

# MATERIALS SCIENCE & ENGINEERING

DANGER - HIGH VOLTAGE



**The world is experiencing a materials revolution.** Advances in materials have preceded almost every technological leap since the beginning of civilization and engineered materials are crucial to the continued vitality of countless industries. The University of Washington's Materials Science & Engineering Department is at the heart of this revolution preparing our students and conducting research to meet the needs of modern technology.

## MSE EDUCATION

Preparing students for successful careers is our highest priority. Our graduates find employment in aerospace, automotive, biomedical, chemical, construction, electronics, energy and numerous other fields.

## DEGREE PROGRAMS

**Bachelor of Science (BS)** - prepares students for graduate work or careers in industry, government, or academia.

**Master of Science (MS)** - prepares students for advanced careers in industry and academia along with future PhD studies.

**Doctor of Philosophy (PhD)** - trains engineers for leadership roles in academia, industry and research institutions.

## STUDENT DEMOGRAPHICS

Undergraduate enrollment: 141 | Bachelor's degrees awarded 2017: 55

Graduate enrollment: 113 | Master's degrees awarded 2017: 37

Doctoral degrees awarded 2017: 3

DIVERSITY OF DEGREE RECIPIENTS	BS	MS/PhD
Women	31%	20%
Underrepresented Minorities*	4%	10%
International Students	27%	43%

\*African American, Hispanic American, Native American and Hawaiian/Pacific Islander

# UNDERGRADUATE LEARNING

## Program Features

We offer an ABET-accredited Bachelor of Science (BS) program. The department graduates the highest number of undergraduate students per faculty member among peer departments nationwide.

Unique aspects of our program include:

- Active student professional organizations
- Diverse student body
- Small class size
- Hands-on, team-based learning
- Undergraduate research projects
- A combined BS/MS program for well-qualified undergraduate students

## Excellence

Our undergraduate students win a variety of awards and scholarships.

- NSF Undergraduate Research Fellowships
- UWEB Scholarships
- UW Mary Gates Scholarships
- Husky Promise Scholarships
- SAMPE Scholarships
- NASA Space Grant
- National Defense Medal
- First-place in national bridge and wing building and ceramic mug drop competitions

# GRADUATE LEARNING

## Program Features

We offer an outstanding Master of Science (MS) and Doctor of Philosophy (PhD) program. Our students perform cutting-edge, interdisciplinary research on biomaterials for tissue engineering, ceramics and polymers for energy applications, composites and metals for aerospace, genetically engineered molecules, and semiconductors for electronics. Additional program features include:

- Educational and research training involving synthesis, processing, characterization and fabrication of all classes of materials using state-of-the-art research equipment and facilities
- Doctoral dissertation research opportunities for leading-edge, interdisciplinary work
- Research and teaching assistantships, stipends and fellowships for our doctoral program
- Faculty collaboration for a final project, thesis or internship for our master's program

## Excellence

MSE doctoral students receive many fellowships from the department, College of Engineering and the Graduate School including AME, ARCS, Bank of America, Delimitros, Ford, Intel, Nanotechnology, NASA Space Grant, NSF, Schwager, Stoebe and Wagstaff.



# FACULTY

## Composition

- 13 core faculty members
- 2 research faculty members
- 7 adjunct faculty members
- 14 affiliate faculty members
- 17 postdoctoral researchers

## Achievements

In recent years, our faculty members earned the following honors:

- 2017 SAMPE Fellow
- 2017 Thomson Reuters Top 1% Highly Cited Researchers in Materials Science
- 2016 Royal Society of Chemistry Fellow
- 2016 Alexander von Humboldt Forschungspreis Career Research Award
- 2016 Fulbright Fellow

# RESEARCH AND INNOVATION

Our students and faculty conduct research in a variety of areas. Many of the research topics are interdisciplinary and involve participation from other engineering, basic science and medical disciplines.

## Active Nanoscale Material Systems

**Bruce Hinds** focuses on reinventing engineering membranes to become active nanoscale devices. These are based on biomimetic nanopores with active gatekeepers and nano-electrode architectures. Application areas include energy storage, environment, biochemical conversions/separations, and medical devices.

## Advanced Materials for Energy Storage and Conversion

**Jihui Yang** uses various experimental and theoretical techniques to design, synthesize, test, and understand advanced thermoelectric materials and Li-ion battery materials for energy conversion and storage.

## Advanced Structural Materials

**Dwayne Arola** focuses on the structure-property relationships of natural and engineered materials, with emphasis on fatigue, fracture behavior and the mechanisms of degradation posed by aging, environment and synergistic processes.

## Biomaterials: Nanoparticles and Tissue Engineering

**Miqin Zhang** combines the study of biomaterials and materials science to explore the interactions between materials and biological systems and develop materials and devices for biological and medical applications.

## Computational Materials

**Lucien Brush** focuses on mathematical modeling of material behavior in processes that involve phase transitions, interfacial phenomena and thin film hydrodynamics.

## Magnetism, Nanosciences and Bioengineering

**Kannan Krishnan** works at the intersection of magnetism, materials and medicine focusing on diagnostics, imaging and therapy, with appropriate translational research and commercialization activities. He also emphasizes nanoscale magnetic/transport phenomena and advanced characterization methods to develop new materials and devices for information and energy technologies.

## Materials in Extreme Environments

**Fumio Ohuchi** explores next generation materials for energy, information, and transportation technologies that can withstand extreme environments. Current projects explore the chemical and physical effects of materials in space.

## Molecular Biomimetics and Genetically Engineered Materials

**Mehmet Sarikaya** leads an interdisciplinary team of researchers to combine nature's proven molecular tools with nanoengineered materials in an emerging research methodology called molecular biomimetics.

## Molecular Self-Assembly

**Christine Luscombe** focuses on expanding current molecular self-assembly processes to develop functional molecules with novel electronic and photonic properties, ranging from well-defined macromolecules to polymers.

## Nanomaterials for energy related applications

**Guozhong Cao** examines the chemical processing of nanostructured materials for energy related applications including solar cells, batteries and supercapacitors as well as actuators and sensors.

## Nanoscale Optoelectronic Materials

**Peter Pauzauskie** explores basic materials science and engineering research to design, synthesize, and characterize nanoscale optoelectronic materials with unique compositions and morphologies.

## Nanoscale Optoelectronics

**Xiaodong Xu** aims to understand the optical, electronic and quantum properties of novel solid state nanostructures through nanoscale device design, optical spectroscopy, electrical transport, and scanning photocurrent measurements.

## Photonics, Optoelectronics, Biosensing and Nanoscience

**Alex Jen** employs molecular, polymeric and bio-macromolecular self-assemblies to create ordered arrangements of organic and hybrid functional materials for photonics, optoelectronics, nanomedicine and nanotechnology.

## Scalable Printed Electronics and Energy Devices

**Devin MacKenzie** researches solution-processible nanoscale, organic and ionic materials and their scalable processing via roll-to-roll deposition, nanopatterning and large area printing. These advanced materials, low energy and cost manufacturing approaches are used to create printed solarcells, batteries, sensors, and 3D and flexible electronics.

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## Centers for Excellence

The department is a lead partner or a core member in the following interdisciplinary centers:

- Institute for Advanced Materials and Technology (iAMT)
- Genetically Engineered Materials Science and Engineering Center (GEMSEC)
- Micron Laboratory for Combinatorial Materials Exploration
- Materials and Devices for Information Technology Research (MDITR) Science and Technology Center
- UW Center for Nanotechnology
- Microscale Life Sciences Center

# TRAILBLAZERS

Many notable figures in materials industry and education hold degrees from the Department of Materials Science & Engineering. Here are just a few outstanding examples of alumni achievement.



## **Stephen T. Ching (BS '72 Ceramic Engineering)**

Stephen Ching is co-founder, president and VP of engineering at Isolink Inc., the leading supplier of optoelectronic radiation-tolerant components worldwide for military, aerospace, hybrid, industrial, medical and telecommunications markets. The company pioneered the miniaturization of some of

the most advanced optoelectronic components. Before founding Isolink, Stephen worked for Fairchild Semiconductors Linear Integrated Circuits and Hewlett Packard's optoelectronics division.



## **Tom H. Delimitros (BS '63, MS '66 Ceramic Engineering)**

2001 MSE Distinguished Service Award  
1993 College of Engineering Diamond Award for Distinguished Service

Tom Delimitros was a founding general partner of three advanced material technologies venture funds from 1989 to 2011. Currently, he is at Delventec Investments, his personal investment vehicle, and serves on the boards of Photodigm, Inc. and TRS Group Inc., among others. Tom served on the board of the UW Foundation, and as chairman of the MSE External Advisory Board. As the leader of the MSE Initiative, he helped to raise \$2.5 million to build Mueller Hall and equip new labs, and established the Tom H. Delimitros Fellowship for MSE.



## **Bonnie J. Dunbar (BS '71, MS '75 Ceramic Engineering)**

1999 MSE Distinguished Service Award  
2004 UW Alumna Summa Laude Dignata  
2012 College of Engineering Diamond Award for Distinguished Service

A veteran of five space missions as a NASA mission specialist astronaut, Bonnie Dunbar flew aboard the space shuttles Atlantis, Challenger, Columbia and Endeavor. Previously she served as a NASA mission controller, and held research and engineering positions at Boeing, Harwell Laboratories in the UK and Rockwell International. After retiring from NASA in 2005, Bonnie served as president and CEO of the Museum of Flight in Seattle and as director of higher education and STEM at The Boeing Company. She is a member of the National Academy of Engineering and has received numerous awards and honors.



## **Randy Kurosky (BS '88 Ceramic Engineering)**

2014 College of Engineering Diamond Award for Entrepreneurial Excellence

As the co-inventor of two ceramic oxide powder processes and engineer of over 3,000 different metallic oxide compositions, Randy Kurosky turned Seattle Specialty Ceramics, a technology transfer startup, into Praxair Specialty Ceramics, one of the premier electronic grade specialty ceramics companies. As an undergraduate, Randy co-invented a patented process, combustion spray pyrolysis, that earned him six publication co-authorships. His innovations on the synthesis of solid oxide fuel cell materials have become the industry standard.



## **Mohan S. Misra (BS '70 Metallurgical Engineering)**

2013 MSE Distinguished Service Award

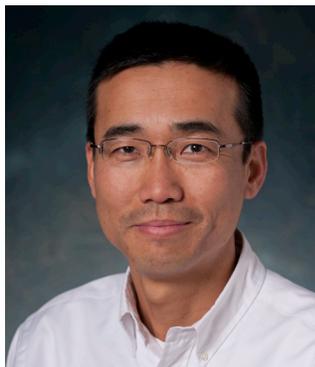
Mohan Misra founded ITN Energy Systems, Inc. in 1995 to research, develop and commercialize emerging technologies in energy, environment and space. Previously he led Materials Research & Technology at Martin Marietta Aerospace, developing thin-film photovoltaics, smart materials and structures, advanced composites, lightweight structures and solar arrays for aerospace applications. He has over 10 patents, 40 technology idea disclosures and over 100 technical publications.



## **Larry A. Watters (BS '72 Metallurgical Engineering)**

2010 MSE Distinguished Service Award

A founding member of Taggart Global LLC, Larry Watters has served as managing director for the company since 1993. Starting as a small start-up company, Taggart has grown into a business with over \$400 million in operating revenue, providing solutions in the coal production, power generation, steel making, and material handling sectors. Larry has served on the boards of the Society for Mining, Metallurgy and Exploration - American Institute of Mining, Metallurgical and Petroleum Engineers (SME-AIME), the International Coal Preparation Congress and the Coal Preparation Society of America.



**“Engineering’s grand challenges necessitate developing superior materials and material systems. Materials science and engineering is in a unique position to address the significant problems by performing cutting-edge research, and educating students in a wide spectrum of areas from fundamentals to engineering traditional and advanced materials.”**

-Jihui Yang, Chair and Professor, Materials Science & Engineering

