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1. EDUCATION

Doctor of Philosophy in Mechanical Engineering, 2014

University of Delaware, Newark DE

Bachelor of Engineering (Hons.) in Mechanical Engineering, 2008

Panjab University, Chandigarh (India)

2. PROFESSIONAL RESEARCH EXPERIENCE

Manager of Research Projects, March 2016 - present

Nanotribology Laboratory of Prof. Robert W. Carpick

Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania

Postdoctoral Associate, June 2014 – February 2016

Nanotribology Laboratory of Prof. Robert W. Carpick

Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania

3. AWARDS AND HONORS

Marshal B. Peterson Award, American Society of Mechanical Engineers (ASME), 2016

Biennial award recognizing early career achievement and promise for pursuit of research in tribology

Poster Award, Gordon Research Seminar on Tribology, 2016

Early Career Researcher Award, Society of Tribologists & Lubrication Engineers (STLE), 2015

Poster Award, Gordon Research Seminar on Tribology, 2014

Professional Development Award, University of Delaware, 2014, 2012

Graduate Scholarship, National Association for Surface Finishing, 2014

Student Scholarship, Society of Tribologists & Lubrication Engineers, Philadelphia Section, 2013

Young Tribologist Award, Society of Tribologists & Lubrication Engineers, 2013

Graduate Achievement Award, University of Delaware Department of Mechanical Engineering, 2013

University Graduate Fellow, University of Delaware, 2012

Best Poster Award, Society of Tribologists & Lubrication Engineers, Annual Meeting, 2012

Poster Award, ASME-STLE International Joint Tribology Conference, 2011

Best Research Presentation, UD Mechanical Engineering Graduate Research Symposium, 2010

4. SELECTED PROFESSIONAL ACTIVITIES

- Technical Editor, STLE Tribology and Lubrication Technology, 2018
- Co-Chair, Gordon Research Seminar on Tribology, 2018
- Chair, STLE Nanotribology Education Course, 2018
- Vice Chair, Nanotribology Technical Committee of the STLE Annual Meeting, 2018
- Invited Peer Reviewer on 39 manuscripts in journals including Nature Communications, Scientific Reports, ACS Applied Materials and Interfaces, ACS Nano Letters, Journal of Materials Research, Journal of Composite Materials, ASM International, Wear, Tribology Letters, ASME Journal of Tribology, Tribology Transactions, Wear of Materials (conference)

5. RESEARCH INTERESTS

Tribology (friction, wear, adhesion, failure and reliability), surface science and multi-scale mechanics of materials; Scanning Probe Microscopy and related techniques, including nanotribology and SPM nanolithography; Experimental methods in the multi-scale tribology of liquid and solid lubricant materials, including lubricant additives and interactions, multifunctional polymer, ceramic and metal-matrix nanocomposites; Surface analytical techniques, surface metrology, metallography and powder metallurgy; Machine design, control and instrumentation.

6. PEER-REVIEWED PUBLICATIONS

Total citations=240, h-index=6 (source: Google Scholar); *equal contribution

Manuscripts in preparation (in final stage before submission):

1. An *in-situ* study of tribofilm growth kinetics generated from nanoparticle anti-wear additives
H.S. Khare, R.W. Carpick, *et al.*
2. Nanotribological printing: An additive method for nanoscale lithography
H.S. Khare, R.W. Carpick, *et al.*
3. Additive synergies between ZDDP and ZrO₂ nanoparticle additives in low viscosity lubricants
H.S. Khare, R.W. Carpick, *et al.*

Published peer-review articles:

1. Interrelated effects of temperature and environment on wear and tribochemistry of an ultralow wear PTFE composite
H.S. Khare*, A.C. Moore*, D.R. Haidar, L. Gong, J. Ye, J.F. Rabolt, D.L. Burris, *Journal of Physical Chemistry C*, **119** (29), 16518-16527 (2015)
2. Quantitative characterization of solid lubricant transfer film quality
J. Ye, **H.S. Khare**, D.L. Burris, *Wear*, **316** (1), 133-143 (2014)
3. Surface and subsurface contributions of oxidation and moisture to room temperature friction of molybdenum disulfide
H.S. Khare, D.L. Burris, *Tribology Letters*, **53** (1), 329-336 (2014)
4. The effects of environmental water and oxygen on the temperature-dependent friction of sputtered molybdenum disulfide
H.S. Khare, D.L. Burris, *Tribology Letters*, **52** (3), 485-493 (2013)
5. The extended wedge method: Atomic force microscope friction calibration for improved tolerance to instrument misalignments, tip offset, and blunt probes
H.S. Khare, D.L. Burris, *Rev. of Sci. Instruments*, **84** (5), 055108 (2013)
6. Transfer film evolution and its role in promoting ultra-low wear of a PTFE nanocomposite
J. Ye, **H.S. Khare** and D.L. Burris, *Wear*, **297** (1), 1095-1102 (2013)
7. A quantitative method for measuring nanocomposite dispersion
H.S. Khare, D.L. Burris, *Polymer*, **51** (3), 719-729 (2010)
'Top 25 Hottest Article' in Polymer (January-March, 2010)

Featured Articles

1. Methods in characterization of nanoscale friction in solid lubricants
H.S. Khare, D.L. Burris, *Tribology and Lubrication Technology*, September 2012
2. Characterization of nanoscale surface films in solid lubricants
H.S. Khare, D.L. Burris, *Tribology and Lubrication Technology*, May 2012

7. PATENTS AND DISCLOSURES

1. Systems and Methods for Nano-Tribological Manufacturing of Nanostructures, International Patent WO/2017/044331 (2017)
2. Nano-additives enabled advanced lubricants, International Patent WO/2016/179224 (2016)

8. GRANT WRITING EXPERIENCE

- Helped conceptualize and lead author on an NSF Grant Opportunities for Academic Liaison with Industry (GOALI) proposal (with ExxonMobil Research & Engineering), titled '*Enabling Ultra-Low Viscosity Lubricants Through Fundamental Understanding of Additive Interactions and Tribofilm Growth Mechanisms: An In-Situ Study*', 2017 (**awarded, \$383,819; role: Senior Personnel**).
- Helped conceptualize and author a Phase II Department of Defense Small Business Technology Transfer (STTR) grant, titled '*Fuel Efficient Nano-Fluid Gear Oil*', 2017 (**awarded, \$340,000**)
- Conceptualized and authored an NSF Research Experience for Undergraduates (REU) Supplement to the grant '*Temperature dependence of atomic scale friction*', CMMI-1401164, 2017 (**awarded, \$5,000**).
- Conceptualized and authored a proposal for an undergraduate summer research project at the UPenn Singh Center REU program, 2016 (**awarded, \$5,500, plus instrument user fees**).
- Conceptualized and authored two proposals to support summer undergraduate researchers through the Penn Undergraduate Research Mentoring Program (PURM), 2015, 2016 (**awarded, \$5,000 each**).
- Assisted in conceptual development and writing of a grant proposal submitted to the Department of Energy's Vehicle Technologies Office Incubator Program, titled '*Friction Reduction in Rolling Bearings through High Performance Greases – A Nanotechnology Approach*', 2015 (**not awarded**).
- Helped conceptualize, co-authored and collected preliminary data for an NSF proposal titled '*A Direct Experimental Link Between Atomic-Scale and Macroscale Friction*', CMMI #1434435, 2014 (**awarded, \$297,946**).
- Helped conceptualize and led the writing of a seed funding grant at the Department of Mechanical Engineering (University of Delaware) titled '*Metal-Matrix Nanocomposites as Next Generation Tribomaterials*', 2014 (**awarded, \$30,000**).
- Contributing co-author of project report titled '*Linking Tribofilm Nanomechanics to the Origins of Low Friction and Wear*', submitted to the Air Force Office of Scientific Research (AFOSR), 2013.

9. PRESENTATIONS

Presenting author on 19 contributed talks and 9 poster presentations (see #18 for list of contributed talks).

Invited Talks

1. Enabling Novel Nanomanufacturing Methods and Advanced Lubricant Additives Using *In-Situ* Atomic Force Microscopy
Singh Nanovation Conference at the University of Pennsylvania, Philadelphia PA, 2017
2. Revealing Growth and Wear Protection Mechanisms of Engine Oil Additive Tribofilms through *in-situ* Atomic Force Microscopy
Microscopy Symposium of the Philadelphia Society of Microscopy, Philadelphia PA, 2017
3. Fundamental studies of molybdenum disulfide tribology
STLE Philadelphia Section Meeting, Oreland, PA 2014
4. Scanning Probe Microscopy (SPM) applications in tribology
Bruker Nano Surface Metrology Workshop, UD Center for Composite Materials, Newark DE, 2012
5. Applications of 3D optical microscopy in tribology research
Bruker Nano Surface Metrology Workshop, UD Center for Composite Materials, Newark DE, 2012

10. TEACHING EXPERIENCE

1. **Guest Lecturer**, Fall 2017, 2016, 2015
MEAM 504: Tribology (lectures on Solid Lubrication and Boundary Lubrication)
Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania
2. **Teaching Assistant/Recitation Instructor**, Fall 2016, 2015
MEAM 354: Mechanics of Solids
Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania
3. **Teaching Assistant/Laboratory Instructor**, Fall 2013
MEEG 311: Vibrations and Control
Department of Mechanical Engineering, University of Delaware
4. **Teaching Assistant/Laboratory Instructor**, Spring 2009
MEEG 346: Thermal Laboratory
Department of Mechanical Engineering, University of Delaware
5. **Teaching Assistant/Laboratory Instructor**, Fall 2008
MEEG 331: Fluid Mechanics I
Department of Mechanical Engineering, University of Delaware

11. TRAINING IN PEDAGOGY

1. **Fundamentals of Classroom Teaching**, October – November 2015
U Penn Center for Teaching and Learning and School of Engineering and Applied Science
2. **Creating Assessments and Evaluation Plans**, September – December 2015
Center for the Integration of Research, Teaching and Learning (CIRTL)
3. **Course in College Teaching**, January – May 2015
University of Pennsylvania's Center for Teaching and Learning
4. **An Introduction to Evidence-Based Undergraduate STEM Teaching**, October – November 2014
Center for the Integration of Research, Teaching and Learning (CIRTL)
5. **Pedagogy and Orientation for the American Classroom**, July – August 2008
International Teaching Assistant Training Program, University of Delaware

12. RESEARCH MENTORING

- Lu Fang, ME PhD '21, University of Pennsylvania, 2017
Mechanisms of Lubricant Additive Interactions using Atomic Force Microscopy
- Samantha Lunt, BSME '20, University of Pennsylvania, 2017
Interaction of ZDDP anti-wear additives with ZrO₂ nanoparticle additives
- Eugenia Bejar, BSME '18, University of Pennsylvania, 2016
Design and fabrication of a variable temperature microtribometer
- Daniel Anderson, BSMSE '19, UPenn-Georgia Tech REU, 2016
Mechanisms of ZDDP tribofilm growth
- Noah Glachman, BSMSE '18, University of Pennsylvania, 2016
Interaction of nanoparticle anti-wear additives with lubricant co-additives
- Julia Lin, BSME '18, University of Pennsylvania, 2015
Design and control instrumentation of an AFM-modeled microtribometer
- David Anlian, BSME '14, University of Delaware, 2014
Effects of environment and temperature on the tribology of PTFE nanocomposites

- Jaghab Hishmeh, BSME '15, University of Delaware, 2013
Tribology of metal-matrix composites; design and validation of precision locating fixtures
- Steven Rosenkrantz, BSME '14, University of Delaware, 2012
Fabrication and testing of metal-matrix nanocomposites
- Jeffrey Lugo, BSME '11, University of Delaware, 2010
Design and fabrication of custom environmental chamber

13. OUTREACH ACTIVITIES

1. **Tribology STEM Camp**, May 2017, 2016, 2015
STLE Annual Meeting and Exhibition
Led high school sophomores and juniors through hands on friction experiments on an atomic force “MACRO scope” to demonstrate the concept of atomic “stick-slip” in nanotribology.
2. **Philly Materials Day**, February 2017, 2016
University of Pennsylvania and Drexel University, Philadelphia PA
Co-organized various hands-on demos on tribology and surface science, geared toward children aged 5-years and above.
3. **Nano-Bio Interface Center (NBIC) Nano-Day**, October 2016, 2015, 2014
University of Pennsylvania, Philadelphia PA
Led groups of high school students through an interactive 15-minute hands-on demonstration of Atomic Force Microscopy.
4. **National Society of Black Engineers (NSBE) STEM Conference**, September 2014
University of Pennsylvania, Philadelphia PA
Co-developed and led tribology demonstrations, and hands-on activities and experiments for middle and high-school students. Activities included replicating DaVinci’s tribology experiments for verifying the laws of friction.
5. **Academic Job Search Panel Discussion**, December 2012
Mechanical Engineering Graduate Association, University of Delaware, Newark DE
Organized and led an informal panel discussion for Mechanical Engineering undergraduate and graduate students on the prospects and strategies for successful careers in academia.
6. **Undergraduate Research and Applying to Graduate School**, April 2012
Mechanical Engineering Graduate Association, University of Delaware, Newark DE
Organized an informal panel discussion for Engineering majors, exploring strategies for getting involved in research as an undergraduate and applying to graduate school.

14. SYMPOSIUM PLANNING AND ORGANIZATION

- Gordon Research Seminar on Tribology, Discussion Leader, 2016
- STLE Tribology Frontiers Conference, Session Chair, 2016
- STLE Early Career Committee, since 2016
- STLE Annual Meeting Nanotribology Technical Committee
 - Paper Solicitation Chair, Nanotribology Sessions, 2017
 - Paper Solicitation Co-chair, Nanoparticle Additives and Interactions special session, 2017
 - Paper Solicitation Chair, Nanotribology-Materials Tribology Joint Session, 2016
 - Technical Session and Vice Paper Solicitation Chair, 2013-16

- STLE Annual Meeting Materials Tribology Technical Committee
 - Vice-Paper Solicitation Chair, 2014-15
 - Technical Session Chair, 2012-14

15. ACADEMIC SERVICE

- University of Delaware Mechanical Engineering Graduate Association (MEGA): Founding Member and Vice President, 2011-12
- Panjab University Society of Automotive Engineers (SAE) Student Chapter: Founding Member and President, 2007-08

16. MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS

American Society of Mechanical Engineers (ASME), since 2009

Society of Tribologists and Lubrication Engineers (STLE), since 2010

17. COMPLETE LIST OF PRESENTATIONS

Contributed Conference Talks (as presenting author)

1. *In-situ* Atomic Force Microscopy Study of Additive Tribofilm Formation: The Effect of Shear Rate and Asperity-Scale Surface Interactions on ZDDP Tribofilm Growth
H.S. Khare, N.N. Gosvami, D.C. Anderson, A. Jackson, R.W. Carpick, *ASTM Symposium of Tribometry and Tribochemistry*, Boston MA, 2017
2. Contribution of Shear Rate and Asperity-Scale Surface Interactions on the Growth of ZDDP Tribofilms: An *In-situ* Atomic Force Microscopy Study
H.S. Khare, D.C. Anderson, A. Jackson, R.W. Carpick, *STLE Annual Meeting*, Atlanta GA, 2017
3. *In-situ* AFM measurements of nanoparticle anti-wear additives: growth mechanisms and interactions with co-additives
H.S. Khare, I. Lahouij, N. Glachman, A. Jackson, Z. Chen, G.D. Cooper, R.W. Carpick, *Tribology Frontiers Conference*, Chicago IL, 2016
4. Revealing Mechanisms of Growth and Wear Protection of Nanoparticle Additive Tribofilms Through *In-Situ* Atomic Force Microscopy
H.S. Khare, I. Lahouij, A. Jackson, Z. Chen, G.D. Cooper, R.W. Carpick, *Gordon Research Seminar on Tribology*, Lewiston ME, 2016
5. *In-situ* AFM measurements of the interaction between conventional lubricant additives with a novel anti-wear nanomaterial
H.S. Khare, I. Lahouij, A. Jackson, Z. Chen, G.D. Cooper, R.W. Carpick, *STLE Annual Meeting*, Las Vegas NV, 2016
6. Nano-Tribological Printing: A novel additive manufacturing method for nanostructures
H.S. Khare, N.N. Gosvami, I. Lahouij, G.D. Cooper, R.W. Carpick, *MRS Meeting*, Boston MA, 2015
7. *In-situ* growth of anti-wear tribofilms at a nano-scale lubricated contact from a novel nanomaterial
H.S. Khare, N.N. Gosvami, I. Lahouij, A. Jackson, W. Xu, Z. Chen, G.D. Cooper, R.W. Carpick, *STLE Annual Meeting*, Dallas TX, 2015
8. The effects of high temperature on the wear and transfer of alumina-PTFE nanocomposites
H.S. Khare, J. Ye, D.L. Burris, *STLE Annual Meeting*, Lake Buena Vista FL, 2014
9. Coupled effects of environmental composition and temperature on the friction of MoS₂
H.S. Khare, D.L. Burris, *STLE Annual Meeting*, Lake Buena Vista FL, 2014
10. Nanotribological and nanomechanical properties of tribofilms in MoS₂ solid lubricants
H.S. Khare, D.L. Burris, *STLE Annual Meeting*, Detroit MI, 2013

11. *In-situ* calibration of lateral force in AFM-nanotribology
H.S. Khare, D.L. Burris, *International Joint Tribology Conference*, Denver CO, 2012
12. Isolating the effects of water, oxygen and temperature on MoS₂ tribology
H.S. Khare, D.L. Burris, *International Joint Tribology Conference*, Denver CO, 2012
13. Characterization of nanoscale surface films in molybdenum disulfide
H.S. Khare, D.L. Burris, *STLE Annual Meeting*, St. Louis MO, 2012
14. Characterization of nanoscale surface films in solid lubricants
H.S. Khare, D.L. Burris, *International Joint Tribology Conference*, Los Angeles CA, 2011
15. A quantitative metric for nanocomposite dispersion analysis
H.S. Khare, D.L. Burris, *STLE Annual Meeting*, Las Vegas NV, 2010

Poster Presentations

1. An *In-situ* Atomic Force Microscopy Study of ZrO₂ Nanoparticle and ZDDP Additive Tribofilm Growth and Wear Protection
H.S. Khare, N.N. Gosvami, I. Lahouij, S. Lunt, A. Jackson, Z. Chen, G.D. Cooper, R.W. Carpick, *ExxonMobil-UPenn Research Symposia*, Philadelphia PA, 2017
2. Revealing Mechanisms of Growth and Wear Protection of Nanoparticle Additive Tribofilms Through *In-Situ* Atomic Force Microscopy
H.S. Khare, I. Lahouij, A. Jackson, Z. Chen, G.D. Cooper, R.W. Carpick, *Gordon Research Conference and Seminar on Tribology*, Lewiston ME, 2016
3. Coupled effects of environmental composition and temperature on the friction of MoS₂
H.S. Khare, D.L. Burris, *Gordon Research Conference/Seminar on Tribology*, Waltham MA, 2014
4. Evaluation of competing mechanisms in the thermal and environmental dependence of MoS₂ friction
H.S. Khare, D.L. Burris, *STLE Annual Meeting*, Detroit MI, 2013
5. *In-situ* AFM calibration for quantitative nanotribological studies
H.S. Khare, D.L. Burris, *International Joint Tribology Conference*, Denver CO, 2012
6. Isolating the effects of water, oxygen and temperature on MoS₂ tribology
H.S. Khare, D.L. Burris, *Gordon Research Conference on Tribology*, Waterville ME, 2012
7. Methods in characterization of nanoscale friction in solid lubricant tribofilms
H.S. Khare, D.L. Burris, *STLE Annual Meeting*, St. Louis MO, 2012
8. Characterization of nanoscale surface films in solid lubricants
H.S. Khare, D.L. Burris, *International Joint Tribology Conference*, Los Angeles CA, 2011
9. High temperature tribology of solid lubricants for space
H.S. Khare, E.D. Bonnevie, D.L. Burris, *UDRF Research Symposium*, Newark DE, 2010

Colloquia and Seminars

1. On the face of things: A multi-scale approach to understanding friction and self-lubrication
H.S. Khare, D.L. Burris, *University of Delaware Graduate Student Forum*, Newark, DE, 2012
2. Characterization of Nanoscale Surface Films in Solid Lubricants
H.S. Khare, D.L. Burris, *University of Delaware Graduate Student Forum*, Newark, DE, 2011
3. Tribology: Mechanics of materials in contact
H.S. Khare, D.L. Burris, *Dept. of Mechanical Engineering, University of Delaware*, Newark, DE, 2011