Dear colleagues and friends,

I am delighted to share the Department of Materials Science and Engineering’s 2015 Annual Report highlighting our outstanding faculty, student achievements and the performance of our department.

Since our department’s launch in 2013, we have witnessed significant growth in our student enrollment, faculty, facilities and research. In the 2015 academic year, we graduated 6 Master of Science and 13 Ph.D. students. Fall 2015 began with a record number of 34 new M.S. and Ph.D. students. This brings our total number of graduate students to 132.

We plan to launch an undergraduate program in collaboration with the College of Science as early as fall 2017. The minor program in materials science and engineering we started last year has been a tremendous success in terms of enrollment and we are looking forward to a widespread undergraduate interest in our bachelor’s degree program.

Our department will be a Research Experience for Undergraduates (REU) site on Multifunctional Materials funded by the National Science Foundation offering research opportunities to highly talented, domestic undergraduate students. This is a major accomplishment for our faculty considering we do not have a full-fledged undergraduate program yet.

New faculty members of our department include Svetlana Sukhishvili, professor, specializing in polymers and soft materials; Homero Castaneda, associate professor, specializing in corrosion; Michael Demkowicz, associate professor with research interests in computational materials science; and Ankit Srivastava, assistant professor, specializing in micromechanical modeling of materials.

We hired Raymundo Case as professor of practice, a full-time non-tenure-track appointment. As a staff scientist in ConocoPhillips, he brings extensive research and industry experience in risk assessment of failure by corrosion in the oil and gas industry.

Two of our faculty members were awarded National Science Foundation’s Designing Materials to Revolutionize and Engineer our Future (DMREF) grants — Raymundo Arróyave for his research in high temperature shape memory alloys and Michael Demkowicz for his research in nanometallic materials.

This year we moved five of our research facilities to the new Frederick E. Giesecke Engineering Research Building, a 70,000 square-foot integrative research facility located at Texas A&M University’s Research Park. These include the Materials Characterization Facility, AggieFab, the National Corrosion and Materials Reliability Center (previously National Corrosion Center), the Polymers Processing Lab, and the Hydrogen Materials Lab.

We encourage the efforts of Women in Materials Science (WiMS), a student organization led by Sukhishvili that is changing existing cultural perceptions about women’s roles in STEM fields. Over the past year, students involved in the organization have participated in numerous outreach activities aimed at introducing science and engineering to middle and middle school-aged girls in the Bryan/College Station area.

It is an honor to present the accomplishments of our faculty and students to you in this report. I encourage you to come visit us and see how our department is expanding and flourishing.

Dr. Ibrahim Karaman
Department Head and Chevron Professor I
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CREDITS
Department Head
Dr. Ibrahim Karaman
Editor
Tim Schnettler
Content
Shraddha Sankhe
Design
Haley Posey
Engineering Communications
MSEN Degrees Awarded

2013-14
- 13 Ph.D.
- 6 M.S.
- Total: 19

2014-15
- 13 Ph.D.
- 1 M.Eng.
- 5 M.S.
- Total: 19

Total Research Expenditures

- 2013: $3.4 Million
  - Based on 6 MSEN Faculty FTEs
- 2014: $4 Million
  - Based on 7.5 MSEN Faculty FTEs
- 2015: $4.3 Million
  - Based on 11 MSEN Faculty FTEs
**FALL 2015 STATS**

- **25%**
  Female students enrolled

- **165**
  Average Quantitative GRE score of incoming students (maximum score: 170)

- **152**
  Average Verbal GRE score of incoming students (maximum score: 170)

- **7.2**
  Average number of journal articles published per faculty member

- **6**
  Average number of journal articles published per graduating Ph.D. student

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**MSEN Student Enrollment**

**Fall 2015**

- **110 Ph.D.**
- **22 M.S.**
- **Total: 132**

**Fall 2014**

- **86 Ph.D.**
- **13 M.S.**
- **Total: 99**

**Fall 2013**

- **81 Ph.D.**
- **9 M.S.**
- **Total: 90**
ADVANCING RESEARCH IN MATERIALS SCIENCE AND ENGINEERING

The Department of Materials Science and Engineering has five major emphasis areas of research: computational materials science, advanced structural materials, polymers and composites, materials for extreme environments, and multifunctional materials. These five areas help the department develop and enhance its overall curriculum and facilities.

### Computational Materials Science

This research area elucidates the fundamental, multi-scale processes underlying materials behavior through computational models and exploits such models and simulations to assist in the discovery and development of materials capable of enabling new technologies.

**Labs:** Computational Materials Science Laboratory, Computer Engineering of Nanomaterials and Devices Laboratory

**Faculty:** R. Arróyave, T. Cagin; A. Needleman; A. Srivastava; X. Qian; M. Demkowicz

### Multifunctional Materials

This research area combines multiple functions into a single material. Often, multi-functional materials have strong coupled responses to one or more external fields allowing for energy transduction.

**Labs:** Hybrid Multifunctional Composites Laboratory, Microstructural Engineering of Structural and Active Materials Laboratory, Phase Transformation Engineering Material Laboratory, Center for Intelligent Materials and Structures, Polymer Technology Center

**Faculty:** T. Creasy; I. Karaman; D. Lagoudas; R. Arróyave; P-T. Lin; P. Shamberger; X. Qian; H-J. Sue; A. Benzerga
Polymers and Composites

This research area combines the knowledge base of designing, developing and delivering high performance functional polymers and composites in an effort to develop fundamental knowledge of these unique materials, as well as to provide design and production insight for product development.

**Labs:** Polymer Technology Center, Polymers Processing Laboratory

**Faculty:** S. Sukhishvili; H-J. Sue; T. Creasy; R. Talreja; A. Benzerga; D. Lagoudas

Materials for Extreme Environments

This research area applies scientific knowledge and natural laws in order to design and engineer materials to combat natural phenomenon such as corrosion, erosion, and many other degradation mechanism in extreme environments.

**Labs:** National Corrosion and Materials Reliability Center, High Temperatures Materials Laboratory

**Faculty:** R. Castaneda; H-J. Sue; M. Radovic; T. Cagin; L. Liu; M. Demkowicz

Advanced Structural Materials

This research area includes study of materials for their mechanical properties using an applied force. Structural materials such as concrete, composites, and steel are what keep our bridges standing, our airplanes flying, and our power generators humming.

**Labs:** Microstructural Engineering of Structural and Active Materials Laboratory, Severe Plastic Deformation Processing Laboratory, Center for Intelligent Multifunctional Materials and Structures, Hydrogen Materials Laboratory

**Faculty:** R. Talreja; M. Radovic; A. Needleman; A. Benzerga; T. Hartwig; I. Karaman; M. Demkowicz
MSEN receives significant new NSF funding

Demkowicz receives DMREF grant to develop nanometallic materials

Dr. Michael J. Demkowicz, associate professor, was awarded a grant to speed up the development and application of nanometallic materials (NMMs).

The grant is supported by the National Science Foundation’s (NSF) Designing Materials to Revolutionize and Engineer our Future (DMREF) program and is a collaborative effort between Texas A&M, the University of Michigan and Virginia Polytechnic Institute and State University. Texas A&M is the lead institution and Demkowicz is the principal investigator.

The project, “Designing and Synthesizing Nano-Metallic Materials with Superior Properties,” will develop NMMs that possess extreme strength, resistance to damage from repeated loading and the unique property of being resistant to radiation damage.

By integrating theory, modeling and experiments, the project led by Demkowicz aims to engineer the architectures, interfaces, and compositions of NMMs to achieve superior mechanical performance. The project will follow an iterative design-synthesize-test cycle that scans the design space rapidly and integrates insights gained in each iteration by updating theoretical models connecting design parameters to performance metrics.

Arróyave leads a new NSF-DMREF project

Dr. Raymundo Arróyave, associate professor, is leading a grant from the National Science Foundation’s (NSF) Designing Materials to Revolutionize and Engineer our Future (DMREF) program to speed up the development and application of high temperature shape memory alloys (HTSMAs).

The project, “DMREF: Accelerating the Development of Phase-Transforming Heterogeneous Materials: Application to High Temperature Shape Memory Alloys,” aims to shorten the time necessary for the development of HTSMAs equipped with tailored properties. It builds from the past and current research projects with NASA, the Air Force Office of Scientific Research and other leaders in the aerospace industry.

The NSF, in support of the multi-agency federal Materials Genome Initiative (MGI), seeks to target one of the primary MGI goals — to halve the current time and cost for transitioning breakthroughs from the laboratory to the marketplace — a process that can take as long as two decades.

The project aims to shorten the time necessary for the development of HTSMAs equipped with tailored properties. It builds from the past and current research projects with NASA, the Air Force Office of Scientific Research and other leaders in the aerospace industry.
Castaneda receives USAFA Grant
This grant allows Dr. Homero Castaneda to study corrosion mitigation and damage mechanisms by characterizing damage and performance evolution of non-hexavalent-chromium coatings and validate the predictive performance of the coating/substrate system under stress conditions.

Benzerga receives grant to study fracture-resistant magnesium alloys
Dr. Amine Benzerga received $419,500 grant from the National Science Foundation (NSF) for the project “Engineering the Anisotropy of Magnesium Alloys for Enhanced Performance” to study fundamental research to provide strategies for producing fracture-resistant Mg alloys, including during forming operations.

Sukhishvili receives NSF grant
Dr. Svetlana Sukhishvili received a $424,000 grant from the National Science Foundation (NSF) for the project “Nonlinear Growth of Polyelectrolyte Multilayers: Chain Dynamics and Film Structure” to conduct fundamental research on controlling the structure of functional polymer coatings for biomedical and optical applications.

Lagoudas and Karaman awarded Air Force Office for Scientific Research Grant
Dr. Ibrahim Karaman, Dr. Dimitris Lagoudas and Dr. Theocharis Baxevanis (aerospace engineering) were awarded this grant. This project aims to elucidate the failure micromechanisms and mechanics of recently discovered high temperature shape memory alloys (HTSMAs) under repeated actuation. HTSMA-based devices can contribute significantly to the development of more efficient, simple, and robust actuation systems.

Karaman and Arróyave awarded NSF Grant on Multifunctional Glasses
Dr. Ibrahim Karaman and Dr. Raymundo Arróyave received this grant to investigate why some metallic alloys belonging to the so-called Heusler family behave like a rather unusual kind of glass. In normal glass, atoms that normally would sit in well defined positions instead arrange themselves in an amorphous manner making the material glassy.

Shamberger receives continued support from Air Force Research Laboratory
Dr. Patrick Shamberger received continued support from Air Force Research Laboratory to investigate filament formation process in nonvolatile metal-oxide resistance switch devices. This project combines experimental and simulation approaches to investigate the role of oxide microstructure in influencing device variability.

Sue receives Lloyd Register Foundation Grant
Dr. Hung-Jue Sue received the Lloyd Register Foundation research project grant to explore the potential of copper/carbon nanotube metal matrix composites in the fabrication of electrically conductive materials with enhanced properties for use in subsea power transmission applications. National University of Singapore, University of Cambridge, Institute of Occupational Safety in Scotland, Kaneka Corporation, and Texas A&M University are jointly conducting this research.
Scoliosis is typically defined as the curvature of the spine, which in severe cases can lead to severe physical deformity in addition to pulmonary and cardiac problems. Early-onset scoliosis refers to spine deformity that is present before 10 years of age. Children with early-onset scoliosis often spend their entire childhood undergoing several surgical procedures to correct the curve in their spine. Surgeons implant metallic growing rods in the spine and expand them in bi-annual surgeries to keep up with the child's growth. As the body moves, the screws attaching the rods to the bone become loose, increasing the chances of additional complicated surgeries to keep the rod in place.

Dr. Ji Ma, Texas A&M Engineering Experiment Station assistant research scientist, and Dr. Ibrahim Karaman, Chevron Professor I and head of the Department of Materials Science and Engineering at Texas A&M University, have designed a growing rod material that can significantly reduce the complications from corrective surgeries.

The material, a superelastic adaptive alloy, is five times more flexible than any currently available growing rod implants. It allows natural movement of the body and adjusts itself depending on the stress applied by the growing spine. This could potentially improve the success rate of the treatment. Materials composing the implant are required to be biocompatible, fatigue and corrosion resistant, and they have to be compatible with the biomechanical environment of the patient's body and the bone.

The bone is a living tissue that responds to the change in forces that arise once an implant is mechanically fixed to the skeleton. Unfortunately, the large mismatch between the mechanical properties of the metallic implants and the bone frequently result in complications, such as implant loosening, bone atrophy from stress shielding, and bone disease near implant extremities. These problems become increasingly important in young patients with osteoporotic or immature bones, where implant-related complication rates are markedly higher, the researchers say.

Using a series of thermo-mechanical processing steps, Ma and Karaman engineered a new titanium shape memory alloy. It possesses stress-dependent elastic properties that gradually decrease as the stress on it is increased.

"By modifying these properties to fit the biomechanical environment of the bone, it is now possible to create a device that satisfies the seemingly conflicting requirements of rigidity and flexibility required in growing rods," said Ma.

The adaptive alloy allows growing rods to bend at the ends and stay stiff in the middle giving the necessary support to the spine. The patient's natural movements stay flexible due to reduced friction and stress.
“This is not something you can do with all materials,” said Ma. “We preserve the strength and add flexibility to the implants without compromising the mechanical properties.”

Karaman’s National Science Foundation grant, “Design and In-vitro Characterization of Ni-free Biocompatible Shape Memory Alloys,” led to the present-day technology and its application in early onset scoliosis treatment. The researchers set out to develop a titanium-niobium alloy as an alternative to nickel titanium shape memory alloy since it has better biocompatibility and corrosion resistance similar to the human bone.

They later found evidence that nickel titanium alloy offered the same properties as the titanium niobium alloy. Currently, they are using both the alloys as candidates for the application in growing rods. The adaptive alloy is designed to have bio-inert constituents, less sensitivity to impurities and inclusions, better corrosion resistance, more stable fatigue response and predictable fatigue life.

Ma and Karaman are now working with Dr. Dennis Devito at Children’s Orthopedics of Atlanta to get a surgeon’s perspective on effective application of the technology.

“All children experience at least one complication during their treatment,” said Devito. “Ma and Karaman’s research offers a potential solution to some of the complications.”

The researchers have begun to commercialize the adaptive alloy technology. In 2015, they co-founded Adallo, LLC with Eric Flickinger, CEO at Meditech Spine LLC to develop prototype testing.

In April 2016, Karaman and Ma received $199,100 from National Science Foundation’s Accelerating Innovation Research-Technology Transfer program to enable research discoveries in entrepreneurial and market-oriented thinking.
A student team from Texas A&M University, led by MSEN Ph.D. students Blake Teipel and Charles “Brandon” Sweeney, won the grand prize at the Rice Business Plan Competition for its startup company TriFusion Devices. The startup has developed customizable, 3-D printed prosthetic leg devices that can be manufactured in hours instead of weeks, and would cost far less than anything on the market.

The TriFusion Devices team included founders Teipel and Sweeney and Britton Eastburn, a combined medical student at the Texas A&M Health Science Center’s College of Medicine and an MBA student at the Mays Business School.

They pitched their inexpensive, customizable 3-D printed prosthetic device technology to four separate panels of judges that included venture capitalists, angel investors, entrepreneurs, service providers and local business executives. The team developed a carbon nanotube-coated printer filament and a microwave welding process to fuse 3-D printed parts together, making them strong and durable. They can go from scans of a patient geometry to a finished device in less than 48 hours.

The Aggies collected four checks totaling nearly $400,000 at the competition, including the $300,000 Investment Grand Prize from the GOOSE Society of Texas; the $60,000 TiE Angel Investment Prize; the $25,000 Medical Device Accelerator Prize and the $10,000 Pearland Spirit of Entrepreneurship Prize. This was the first time a Texas A&M team won the competition.

“TriFusion Devices has the potential to transform the biomedical device industry, healthcare, military and commercial manufacturing sectors,” said Dr. Ibrahim Karaman, Chevron Professor I and head of materials science and engineering. “Blake and Brandon are role models for other students with entrepreneurial aspirations. They have set a great example in taking research from labs to commercialization.”

“We were so honored to present our technology and business idea at the Rice Business Plan Competition, the world stage for entrepreneurship,” said Sweeney. “TriFusion was especially proud to represent Texas A&M and have the chance to prove that Aggies can compete with and conquer the world’s best universities. Everyone should know that at Texas A&M, we like to break a mental sweat too.”

Since spring 2015, Teipel and Sweeney have taken top honors in multiple competitions, winning first place at the Mays Business School’s Center for New Ventures and Entrepreneurship Raymond Ideas Challenge, the inaugural SEC Pitch Competition in Atlanta and the Baylor Business Plan Competition in February 2016.
Women in Materials Science aims to shrink gender gap

Research shows that America desperately needs professionals specializing in science, technology, engineering and mathematics (STEM) to expand and advance its economy and society. Currently less than 15 percent of engineers are women. To reverse this statistic, maintaining enthusiasm in science, technology, engineering and mathematics among students throughout high school and college is not only important, but also necessary.

Women in Materials Science (WIMS), a student organization in MSEN believes in changing existing cultural perceptions about women’s roles in STEM fields.

In February, WIMS met with middle school students from the Girl Scouts of Central Texas at STEMFest that was organized by the Dwight Look College of Engineering’s Women in Engineering office. The purpose of the event was to encourage the students to pursue careers in science and engineering. WIMS members developed several activities to make science fun. They engaged students with experiments that included simple polymer technology demonstrations such as hydrogel to create the effect of snow in addition to demonstrations with shape memory alloys.

The same week, a group of 15 students from Liberty Christian High School in Argyle, Texas, visited with WIMS’ members on the Texas A&M campus for laboratory tours and demonstrations. WIMS members prepared short presentations and hands-on experiments and, more importantly, shared their personal stories and experiences with the visiting students.

“We believe that these repeated activities will help trigger interests in science and engineering at an important age when they still have ample opportunities to advance academically in order to be able to pursue careers in science and technology,” said Victoria Albright, vice president of WIMS and a doctoral student in MSEN.
Aronson’s research interests include neutron scattering, magnetic phase transitions, electronic instabilities and novel materials synthesis. She has joint appointment with the Department of Physics and Astronomy in the College of Science.

Selected 2015 Publications


Arróyave specializes in computation thermodynamics and kinetics of materials. His research focuses on thermodynamics of materials, kinetics of phase transformations and thin film thermodynamics.

Selected 2015 Publications

Selected 2015 Publications


Dr. Tahir Cagin
Professor
Ph.D., Clemson University, 1988

Cagin’s research interests include computational materials science and nanotechnology, characterization and development of multifunctional nano-structured materials, materials for thermal management, power generation and energy harvesting, and development and application of multiscale simulation methods.

Dr. Amine Benzerga
Associate Professor
Director, Center for Intelligent Materials and Structures (CiMMS)

Ph.D., Ecole des Mines de Paris, France, 2000

Benzega’s research interests include mechanics of materials, high-performance computing, anisotropy in plasticity and fracture, ductile fracture, discrete dislocation plasticity and dislocation mechanics, and macromolecular mechanics of polymers and their composites.

Selected 2015 Publications

Dr. Homero Castaneda
Associate Professor
Ph.D., Pennsylvania State University, 2001

Castaneda’s research interests include multiscale tools for corrosion analysis and mitigation in oil and gas systems, dynamic electrochemical characterization and monitoring of operating batteries and damage evolution of coatings / steel and coatings / aluminum interfaces.

Selected 2015 Publications


Selected 2015 Publications


Dr. Micheal J. Demkowicz
Associate Professor
Ph.D., Massachusetts Institute of Technology, 2005

Demkowicz specializes in computational materials design, fundamental physics of material behavior, mechanical behavior, and radiation response of materials. He joined the department in spring 2016.
Dr. Karl 'Ted' Hartwig
Professor
Ph.D. Metallurgical Engineering University of Wisconsin, 1977

Hartwig’s research interests include severe plastic deformation processing to improve microstructure, strength, and ductility in metal alloys, and understanding microstructure-property-processing relationships, with a focus on materials for low temperature superconductors, nuclear reactor containment, and ballistic applications.

Selected 2015 Publications


Dr. Ibrahim Karaman
Department Head, Professor, Holder of Chevron Professorship I
Ph.D., University of Illinois Urbana-Champaign, 2000

Karaman’s research interests include processing-microstructure-mechanical/functional property relationships in metallic materials exhibiting simultaneous dislocation slip and twinning deformation and slip-twinning-martensitic transformation; twinning and martensitic phase transformation in metallic materials; and magnetic, thermal and mechanical activation of martensitic phase transformation.

Selected 2015 Publications

Dr. Pao-Tai Lin
Assistant Professor

Ph.D., Northwestern University, 2009

Lin’s research is focused on mid-infrared integrated photonics, biomedical sensors on a chip, multiscale fabrication technologies, reconfigurable materials, nanophotonics & meta-materials. He has joint appointment with the Department of Electrical and Computer Engineering.

Selected 2015 Publications


Dr. Dimitris Lagoudas
University Distinguished Professor
Senior Associate Dean for Research

Ph.D., Lehigh University, 1986

Lagoudas specializes in micromechanics of active materials and smart structures in addition to phase transformations in shape memory alloys (SMA), thermoelectric heat transfer in SMA actuators, SMA elastomeric composite dampers, and oxidation and damage in metal matrix composites. He has joint appointment with the Department of Aerospace Engineering.

Selected 2015 Publications

• Volk, B. L.; Maitland, D. J.; and Lagoudas, D. C. “Internal Variable Based Phase Transition Models for Thermally Actuated Shape Memory Polymers” Shape Memory Polymers for Aerospace Applications: Novel Synthesis, Modeling, Characterization and Design, pp. 267, 2015.
Selected 2015 Publications


**Dr. Alan Needleman**

Professor
Helder of TEES Distinguished Research Professorship

Ph.D. Harvard University, 1971

Needleman is a member of National Academy of Engineering. His research interests include computational modeling of deformation, fracture processes in structural materials. A general objective is to provide quantitative relations between the measurable features of the materials' micro-scale structure and its macroscopic mechanical behavior.

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Selected 2015 Publications


**Dr. Xiaofeng Qian**

Assistant Professor

Ph.D., Massachusetts Institute of Technology, 2008

Qian’s research is in materials theory, discovery, and design for energy applications and device design aided by high-throughput computing. He is involved in two-dimensional materials and their coupled multi-physical properties with applications in optoelectronics, photovoltaics, catalysis, sensing, energy storage, etc.

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Dr. Patrick Shamberger
Assistant Professor, Undergraduate Degree Program Director
Ph.D., University of Washington, 2010

Shamberger’s research interests include engineering of phase transitions with tailored properties, thermal storage materials for energy storage and thermal management applications, theory and methodology of diffraction-based materials analysis, and materials informatics.

Selected 2015 Publications

- Shamberger, P. J.; and O’Malley, M. J. “Heterogeneous nucleation of thermal storage material LiNO3·3H2O from stable lattice-matched nucleation catalysts.” Acta Materialia, Vol. 84, pp. 265-274, 2015

Dr. Miladin Radovic
Associate Professor, Associate Department Head
Ph.D., Drexel University, Philadelphia, 2001

Radovic’s research interests include processing of advanced ceramics and ceramics composites, high temperature materials for energy applications, characterization and modeling of mechanical properties of ceramic and ceramic composites, and resonant ultrasound spectroscopy.

Selected 2015 Publications

Dr. Hung-Jue Sue
Professor
Holder of TEES Professorship
Director of Polymer Technology Center
Ph.D., University of Michigan, 1988

Sue’s research interests include high performance functional materials, structure-property relationships, and utilization of processing tools to enhance physical and mechanical properties of polymers.

Selected 2015 Publications


Dr. Ankit Srivastava
Assistant Professor
Ph.D., University of North Texas, 2013

Srivastava’s research interests include micromechanical modeling of heterogeneous materials, microstructure-based crystal plasticity finite element modeling, phase transformations, statistical fracture modeling, quantifying constitutive behavior of materials by small scale experiments, in-situ mechanical testing, failure analysis, and microstructure design.

Selected 2015 Publications


Ph.D., University of North Texas, 2013

Srivastava’s research interests include micromechanical modeling of heterogeneous materials, microstructure-based crystal plasticity finite element modeling, phase transformations, statistical fracture modeling, quantifying constitutive behavior of materials by small scale experiments, in-situ mechanical testing, failure analysis, and microstructure design.

Selected 2015 Publications

Dr. Ramesh Talreja  
Professor  
Holder of Tenneco Professorship  
Ph.D., The Technical University of Denmark, 1974  

Talreja’s research interests include damage, fatigue and failure of composites, effects of manufacturing defects, aging aircraft and sustainability of aerospace vehicles.

Selected 2015 Publications


Dr. Svetlana A. Sukhishvili  
Professor  
Ph.D., Moscow State University, Russia, 1989  

Sukhishvili’s research interests include stimuli-responsive all-polymer and polymer nanocomposite assemblies, structure and dynamics of polyelectrolyte assemblies, materials with controllable optical, swelling and drug-release responses, remote manipulation of material shape, smart antibacterial materials, surface modification for controlling wettability, adhesion and adsorption.

Selected 2015 Publications

A new model for excellence in corrosion education and research

The National Corrosion and Materials Reliability Center was established in fall 2015 to provide solutions to the corrosion needs of industry and government that maximizes asset life, production efficiency and worker safety. The center led by Dr. Homero Castaneda aims to educate and train the next generation of corrosion leaders. It provides state-of-the-art capabilities in the research and development of corrosion resistant materials, corrosion mitigation strategies, corrosion sensors, and life prediction tools; assessment of technologies and development of life cycle costs.
Materials Science and Engineering

Degrees Offered

**Undergraduate**
Minor in Materials Science and Engineering

**Graduate**
Master of Science in Materials Science and Engineering
Master of Engineering in Materials Science and Engineering
Doctor of Philosophy in Materials Science and Engineering

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