactam) (PNVCL) and Poly(N-Isopropylacrylamide) (PNIPAm) are both biocompatible thermo-responsive hydrogels with a near-physiological lower critical solution temperature (LCST), rendering them suitable for biomedical use. These hydrogels exhibit swelling below their LCST and de-swell above it, responsive to temperature changes in the environment. Recent investigations focus on the dynamic properties of hydrogels when combined with pliable materials. Hydrogels function as the active layer, expanding during swelling, while flexible/soft materials act as the passive layer, restraining stretching effects induced by swelling. This synergy results in structural shapeshifting. The research highlights the advancement of nanoclay-incorporated NVCL/NIPAm copolymers, showcasing improved mechanical performance, promising exciting prospects for shapeshifting biomedical technologies.

Day:4- 14:30:14:45	**Mr Tommaso Posenato - Université Claude Bernard Lyon 1 S011**

BORON CONTAINING DYNAMIC POLYMERS for HYDROGEN STORAGE

Introducing boron into polymers can lead to materials which could be used in catalysis, self healing materials and organic batteries. Boron-containing polymers could be part of a global solution to store hydrogen safely for on-demand usage, through dehydrogenation. Indeed, the inclusion of boron with macromolecular architectures boron could lead also to different polymer properties, like higher Tg and easier recycling. Changing the ligands could yield new materials: boron can form strong and dynamic bonds with different atoms and moieties. Nucleophilic species can modify boron geometry and hybridization, a sp2 trigonal-sp3 tetrahedral boron equilibrium. This subject is developed through 4 axis: i) the optimization of the synthesis of boron containing polymers, ii) the variation of the position that boron atoms occupy within the polymer architecture iii) the ligands of the boron atom and their influence on the polymer properties, iv) potential hydrogen storage.

Day:4- 11:00:11:15	**Mr Hyun Suk Wang - ETH Zurich OC101**

Controlled Depolymerization of RAFT Polymethacrylates

Current depolymerization reactions are typically uncontrolled, thus providing no handle over the molecular weight and limiting further applications. Herein, we report a controlled RAFT depolymerization that enables a gradual decrease in molecular weight, resembling the reverse process of controlled polymerization. The key to our strategy is to enhance chain deactivation over depropagation by employing RAFT agents with high chain-transfer activity, resulting in the gradual unzipping of polymer chains and a linear decrease in molecular weight over time. As an exemplary application, we demonstrate that controlled depolymerization enables the structural characterization of various copolymers (i.e., AB diblock versus BA diblock versus statistical versus gradient) by facilitating the sequential release of monomers from the chain end, pushing the boundaries of depolymerization and unlocking new applications.

Day:4-
11:15:11:30

Ms Suna Azhdari - University Twente
OC101

Innovative Fully Biodegradable Block Copolymers: Pioneering Versatile Drug Encapsulation with Polymer Cubosomes

Innovating drug delivery, our research introduces a polyphosphoester and polylactide-based block copolymer, synthesized using anionic ring-opening polymerization, adept at encapsulating a diverse range of hydrophobic molecules, dyes, and drugs. Advanced nanoengineering techniques enable these polymers to self-assemble into highly ordered, porous microparticles. Unique in their composition, these polymer cubosomes degrade into harmless byproducts, such as lactic acid and phosphate ions, ensuring environmental safety. These structures serve as universal carriers, compatible with both hydrophobic and hydrophilic cargoes, and are capable of releasing active substances within a few days. Their versatility and environmentally-friendly degradation process mark a significant leap in pharmaceutical applications, blending sustainability with enhanced efficacy in drug delivery.

Day:4-
11:30:11:45

Ms Eloise Billington - University of Manchester
OC101

Development of Fibre Reinforced Composites from Degradable and Reprocessable Polyester Resins

Fibre reinforced polymer composites (FRPs) are used for a wide variety of applications, including wind turbine blades, boats and automobiles. However, the vast majority are synthesised using non-renewable feedstocks, and due to a lack of recycling technologies, large quantities of waste are created at their end-of-life. FRPs generally have a thermosetting matrix, limiting their reprocessability and recyclability, but alternative thermosets that offer greater value at end-of-life are those containing dynamic cross-links, which undergo reversible exchange reactions or are chemically depolymerisable. We have recently developed cross-linked polyester systems from cyclic ester monomers that achieve both goals, thus are more sustainable. This contribution will discuss the relationship between monomer and comonomer performance, lay-up procedure (hand lay-up, vacuum assisted resin infusion, hot press) and reinforcement (glass fibre, carbon fibre) to tune composite performance.

Day:4-
11:45:12:00

Dr Fernando Vidal - Basque Center for Macromolecular Design and Engineering, POLYMAT Fundazioa
OC101

Strategies for boron-based advanced materials: from stimuli-responsiveness to toughened elastomers

Polymer materials with tricoordinate boron centers have found a plethora of applications, from optoelectronics, to chemical sensors, and heterogeneous catalysts due to the relatively high Lewis acidity of organoborane moieties and their ability to participate in larger π-conjugated systems. Additionally, boron compounds can engage in a variety of dynamic chemistries, including supramolecular interactions (classical and frustrated Lewis pairs), as well as reversible covalent bonds (B-O exchange). Here, advances in developing functional polymers with tri- and tetracoordinated boron centers will be presented. First, the modulation of the dynamic interaction between Lewis pairs will be utilized to directly control the physical and mechanical properties of supramolecular polymer networks. Secondly, a modular strategy to create degradable organoborane-containing polyesters will be introduced, which enabled the construction of toughened elastomers with dynamic boronic ester bonds.

Day:4- 12:00:12:15	**Ms Maisarah Abdul Rahman - The University of Edinburgh OC101**

Exploiting Heterometallic Cooperativity in Cyclic Ester Ring-Opening Polymerisation

The ring-opening polymerisation (ROP) of cyclic esters is an efficient route for producing useful polyester materials. Poly(ε-caprolactone) and poly(lactic acid) are two key aliphatic polyesters accessible via ROP, with many applications due to their desirable properties, biocompatibility and biodegradability. Toxicity concerns over the industrially-used tin octanoate (Sn(Oct)2) as a ROP initiator has sparked a drive to develop efficient catalysts based on earth abundant, low-toxicity metals (e.g. Na, Mg, Ca, Zn, Al), yet few can compete with the industrial standard. Recently, heterometallic (mixed-metal) cooperativity has emerged as a powerful method of enhancing catalytic activity in cyclic ester ROP. This presentation will explore how different combinations of heterometals, supported by a ProPhenol ligand scaffold, can enhance the catalyst activity and deliver excellent control over the polymer structure, both in the homo- and co-polymerisation of cyclic esters.

Day:4- 12:15:12:30	**Mr Oliver Harris - Loughborough University OC101**

New RAFT polymer, synthesis and kinetics, derived from plant oils

Plant oils are an abundant renewable resource that have been demonstrated in the literature to be a suitable feedstock for polymers with interesting properties (low Tg, hydrophobicity, functionalisation of unsaturations in pendant groups). In this work plant oil based monomers (POBMs) were synthesised from four different feedstocks via a one-step, industrially relevant reaction, and the kinetics of their polymerisation in a RAFT system were investigated. The reactions of the feedstock oils have been investigated in terms of: the average chain length of fatty acids; the degree of unsaturation of fatty acids as well as different levels of impurities in the feedstock. Polymerisations were carried out in toluene using AIBN as an initiator and DDMAT was selected as an appropriate chain transfer agent. 1H NMR spectroscopy and GPC were used to obtain monomer conversion, Mw and _ kinetics data from the polymerisations that was subsequently used to assess the control of the reaction by RAFT.

Day:4- 12:30:12:45	**Mr Morgan Reynolds-Green - University of Nottingham OC101**

Simple chemical modifications of fatty acids to synthesise novel polymers for industrial application.

The need for bio-derived lubricants is of growing interest and concern to those in the field. Vast quantities of lubricating base oils are released into the environment each year, with over 95% of these being non-biodegradable, and often toxic. In this work, the simple chemical modification of renewable and widely available fatty acid feestocks is explored, to enable the production of novel polymers with potential for lubricant applications, having less deleterious effects on the environment. These novel lubricating polymers bear semblance to estolides, a class of secondary esters synthesised from fatty acids and already commercially applied, though uniquely these novel polymers contain additional chemical handles enabling further functionalisation and tailoring of properties. Analysis of these novel materials indicates excellent physical and chemical properties, comparable with products already on the market.

Day:4- 11:00:11:30	**Professor Sebastien Lecommandoux - BUTTERWORTH HALL**

TBC

TBC