



**Non-Covalent** Polymer Functionalized Multi-wall Graphistrength® C100 Carbon Nanotubes  
ZNT-C, ZNT-W, ZNT-Ep, ZNT-Es (R&D)

**Safety Data Sheet**

**Section I: Product and Company Identification**

<b>Manufacturer</b>	Zyvex Technologies
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<b>Email</b>	cballard@zyvextech.com
<b>Product Names</b>	ZNT-C, ZNT-W, ZNT-Ep, ZNT-Ep
<b>Chemical Name</b>	Non-Covalent Functionalized Multi-wall Carbon Nanotubes
<b>Issue Date</b>	December 31, 2014
<b>Recommended Use</b>	For resin and composite applications, coatings, and thermoplastic polymers


**Section II: Hazards Identification**

Emergency Overview

Color: - Black  
Physical State: - Solid  
Form: - Powder (agglomerated)  
Odor: - Slight solvent to none

Warning!

May cause eye and respiratory tract irritation  
Prolonged or repeated contact may dry skin and cause irritation  
For research and development use only by technically qualified individuals under section 5 (h)(3) of the Toxic Substances Control Act

<b>Eye</b>	May be mildly irritating to eyes. Based on animal studies of untreated (raw) nanotubes.
<b>Skin</b>	Not more than slightly toxic. Slightly irritating. Based on animal studies with untreated (raw) nanotubes
<b>Ingestion</b>	Not likely to be a relevant route of exposure. No more than slightly toxic.
<b>Inhalation</b>	Not likely to be a relevant route of exposure; however, under conditions where exposure to vapors or mists is possible, could irritate the respiratory tract.
<b>Classification</b>	
<b>Environment</b>	Toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

### Section III: Physical/Chemical Characteristics

Substance	CAS Number	OSHA Permissible Exposure Limit	Carcinogenicity Classification	~ Wt. %
Arkema Graphistrength C100 (R&D) Multi Wall Carbon Nanotubes	N/A PMN 13-0573 PMN 09-188	ACGIH: Not available OSHA: Not available NIOSH –See Current Intelligence Bulletin 65 <a href="http://www.cdc.gov/niosh/docs/2013-145/pdfs/2013-145.pdf">http://www.cdc.gov/niosh/docs/2013-145/pdfs/2013-145.pdf</a>	Not listed	>/= 87
Proprietary Conjugated Polymer or Molecular Compound	Proprietary	None Established	Not listed	</= 13%

### Section IV: First Aid Measures

<b>After Eye Contact</b>	Flush with large amounts of water for at least 15 minutes, lifting the eyelids to separate them. Do not rub eyes or keep them closed. Seek medical assistance immediately.
<b>After Skin Contact</b>	Immediately wash with large amounts of soap and water, remove contaminated clothing, and seek medical assistance if needed. In case of contact with hot product, immediately flood the affected area with cold water. Wipe excess material from exposed area. Flush exposed skin with water and follow by washing with soap if available. Carefully remove clothing; if clothing is stuck to a burn area do not pull it off, but cut around it. Cover burn area with a clean material. Transport to nearest medical facility for additional treatment.
<b>After Swallowing</b>	Do not induce vomiting. Have victim rinse out mouth with water and then drink sips of water to remove taste from mouth. In general, no treatment is necessary unless large quantities of product are ingested. However, get medical advice. Be sure person does not aspirate into lungs. Seek medical assistance immediately.
<b>After Inhalation</b>	Remove to fresh air immediately and give oxygen if breathing is difficult. Get medical assistance. If not breathing, give artificial respiration.

## Section V: Fire-fighting Methods

<b>Suitable extinguishing media</b>	Alcohol resistant foam, CO <sup>2</sup> powders, water spray.
<b>Unsuitable extinguishing media</b>	Water-jet.
<b>Special protective equipment</b>	Fire fighters and others who may be exposed to products of combustion should wear full fighting turn out gear and self-contained breathing apparatus (pressure demand/NIOSH approved or equivalent) Fire fighting equipment should be thoroughly decontaminated after use.
<b>Special risk posed by the substance or by the actual preparation, its combustion products or gases discharged</b>	Fire will produce dense black smoke. Exposure to decomposition products may cause a health hazard.
<b>Additional information</b>	Cool endangered containers with water in case of fire. Do not allow the quenching water into the sewage system.

## Section VI: Accidental Release Measures

<b>Personal Precautions</b>	Remove ignition sources. Provide for sufficient ventilation. Do not inhale the vapor. Refer to protective measures listed in Section VIII.
<b>Environmental Precautions</b>	Do not empty into drains. If the product contaminates lakes, rivers or sewages, inform appropriate authorities in accordance with local regulations.
<b>Methods for cleaning-up/collecting</b>	Contain and collect spillage with non-combustible absorbent materials, e.g. sand, earth, vermiculite, diatomaceous earth and place in container for disposal according to local regulations (see Section XIII). Clean preferably with a detergent; avoid use of solvents.

## Section VII: Handling and Storage

<b>Information on Safe Handling</b>	Avoid contact with skin and eyes. Do not eat or drink during work - no smoking. Comply with the health and safety at work-laws.
<b>Information about protection against explosions and fires</b>	No particular measures required.
<b>Requirements to be met by storerooms and containers</b>	Containers should be kept dry and sealed. Containers that are opened must be carefully resealed and kept upright to prevent leakage.
<b>Information about separation of incompatible products</b>	Keep away from oxidizing agents, from strongly alkaline and strongly acid materials.
<b>Further information about storage conditions</b>	Always keep in containers of same material as the original one. See also instructions on the label. Avoid heating and direct sunlight.

## Section VIII: Exposure Controls/Personal Protection

<b>Additional information about engineering measures</b>	Avoid contact with skin and eyes. Do not eat or drink during work - no smoking. Comply with the health and safety at work-laws. Investigate opportunities to use engineering controls, including local exhaust systems, lab hoods or enclosed systems to reduce exposure. Any ventilation systems used must be equipped with High Efficiency Particulate (HEPA) filtration. Check that all dust control equipment such as local exhaust ventilation, material transport systems, and air – material separation devices involved in handling these products contain explosion relief vents or an explosion suppression system of oxygen deficient environment. See NFPA Standard 91 and STANDARD 654 for design of exhaust system and safe handling.
<b>Personal Protective Equipment (PPE)</b>	Adequate ventilation should be provided while working with this product.

	<p>Avoid contact with skin. Protect hands with chemical resistant gloves demonstrating performance according to ASTM F-1671 or NFPA199 when handling. Wear lab coat or other protective clothing. Suggested those that meet ASTM F-1671. Remove and wash contaminated clothing upon exposure. Incineration is the required method of disposal for non- reusable personal protective equipment and cleaning materials.</p> <p>Wear chemical safety goggles and full face shield if splashing is possible .Do not breath dust. For tasks with exposure potential, including routine operations where full exposure control is not available, or when managing spills or releases, respiratory protection is required .Use NIOSH-certified air purifying, tight-fitting full face respirator equipped with N-100, P-100, or R-100 filter: a NIOSH –certified powered air purifying respirator with a loose-fitting hood or helmet and a high efficiency particulate air filter with documented evidence of an Assigned Protection Factor of 1000. Observe respirator use limitations specified by NIOSH or the manufacturer. Respiratory protection programs must comply with 29CFR 1910.134. Incineration is the required method of disposal for used respirator Cartridges,</p>
<b>Chemical Hygiene</b>	<p>Wash hands after handling material to minimize the spread of undetected skin contamination. All applicable laboratory safety guidelines should be followed when using this material. Any cleaning operations including routine housekeeping or spill responses must be performed using methods that will prevent powder dispersion. Recommended use of HEPA filtered vacuum (&gt;99% efficiency at sub micron particle size) for cleaning. This can be supplemented by surface wiping with a damp cloth. Any cleaning materials should be disposed of via incinerated methods. Check of state and local waste disposal requirements recommended , they may be more restrictive or otherwise different from federal laws and regulations</p>

## Section IX: Physical/Chemical Properties

<b>Appearance/Odor</b>	Black semi-solid/highly viscous liquid at room temperature with slight odor
<b>Odor Threshold</b>	Not available
<b>pH</b>	N/A
<b>Melting point/Freezing point</b>	Not available
<b>Initial boiling point and boiling range</b>	210-215 °C / 0 Torr
<b>Flash point</b>	Not available
<b>Evaporation Point</b>	Not available
<b>Flammability (Solid, gas)</b>	Not available
<b>Upper/Lower flammability limits</b>	Not available
<b>Vapor Pressure</b>	Not available
<b>Vapor Density</b>	Negligible
<b>Relative Density</b>	Not available
<b>Solubility</b>	Negligible
<b>Partition Coefficient (n-octanol/water)</b>	Not available
<b>Auto ignition Temperature</b>	Not available
<b>Decomposition Temperature</b>	Not available

## Section X: Stability and Reactivity Data

<b>Stability</b>	Stable under normal use conditions.
<b>Incompatibility</b>	Can react vigorously with strong oxidizing agents, strong Lewis or mineral acid, and strong mineral and organic bases. Avoid contact with water or liquids. Do not allow molten product to contact water or other liquids. In this state can cause violent eruptions, splatter hot material, or ignite flammable material.
<b>Decomposition</b>	Should not occur under proper conditions of use. Do not overheat. If thermal decomposition would occur possible by-products Carbon Oxides and Metallic Oxides.
<b>Hazardous Polymerization</b>	Can occur. Polymerization can be catalyzed by acids. Avoid inhalation.
<b>Conditions to avoid</b>	Avoid high temperatures. Stable under recommended storage and handling conditions (See Section VII).

## Section XI: Toxicological Information

<b>Toxicity</b>	* Toxicity tests have not been performed on this Zyvex Technologies product. Treat with caution. Pre-existing skin or lung allergies increase the chance of allergic reaction to exposure.
<b>Eye</b>	May cause irritation. Carbon nanotube toxicity is not known in humans. CNTs were not toxic to rabbit eye in Draize test. Contact with hot product can cause thermal burns which may result in permanent damage or blindness
<b>Skin</b>	May cause skin sensitization and/or irritation. Contact with hot material can cause thermal burns, which may result in permanent damage. Studies on the effects of dermal contact with carbon nanotubes are limited. Carbon nanotubes did not cause enzyme induction, increased DNA synthesis, or hyperplasia in the skin of allergy-susceptible people.
<b>Ingestion</b>	Not likely to be a relevant route of exposure. Toxicity of carbon nanotubes is unknown.
<b>Inhalation</b>	Not likely to be a relevant route of exposure; however, under conditions where exposure to vapors or mists is possible, could irritate the respiratory tract. Toxicity of carbon nanotubes is not known in humans. Carbon nanotubes may cause pulmonary irritation, inflammation, granuloma formation, and/or altered pulmonary function in laboratory animals. Inhaled particles may be transported to other area of the body.
<b>Conditions aggravated by exposure</b>	Existing skin and pulmonary diseases may be aggravated by skin or inhalation exposure to carbon nanotubes.

## Section XII: Ecological Information

<b>Ecotoxicity (aquatic/terrestrial)</b>	Not available for polymer treated nanotubes, results are available upon request for raw carbon /untreated nanotubes.
<b>Details on elimination (persistence / degradability)</b>	Not readily biodegradable.

<b>Bioaccumulative potential</b>	Not readily biodegradable.
<b>General Notes</b>	Do not empty into waters or drains. The product is difficult to biologically degrade. Controlled by Arkema PMN 09-188 and Zyvex PMN 13-0573. Any and all water releases are prohibited.

### Section XIII: Disposal Considerations

<b>Material Escape or Spills</b>	Shut off leaks, if possible without personal risk. Ventilate area. Prevent additional discharge of material, if possible to do so without hazard. For small spills implement cleanup procedures: Dike and contain. Avoid runoff into waterway and ground penetration. Absorb with inert material (i.e., clay or sand) and place into non-leaking container. Dispose of properly. Flush area with water to remove trace residue. Large spills: Use vacuum trucks or pump to storage vessels. Soak up residue with inert material (i.e., clay or sand) and place into non-leaking container. Dispose via incinerated waste stream. Flush area with water to remove trace residue.
<b>Waste Disposal</b>	Incinerated Waste Stream
<b>Handling</b>	Use Personal Protective Equipment (see Section VIII) and proper ventilation.
<b>Storage</b>	Store in cool, dark, dry place with adequate ventilation. Keep away from ignition sources and high temperatures.

### Section XIV: Transport Information

<b>DOT Proper Shipping Name</b>	NOT REGULATED FOR TRANSPORT
<b>DOT Hazard Class</b>	NOT REGULATED FOR TRANSPORT
<b>Identification Number</b>	NOT REGULATED FOR TRANSPORT
<b>Packaging Group</b>	NOT REGULATED FOR TRANSPORT

## Section XV: Regulatory Information

<b>Resource Conservation and Recovery Act (RCRA)</b>	<b>This product is not specifically listed as hazardous waste under RCRA (40 CFR 261). However, it is strongly recommended that this product be treated as a hazardous waste and disposed of accordingly. Incineration required per PMN09-188 and PMN13-0573</b>
<b>SARA Title III: Section 313 Toxic Chemical List (TCL)</b>	<b>This product does not contain chemicals at levels which require reporting under this statute. Some levels of catalyst by products may be present from the initial production of the raw nanotubes Aluminum Oxide <math>\leq 7\%</math> and Iron Oxide <math>\leq 5\%</math> However at this time levels of both have been reduced to <math>\leq 3\%</math> after functionalization or polymer treatment.</b>
<b>TSCA Section 8(b)-Inventory Status</b>	<b>All chemical components of this product are listed or in compliance with TSCA inventory requirements.</b>
<b>TSCA Section 12(b)-Export Notification</b>	<b>This product does contain chemical(s) that are subject to Section 12(b) export notification as defined in PMN 13-0573 consent order (exempt states). And PMN 09-188</b>
<b>CERCLA</b>	<b>The components in this product are either not CERCLA regulated, regulated but present in negligible concentrations, or regulated with no assigned reportable quantity</b>
<b>NTP/IARC/OSHA</b>	<b>No component of this product present at levels greater than or equal to 0.1% is identified as a known carcinogen by NTP</b>
<b>California PROP 65</b>	<b>This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive defects</b>

## **Section XVI: Special Precautions**

**User acknowledges that Zyvex Technologies (ZT) product is sold solely for research and development, and that he/she will use the product in accordance with all applicable government regulations including, but not limited to those described within. The product will be used in accordance with the appropriate Material Safety Data Sheet (MSDS) and “Prudent Practices for Handling Hazardous Chemicals in Laboratories.”**

**User acknowledges that he/she is familiar with the provision of the TSCA exemption for research and development found in 40 CFR 720.36.**

**User agrees to notify ZT in writing if his/her use of ZT products is for manufacturing as defined in TSCA. User further agrees not to use ZT products in manufacturing unless and until user and ZT have ascertained that the product is listed on the TSCA inventory list or that a Pre Manufacturing Notice (PMN) has been filed and approved by the U.S. EPA.**

**THIS PRODUCT FROM ZYVEX TECHNOLOGIES IS SOLD FOR RESEARCH AND DEVELOPMENT PURPOSES ONLY.**

**This information is provided for in good faith and is believed to be correct. Zyvex Technologies; however, makes no representation as to the comprehensiveness or accuracy of this information. Final determination of the suitability of this product and its safe use is the sole responsibility of the user. Accordingly, Zyvex Technologies will not be responsible for damages of any kind resulting from the use of or reliance upon the provided information.**