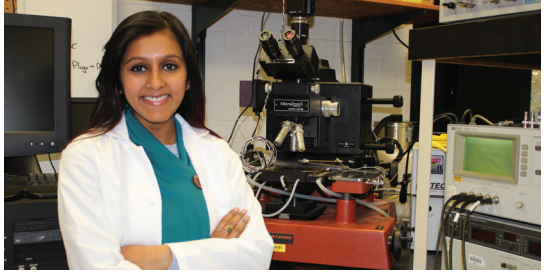

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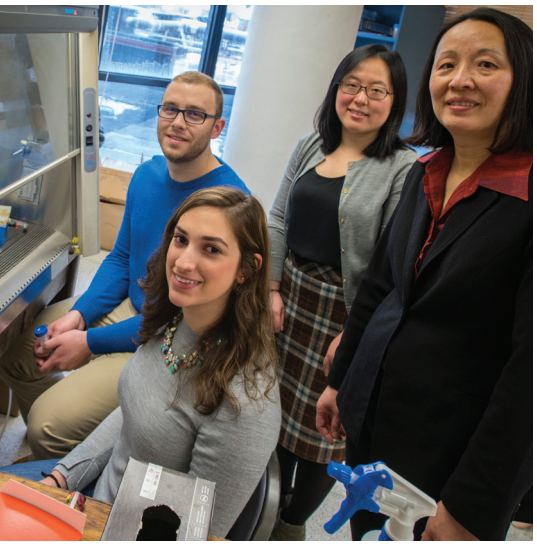

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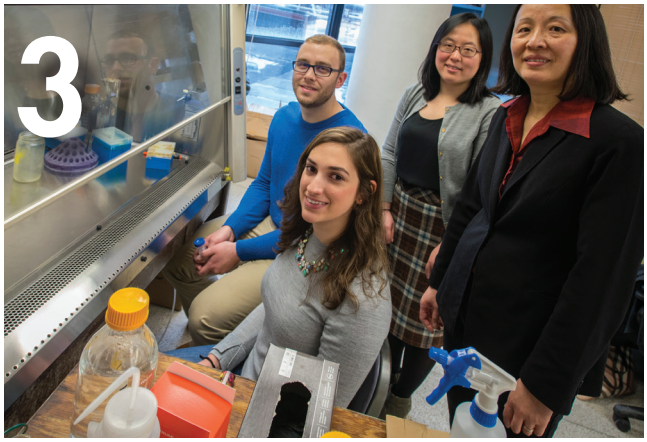

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This outreach bulletin is produced for the students, alumni, faculty, corporate supporters, and friends of the Department of Materials Science & Engineering at the University of Connecticut.

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KEEP IN TOUCH

To stay informed about ongoing news and events happening at UConn's Materials Science and Engineering Department, visit our website regularly: www.MSE.engr.uconn.edu

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UConn Materials Science & Engineering Alumni Group

MSE has experienced an incredibly dynamic year. Our undergraduate and graduate student populations continue to grow such that we are fast approaching 250 graduate students, undergraduates, and post-doctoral researchers. We also now have six senior faculty in major leadership positions (Maric-Vice Provost for Research; Wei-School of Engineering Associate Dean; Alpay-Director of the Innovation Partnership Building; Aindow-Executive Director for Innovation, External Engagement, and Industry Relations; Hebert-Associate Director of the Institute of Materials Science; and Huey-the new MSE department head). Our younger faculty are similarly productive, winning several major federal grants this year alone and one rising to associate professor (Dongare). One faculty member retired as well, but will remain very active as an Emeritus professor (Carter). And, during 2018 we hired five (yes FIVE!) new faculty members into MSE (four assistant and one associate) and still are hiring a Professor in Residence. This is thanks to tremendous support from the Institute of Materials Science, School of Engineering, and the University Provost. Between our superb administrative staff, professional advisors, research and adjunct faculty, and MSE's five female and 15 male tenured or tenure track professors, we are well prepared to continue to rise in prominence. This is both on campus, where we are among the highest ranked departments, and beyond, as our national and international accomplishments continue to be recognized.

Academically our faculty have gained growing success in major funding awards and publications. Our work is increasingly appearing in high impact factor journals (Science, Nature Publishing Group journals, etc.) and as cover stories (most recently for JOM and the Materials Research Society Bulletin). Our faculty are progressively recognized for their reputations through honorary degrees (Laurencin), career achievement awards (Brody), university and AAUP recognition (Alpay), and plenary and other invited lectures (MRS, ACerS, TMS, IEEE, and other meetings). And our research funding continues to grow, including several new >$1M grants in the past fiscal year. This includes novel new equipment and facilities, partnerships with industry in the US and beyond, cross-departmental collaborations, and major multi-institution awards.

Our students are also earning distinguished awards. One of our seniors was named a NASA Intern of the Year (Z. Grady), a junior was named a University Scholar (H. Petal), and a freshman became a Holster Scholar (A. Levin). One of our graduate students earned the coveted Gold Award at the Materials Research Society Fall Meeting (only six awardees among 6500 attendees), several won other speaking and poster contests at smaller conferences, and two were selected as the UConn representatives to government officials in DC and to attend the AAAS sponsored 2018 Catalyzing Advocacy for Science and Engineering (CASE) Workshop.

We're deeply committed to community, university, and professional service as well. Our students, technical staff, and faculty welcomed several hundred high school students into our labs for hands-on demonstrations about materials science, worked closely with focused groups of high school students and teachers for immersive MSE summer experiences, and brought MSE demonstrations to nearly 1000 secondary school students across the state. We serve as editors and co-editors for several major journals, and collectively organize almost 15 conference symposia in any two year period. We're primary organizers for full meetings too, including the MRS Fall 2019 conference. Our efforts on behalf of UConn, and materials science in general, are making a broad impact at every level.

Some of you already heard some of these details by following our activities on our website throughout the year. Or perhaps you attended our annual MSE student and alumni banquet, which grew by another 50% this past spring and resulted in many welcome donations earmarked for future student activities. Next year, watch this space for even bigger and better things to come, including our developing plans to occupy the next new building on campus, Science One. As the new home of MSE amongst the Institute of Materials Science, this will expand our collective materials teaching and research facilities by a full 50%.

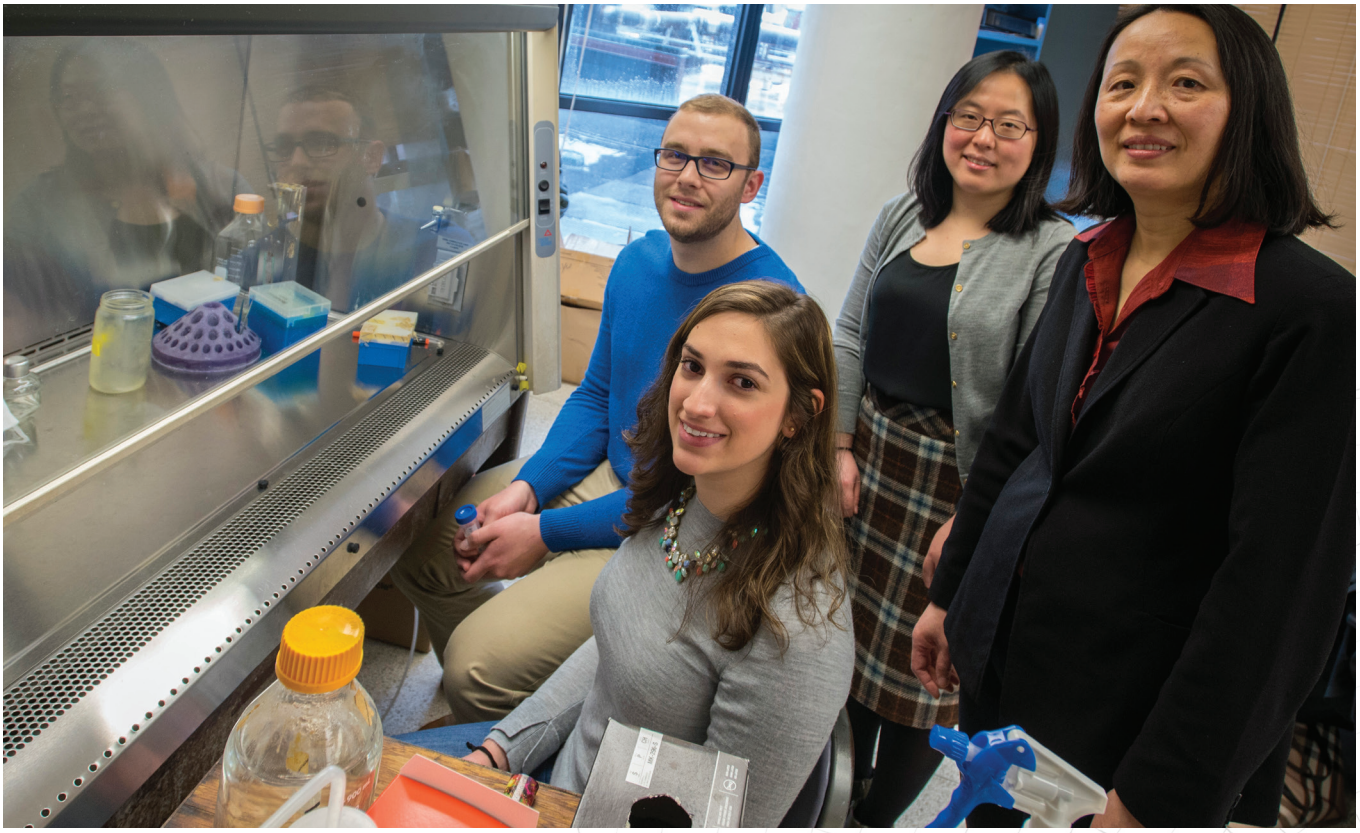
Thank you for your continued support of UConn MSE.

Best regards,

Bryan D. Huey
Department Head

Spider Silk Key to New Bone-Fixing Composite

UConn researchers have created a biodegradable composite made of silk fibers that can be used to repair broken load-bearing bones without the complications sometimes presented by other materials.



Professor Mei Wei, right, with associate professor Dianyun Zhang (back right), Ph.D. candidate in materials science Bryant Heimbach, and undergraduate Beril Tonyali at their lab in the Materials Science Institute. (Sean Flynn/UConn Photo)

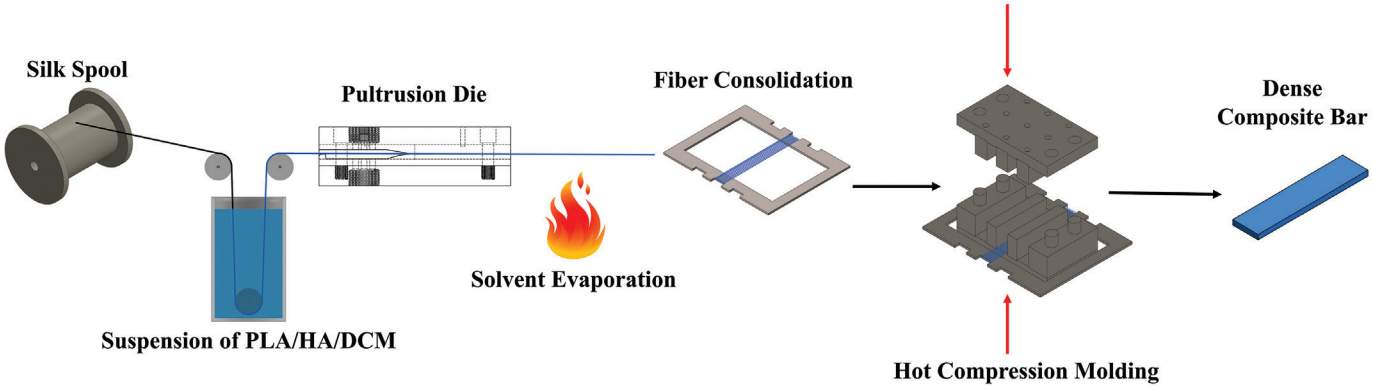
Repairing major load-bearing bones such as those in the leg can be a long and uncomfortable process.

To facilitate repair, doctors may install a metal plate to support the bone as it fuses and heals. Yet that can be problematic. Some metals leach ions into surrounding tissue, causing inflammation and irritation. Metals are also very stiff. If a metal plate bears too much load in the leg, the new bone may grow back weaker and be vulnerable to fracture.

Seeking a solution to the problem, UConn professor Mei Wei, a materials scientist and biomedical engineer, turned to spiders and moths for inspiration. In particular, Wei focused on silk fibroin, a protein found in the silk fibers spun by spiders and moths known for its toughness and tensile strength.

The medical community has been aware of silk fibroin for a while. It is a common component in medical sutures and tissue engineering because of its strength and biodegradability. Yet no one had ever tried to make a dense polymer composite out of it, and that is what Wei knew she needed if she was going to create a better device for healing broken load-bearing bones.

Working with UConn associate professor Dianyun Zhang, a mechanical engineer, Wei's lab began testing silk fibroin in various composite forms, looking for the right combination and proportion of different materials to achieve optimum strength and flexibility. The new composite certainly needed to be strong and stiff, yet not so much so that it would inhibit dense bone growth. At the same time, the composite needed to be flexible, allowing patients to retain their



An overview of the processing techniques used to fabricate high-performance biodegradable composites to assist with bone healing. (Mei Wei/UConn Image)

natural range of motion and mobility while the bone healed. After dozens of tests, Wei and Zhang found the materials they were looking for. The new composite consists of long silk fibers and fibers of polylactic acid – a biodegradable thermoplastic derived from cornstarch and sugar cane – that are dipped in a solution in which each is coated with fine bioceramic particles made of hydroxyapatite (the calcium phosphate mineral found in teeth and bones). The coated fibers are then packed in layers on a small steel frame and pressed into a dense composite bar in a hot compression mold.

In a study recently published in the Journal of the Mechanical Behavior of Biomedical Materials, Wei reports that the high-performance biodegradable composite showed strength and flexibility characteristics that are among the highest ever recorded for similar bioresorbable materials in literature.

And they could get even better.

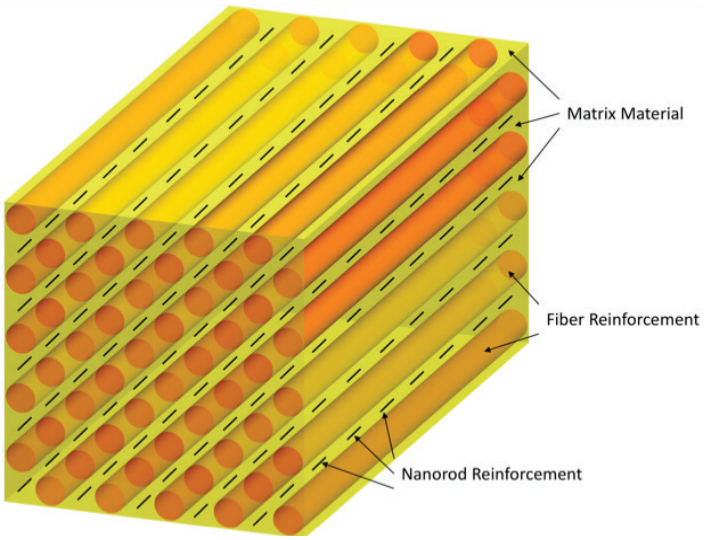
"Our results are really high in terms of strength and flexibility, but we feel that if we can get every component to do what we want them to do, we can get even higher," says Wei, who also serves as the School of Engineering's associate dean for research and graduate education.

The new composite is also resilient. Large leg bones in adults and seniors can take many months to heal. The composite developed in Wei's lab does its job and then starts to degrade after a year. No surgery is required for removal.

Joining Wei and Zhang in the research were Bryant Heimbach, a Ph.D. candidate and materials scientist in Wei's lab; and Beril Tonyali, a UConn undergraduate pursuing a degree in materials science and engineering.

The team has already begun testing new derivatives of the composite, including those that incorporate a single crystalline form of the hydroxyapatite for greater strength and a variation of the coating mixture to maximize its mechanical properties for bones bearing more weight.

By Colin Poitras, UConn Communications

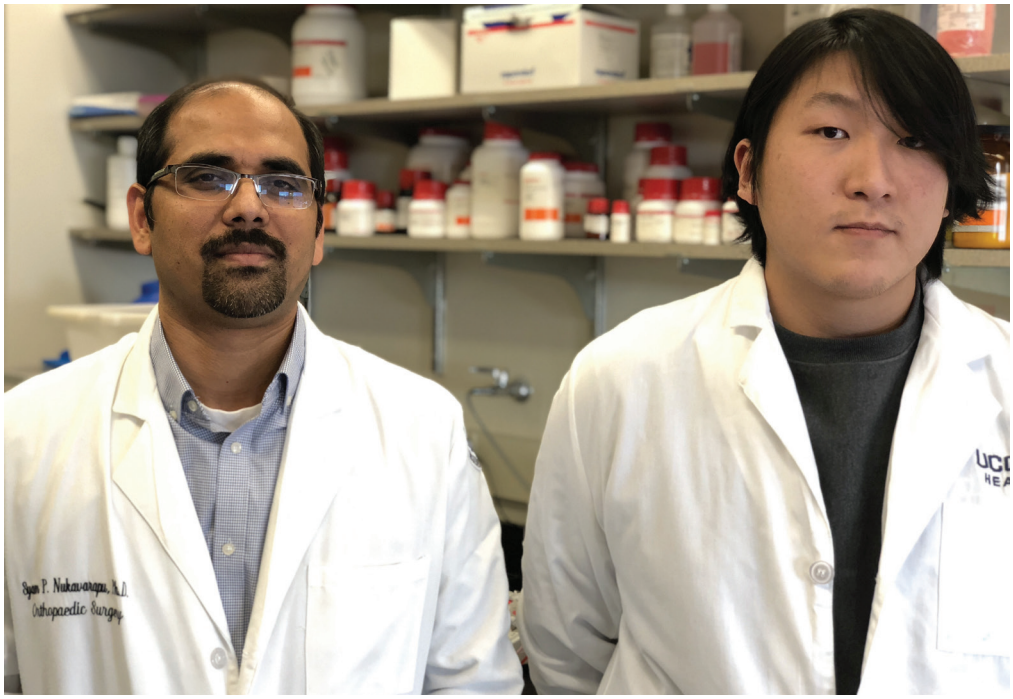


A 3-D rendering of a novel bone-fixing composite developed by a research team led by UConn materials scientist Mei Wei. (Image courtesy of Bryant Heimbach/UConn)

Engineered Cartilage Template to Heal Broken Bones

Helping injured bones regenerate is no easy task, especially when it comes to the longer bones in our bodies. A team of UConn Health researchers led by associate professor of orthopaedic surgery, Syam Nukavarapu, Ph.D., has developed an engineered cartilage template to encourage long bones to regenerate. Syam Nukavarapu also holds joint appointments in the departments of biomedical engineering and materials science and engineering.

There are over 200 bones in an adult human skeleton, ranging in size from a couple of millimeters in length to well over a foot. How these bones form and how they are repaired in the event of injury is different and has posed a challenge for many researchers in the field of regenerative medicine.



Syam Nukavarapu (left) with graduate student researcher Hyun (Damien) Kim in their UConn Health lab (OVPR Photo)

A team of UConn Health researchers led by associate professor of orthopaedic surgery, Syam Nukavarapu, PhD, has designed a novel, hybrid hydrogel system to help address some of these challenges. The UConn team described their findings in a recent issue of Journal of Biomedical Materials Research-Part B, where the work is featured on the journal cover.

There are two processes involved with human skeletal development, which help all the bones in our body form and grow. These processes are called intramembranous and endochondral ossification, IO and EO respectively. While they are both critical, IO is the process responsible for the formation of flat bones and EO is the process that forms long bones like femurs and humeri.

For both processes, generic mesenchymal stem cells (MSCs) are needed to trigger the growth of new bone. Despite this similarity, IO is significantly easier to recreate in the lab since MSCs can directly differentiate, or become specialized, into bone-forming cells without taking any additional steps.

However, this relative simplicity comes with limitations. To circumvent the issues associated with IO, the UConn Health team set out to develop an engineered extracellular matrix that uses hydrogels to guide and support the formation of bone through EO.

"Thus far, very few studies have been focused on matrix designs for endochondral ossification to regenerate and repair long bone," says Nukavarapu. "By developing a hybrid hydrogel combination, we were able to form an engineered extracellular matrix that could support cartilage-template formation."

According to Nukavarapu, vascularization is the key in segmental bone defect repair and regeneration. The main problem with IO-formed bone is caused by a lack of blood vessels, also called vascularization. This means that IO isn't capable of regenerating enough bone tissue to be applied to large bone defects that result from trauma or degenerative diseases like osteoporosis. Although many research-

ers have tried various strategies, successfully vascularizing bone regenerated with IO remains a significant challenge.

On the other hand, vascularization is a natural outcome of EO due to the development of a cartilage template, chondrocyte hypertrophy, and eventual bone tissue formation.

While IO's simplicity caused limitations, EO's benefits result in an intricate balancing act. EO requires precise spatial and temporal coordination of different elements, like cells, growth factors and an extracellular matrix, or scaffold, onto which the MSCs attach, proliferate, and differentiate.

To achieve this delicate balance in the lab, Nukavarapu and his colleagues combined two materials known to encourage tissue regeneration – fibrin and hyaluronan – to create an effective extracellular matrix for long bone formation. Fibrin gel mimics human bone mesenchymal stem cells and facilitates their condensation, which is required for MSC differentiation into chondrogenic cells. Hyaluronan, a naturally occurring biopolymer, mimics the later stages of the process by which differentiated chondrogenic cells grow and proliferate, also known as hypertrophic-chondrogenic differentiation.

The researchers anticipate that cartilage templates with hypertrophic chondrocytes will release bone and vessel forming factors and will also initiate vascularized bone formation. Nukavarapu says that the "use of cartilage-template matrices would lead to the development of novel bone repair strategies that do not involve harmful growth factors."

While still in the early research phase, these developments hold promise for future innovations.

"Dr. Nukavarapu's work speaks not only to the preeminence of UConn's faculty, but also to the potential real-world applications of their research," says Radenka Maric, vice president for research at UConn and UConn Health. "UConn labs are buzzing with these types of innovations that contribute to scientific breakthroughs in healthcare, engineering, materials science and many other fields."

The researchers next plan to integrate the hybrid extracellular matrix with a load-bearing scaffold to develop cartilage templates suitable for long-bone defect repair. According to Nukavarapu, the UConn research team is "hopeful that this is the first step towards forming a hypertrophic cartilage template with all the right ingredients to initiate bone tissue formation, vascularization, remodeling, and ultimately the establishment of functional bone marrow to repair long bone defects through EO."

Jessica McBride, Office of the Vice President for Research

Rainer Hebert Appointed Associate Director of the Institute of Materials Science

Since fall 2017 MSE Associate Professor and Castleman Professor in Engineering Innovation Rainer Hebert has served as the new Associate Director of the Institute for Materials Science (IMS). IMS Director Professor Steven S. Suib praised Dr. Hebert for "his dedication to IMS, his excellent scholarship, and outstanding research program." Dr. Hebert looks forward to his new role and hopes "to contribute to further strengthen the collaboration between IMS researchers and the research activities of IMS."

Dr. Hebert has garnered a range of accomplishments in academia throughout the years. After completing his education at the University of Saarbrücken, Germany in 1997 with a Diploma in Physics, Hebert switched fields to materials science and engineering, graduating with a Ph.D. from the University of Wisconsin-Madison in 2003. He joined UConn in 2006 and is currently serving as Director of the Additive Manufacturing Innovation Center in partnership with Pratt & Whitney. In this role, he leads additive manufacturing projects that focus on basic material science aspects of metal additive manufacturing, while also managing the expansion of the Center. Following years of research on metallic glasses and driven amorphization of metallic multilayers, Dr. Hebert's research interests now focus on the melting and fusion behavior of powder beds interacting with laser beams and the phase selection during the solidification stages of additive manufacturing.

Associate Professor and Castleman Professor in Engineering Innovation Rainer Hebert

Growing UConn's Research Enterprise with an Inclusive Approach

Dr. Radenka Maric has big plans to grow UConn's research enterprise, with a focus on increasing stategic partnerships within and beyond the university's walls.

MSE faculty member Professor Radenka Maric, was appointed Vice President for Research at UConn and UConn Health in the summer of 2017. Maric has already begun to implement initiatives that aim togrow the university's research enterprise by expanding our connections both inside and out.

"Collaboration is the model of the future for scientists and engineers," Maric explains. "I want to bring more faculty, companies, and foundations together on collaborative projects to grow UConn's capabilities and increase our competitiveness for substantial funding for cutting-edge research. Nobody can do that alone."

Maric's global career path has helped her build such connections and partnerships with a variety of stakeholders.
She began her research career at the Japan Fine Ceramics Center and Toyota Motors where she managed technology and business development for fuel cells, electronics, and biomaterials applications, before moving to the U.S. to work at nGimat Corporation, a leading manufacturer and innovator of engineered thin films and nanopowder technologies. While at nGimat, she initiated and led technology and business development and numerous projects with Georgia Tech and Penn State University.

After five years with nGimat, she went on to lead efforts at the National Research Council of Canada's Institute for Fuel Cell Innovation in developing national and international collaboration in fuel cell and batteries across industry, universities, and government organizations in North America, Japan, and Germany.

Now, as Vice President for Research, Maric seeks to build on the momentum she has already seen at UConn. Since arriving in 2010 through the Eminent Faculty Initiative in Sustainable Energy, Maric has pushed for an increased focus on partnerships with industry leaders, increased entrepreneurship among faculty and students, and a greater emphasis on large-scale grants. These all provide a strong foundation for promoting UConn as a top public research university, says Maric.

"The talent at UConn and UConn Health is staggering," says Maric. "We need to continue to galvanize our best resources – our students and faculty – and leverage our state-of-the-art research infrastructure to enhance opportunities for collaborations. We have many very talented undergraduate and graduate students who excel at science and technology development and are hungry for opportunities to work with industry."

Maric's mission includes aligning UConn's research with federal funding priorities, focusing faculty on global research opportunities, building cross-institutional projects, and helping to integrate industry needs into the university's culture, while at the same time supporting the creation of an innovative ecosystem in Connecticut.

"We want to grow our faculty and our students; and we want to grow a strong portfolio of companies associated with UConn through initiatives like the Innovation Partnership Building (IPB) and the UConn Technology Incubation Program (TIP)," says Maric.

This cross-disciplinary approach isn't exclusive to STEM fields; an avid supporter for the arts and humanities, Maric has facilitated partnerships for creative projects, and hopes to encourage interactions between non-STEM fields, such as digital media and design, with scientific disciplines like psychological sciences and neuroscience and engineering. She works closely with UConn faculty, joint faculty from The Jackson Laboratory for Genomic Medicine (JAX) and leadership from both JAX and UConn Health to bring collaboration to the next level of higher research funding.

Prior to her role as VPR, Maric served as executive director of UConn's Innovation Partnership Building (IPB). Her ability to commercialize research aimed towards government, industry, and academic interests has been instrumental to the $132 million project, including leveraging more than $80 million in industry and federal agency projects. The IPB opened its doors in the fall of 2017. The IPB still remains within the scope of Maric's responsibilities and extends her ability to connect UConn with startups and industry leaders. Fellow MSE faculty member Pamir Alpay is now the executive director of the IPB, solidifying the central role materials play in advanced engineering and technology.

In addition to being responsible for managing partnerships with General Electric, Eversource, UTC Aerospace, and others, Maric has a history of creating collaborations between UConn and industry, such as sponsored projects with United Technologies Research Center, NGK Spark Plug (Japan), ELDOR (Italy), Sonalysts, and Proton OnSite, just to name a few.

Continuing to consider UConn's impact, Maric is currently serving as co-Chair, on CTNext's Higher Education Innovation & Entrepreneurship Working Group composed of leaders from a diverse set of colleges, both public and private. This group has already had an impact, as several projects around the state have recently received funding to support innovation, entrepreneurship, tech transfer, and more.

"Connecticut has made a significant investment in UConn aimed at building infrastructure, improving education, development of a new innovation hubs, and training the state's future workforce. UConn's research enterprise is a critically important part of making sure this happens," says Maric. "It helps drive Connecticut's innovation economy by forging important partnerships, commercializing life-saving technologies, supporting entrepreneurship, creating a network among universities, and preparing talented graduates for high-impact jobs."

Professor Bryan Huey Appointed Department Head of MSE

At the end of 2017, Professor Bryan Huey was announced to be the Department Head of the Materials Science and Engineering Department, taking the mantle from Professor Pamir Alpay, who has successfully led the department since 2012.

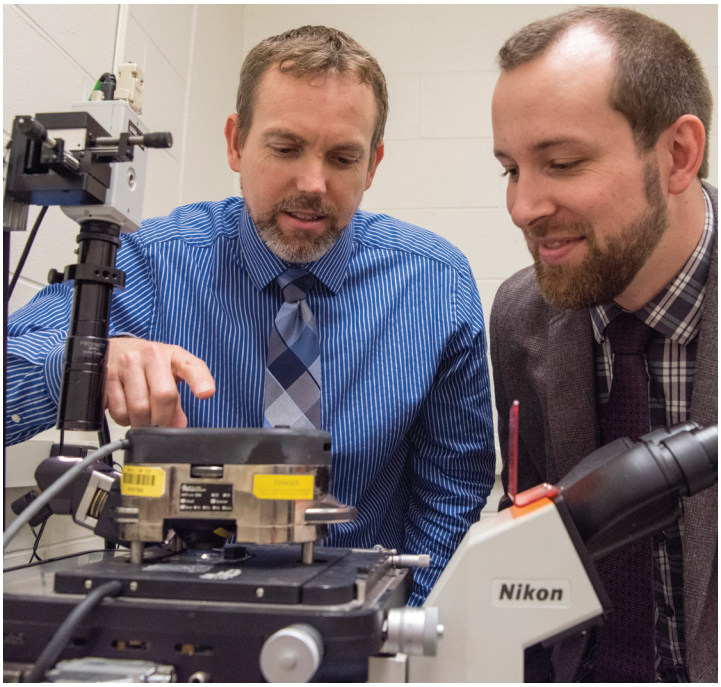
Professor Huey recently served as a United Technologies Professor of Engineering Innovation as well as the Director for Graduate Students in MSE. His path to academia began with a B.S. in Materials Science and Engineering at Stanford University in 1993. Professor Huey went on to obtain his Ph.D. from the University of Pennsylvania in 1999, where he first started working with AFM in Dawn Bonnell's group. While there he developed scanning surface potential microscopy to attain the first nanoscale measurements of potential barriers in varistors.

After completing his Ph.D. he worked at Oxford University as a Marshall-Sherfield fellow and later as a NSF-international post doc. There he teamed up with A. Briggs and O. Kolosov to cultivate ultrasonic force microscopy for mechanical mapping of semiconducting materials.

Later he went to the NIST Ceramic Division as a NRC post doc where he examined ferroelectrics and piezoelectrics with J. Blendell. UConn MSE welcomed Professor Huey to the department in 2004. Since then, Huey has overseen the IMS NanoMeasurements lab, which serves as the UConn facility for atomic force microscopy (AFM) . This lab has featured the highest speed AFM imaging in the US, novel coupled AFM and 3-d optics for nano-bio-mechanics, pioneered AFM-based movies of switching in ferroelectrics, developed novel photovoltaic performance mapping for inorganic and molecular perovskite solar cells, and lately is focused on tomographic AFM (CT-AFM).

Huey's research group also works with in-situ imaging of micro-electro- mechanical-systems, and the local properties of nanoscale materials and coatings. Professor Huey's research group is typically funded by NSF, DOE, NIH, and many industrial partners.

Professor Huey's teachings are often praised in his student evaluations. His classes focus on the topics of materials characterization, nanomaterials, and a course called Nanoscience and Society, which discusses ways to improve engineering recruitment and retention. He has been an invited participant to the NAE's Frontiers for Engineering Education Program in recognition of this cutting-edge course, and as a keynote speaker focused on the impact of science on society for the Conference of Science and Technology Innovation in Nagaoka, Japan.



Professor Bryan Huey and Justin Luria analyzing cadmium telluride using the high-powered LED in Huey's lab. (Ryan Glista/UConn Photo)

In 2007 Professor Huey was recognized as a MSE Outstanding Faculty Member for his research, teaching, and service. During the 2011-2012 academic year Professor Huey was the Villum Foundation (VELUX) Visiting Professor at the iNano Institute of Aarhus University in Denmark. In 2016 he received the Fulrath award for collaborative research and service between the US and Japan.

Professor Huey has also published over 75 papers in a variety of journals such as Nature, Nanoletters, and Applied Physics Letters. He has co-organized one symposium per year and was recently asked to be one of five co-organizers for the ~7000 attendee MRS Fall meeting in 2019.

With support and patience from his wife Tina and son William, Professor Huey looks forward to furthering the excellence and success of MSE as the new head of the department. "There is outstanding potential for UConn MSE. We have excellent faculty, staff, and students, novel facilities, and strong institutional and industry support to expand our education, research and outreach even further," he said.

Harold Brody Honored by Advanced Casting Research Center

The Advanced Casting Research Center of Worcester Polytechnic Institute has bestowed its Merton C. Flemings Award upon Distinguished Professor Harold Brody. The award is given biennially to recognize individuals who have made significant contributions to the understanding of solidification processing fundamentals, which have been applied commercially in the foundry industry.

Dr. Brody, a Distinguished Professor of Materials Science and Engineering has focused his research on understanding casting and solidifications processes, on applying computer-aided analysis and design to materials processing with emphasis on casting, and on innovating in engineering education. At MIT, as a student, as a member of the research staff, and as a visiting professor, Dr. Brody collaborated with Professor Merton Flemings and his colleagues and students to provide models for solute redistribution during dendritic solidification of casting and welds, for application of directional solidification to high temperature superconductors, and for undercooled alloys.

The ACRC is an academic-industry partnership headquartered on the campus of Worcester Polytechnic Institute in Worcester, MA. The center focuses on assisting industry partners with technical issues, specifically in the areas of light metals, non-ferrous alloys, and semi-solid processing.

By Rhonda Ward, IMS

Merton C. Flemings Award presented to Professor Harold D. Brody (left) by Professor Merton C. Flemings of MIT (center), with Professor Diran Apelian of Worcester Polytechnic Institute and founding Director of ACRC (right)

Professor S. Pamir Alpay Given Multiple Awards and Honors

MSE professor and executive director of UConn Tech Park S. Pamir Alpay has recently received several awards. This includes being named a General Electric (GE) Endowed Professor in Advanced Manufacturing, and an award for from the American Association of University Professors (AAUP) for academic and research achievements in the field of materials science.

Pamir joined UConn's Department of Materials Science and Engineering as assistant professor in 2001. Since then, he has held multiple leadership positions in the department while teaching, conducting research and guiding students to success in engineering.

In December 2017, Pamir was appointed the GE Endowed Professor in Advanced Manufacturing by the UConn Board of Trustees for his successful collaborations and innovations in use by industrial partners. These include his research in theory for HVAC system materials based on ceramics, which would lead to more efficient heating and cooling systems for buildings, applications of functional ceramics in night vision goggles and dielectrically tunable oxides in telecommunication devices.

The 2018 Excellence in Research & Creativity: Career Award was bestowed upon Pamir by the UConn AAUP. This award honors research excellence and creativity that enhances the University's academic reputation and recognizes scholarship with a national and international reputation and outstanding service in promoting scholarship at UConn.

In addition to these notable distinctions, in the fall of 2018 Pamir will be inducted as a Fellow of the American Ceramic Society (ACerS) for his extensive investigations into the modeling and applications of functional ceramics.

Pamir has been involved in the field of ceramics science for over 30 years, earning his Bachelor of Science in Metallurgical Engineering in 1990 from the Middle East Technical University in Ankara, Turkey, and his Ph.D. in Materials Science and Engineering (MSE) from the University of Maryland in 1999.

Professor Pamir Alpay is New Executive Director of the UConn Tech Park

Professor of Materials Science and Engineering, Dr. S. Pamir Alpay, serves as new Executive Director of the Innovation Partnership Building at the UConn Tech Park Building at the UConn Tech Park.

UConn's Innovation Partnership Building (IPB) at the UConn Tech Park has new leadership. Professor of Materials Science and Engineering, Dr. S. Pamir Alpay will serve as Executive Director of the state-of-the-art facility and associated industry partnerships, effective immediately. Dr. Alpay replaces Dr. Radenka Maric, who served in the role until her promotion to Vice President for Research at UConn and UConn Health this past July.

"We are thrilled to have someone with Pamir's extensive experience as a scientist and collaborator leading the Tech Park," says Dr. Maric. "Having already worked closely with several of the companies associated with the Tech Park and currently leading the UTAS Center for Advanced Materials which will be housed at the IPB, I am confident that Dr. Alpay will be able to hit the ground running as Executive Director. We are excited to see him build on the progress already achieved by centers located at the IPB, the School of Engineering, and the Institute of Materials Science."

Dr. Alpay received his PhD in Materials Science and Engineering in 1999 from the University of Maryland, where he specialized in modeling of functional materials systems. He remained at the University of Maryland in the Materials Research Center as a postdoctoral research associate until 2001. Dr. Alpay then joined UConn's Department of Materials Science and Engineering (MSE) as an Assistant Professor. He was promoted to the rank of Associate Professor (with academic tenure) and then to Professor in 2007 and 2010, respectively. Since 2013, he has served as the Department Head of MSE.

Dr. Alpay has an impressive research background, which includes an NSF-CAREER Award in 2001, the UConn School of Engineering Outstanding Junior Faculty Award in 2004, over 180 peer-reviewed journal publications and conference proceedings, four invited book chapters, and an invited book co-authored on compositionally graded ferroelectric materials.

According to university leaders, Dr. Alpay also has a proven record as a capable collaborator, having successfully organized several international symposia in major conferences on a variety of topics, including ferroelectric thin films, multiferroic materials, and functional materials in nanoscale. Dr. Alpay is a respected leader in his field, and has delivered nearly 100 invited talks/seminars at academic institutions, national laboratories, industry, and in international meetings and workshops.

Professor Pamir Alpay (Peter Morenus/UConn Photo)

Dr. Alpay is an elected member of the Connecticut Academy of Science and Engineering (CASE), is a Fellow of the American Physical Society, and was the United Technologies Corporation (UTC) Associate Professor in Engineering Innovation from 2008 to 2010. His research focuses on smart/functional materials and multi-scale materials modeling. He is also currently an Editor for the Journal of Materials Science.

In this important leadership role, Dr. Alpay will represent the university in all matters relating to the Tech Park, and will lead efforts to establish new industry partnerships that leverage the space and sophisticated resources available in the IPB with the expertise and capabilities of UConn's world-class faculty.

"The IPB and Tech Park will be an important part of UConn's legacy as a leading public research university," says Alpay. "So much progress has already been made to build this unique facility and establish strong partnerships. I am honored to have the opportunity to continue this work and to play a part in shaping this legacy."

By Jessica McBride, Office of the Vice President for Research

Avinash Dongare Promoted to Associate Professor

We are proud to announce Avinash M. Dongare's promotion to Associate Professor. His dedication towards both research and academia have made him a cornerstone of the department's modelling efforts in particular, for both his students and his fellow professors. Over his career, he has continued to show a real passion for engineering and the field of materials science.

Avinash earned his Ph.D. from the University of Virginia in 2008. Since then, he has focused his efforts on researching and expanding the limits of computational evaluation, especially at the atomic scales, which play a key role in testing, analyzing and tailoring the properties of materials used in building and engineering. Prior to UConn, Avinash's experience includes a position as National Research Council Research Associate with the US Army Research Office investigating the impact behavior of armor materials, followed by a position at North Carolina State University as a senior research associate investigating the degradation and breakdown of the materials used in nuclear power facilities.

In 2012, he was brought to UConn as part of the Faculty 500 initiative launched to help expand UConn's faculty ranks and better further the academic strength of the university. Since then, he has helped students further their understanding of computational analysis while further broadening their horizons in the field. He has since then developed externally funded programs at UConn in the area of computational materials science and mechanics through grants from the National Science Foundation (NSF), US Army Research Office (ARO), US Army Research Laboratory (ARL), Pratt and Whitney (PW) and the Department of Energy (DOE). Of particular importance is the recognition of his contributions through the NSF Faculty Early Career Development (CAREER) Award in 2015.

C. Barry Carter Retires

The department of Materials Science and Engineering would like to extend a thank you to Prof. C. Barry Carter for his 11 years of service at UConn. He has elected to quietly retire this summer.

Fortunately for us, Barry will serve as an emeritus faculty member. In particular, he will continue his research, with a newly-granted NSF grant. We look forward to his continued contributions to UConn MSE and advocacy for our department and faculty, given high profile around the world in the fields of microscopy and ceramics.

Barry first came to Storrs in 2007 to lead the new CMBE department, which then combined Materials Science and Engineering as well as Chemical Engineering. He ably steered this amalgam for 5 years, before both departments sufficiently stabilized to flourish independently again. During his tenure at UConn he built strong collaborations with Sandia National Labs and published updated editions for his widely respected textbooks on Ceramic Materials and on TEM. He also served throughout as the Editor in Chief for the continually rising Journal of Materials Science.

We are grateful to Barry, and his wife Bryony, for their efforts supporting Materials Science at UConn over these many years.

Bryan Huey

$998.939 sponsored by the National Science Foundation (NSF)

Project Title: MRI - Development of Tomographic Atomic Force Microscopy for Nanoscale Volumetric Materials Property Mapping and Machining

Avinash Dongare

$905,502 sponsored by the Department of Energy (DOE)/National Nuclear Security Administration (NNSA) through the Stewardship Science Academic Alliances (SSAA) Program as part of the Center for Research Excellence on Dynamically Deformed Solids (CREDDS)

UConn MSE Featured Prominently at US-Japan Seminar

The US-Japan Seminar on Dielectric and Piezoelectric Ceramics has occurred once every two years for almost four decades, bringing together about 100 scientists and technologists from industry, academia, and government laboratories. It is one of the premier venues for the exchange of scientific ideas on ceramic materials for electronics and serves to foster relationships between experts from Japan and the U.S. The 18th annual seminar was held last November in Santa Fe, New Mexico and was co-organized by the MSE Department Head, Dr. Bryan Huey. A number of MSE faculty, graduate students and alumni participated in the invitation-only seminar and presented their work.

Notably, MSE faculty member Dr. George Rossetti's leadership in the field was recognized with a plenary lecture in memoriam of Professor L. Eric Cross, one of the founders of the biennial meetings. Dr. Cross was an esteemed researcher in the field, a member of the U.S. National Academy of Engineering, and a founding member of the Materials Research Laboratory at the Pennsylvania State University. He was also Professor Rossetti's doctoral research advisor.

In his plenary lecture titled 'Phase Transitions in Ferroelectric Perovskites: Energetics and Phenomenology' Professor Rossetti recounted Dr. Cross's seminal contributions to the phenomenological theory of three distinct types of ferroelectric materials that form the basis for most ceramic capacitors and electromechanical transducers. Professor Rossetti's lecture then focused on work from his own group, covering recent advances in the understanding of these materials obtained through the combined use of experimental and computational thermodynamic approaches.

In fact, this was the second plenary lecture Rossetti presented at a US-Japan Seminar, a rare honor. He delivered his first plenary lecture entitled 'Concepts of Morphotropism in Ferroelectric Solid Solutions' in 2007 at the 13th US-Japan Seminar in Awaji, Japan. There, he presented a phenomenological theory for the phase diagrams of binary ferroelectric systems that captures their key topological features and explains relationships between phase transformations, microstructure, and piezoelectric properties.

Rossetti's connection to researchers in Japan dates back nearly three decades. While a doctoral student he spent a year (1989-1990) in Japan as a visiting scientist at the Carbon and Inorganic Materials Group, Mitsubishi Kasei, Ltd., Yokohama. Rossetti has continued to collaborate with a number of Japanese researchers over the years.

Prabhakar Singh

$760,000 sponsored by the Department of Energy, Office of Energy Efficiency and Renewable Energy

Project Title: Proton Conducting SOFC for Large-Scale Hydrogen Production at Intermediate Temperatures

Mark Aindow

$411,911 sponsored by UTC Aerospace Systems under the UTAS Center of Excellence for Advanced Materials

Project Title: Quasicrystal-Strengthened Aluminum Alloys for Structural Applications and Coatings

C. Barry Carter

$441,402 sponsored by the National Science Foundation, Directorate for Mathematical and Physical Sciences

Project Title: GOALI - Mechanisms of Lithiation and Delithiation Reactions in Layered Materials Combining TEM and Atomic Scale Modeling

Meet Our New Faculty

Hailing from Rochester, New York, Lesley Frame developed her extensive knowledge of materials science through her invaluable research, industry, and teaching experiences. Her most recent positions include Associate Professor of Technology Management at the University of Bridgeport and Director of Product Development at Thermatool Corporation, an Inductotherm Group company in East Haven, CT.

She earned her S.B. from Massachusetts Institute of Technology in the Department of Materials Science Engineering. Frame then completed her M.S. and Ph.D. in MSE at the University of Arizona. After receiving her Ph.D. she remained at the University of Arizona as a postdoctoral researcher with The Arizona Research Institute for Solar Energy. In this position, she worked on the novel design and construction of a solar-thermal desalination unit for use by the Navajo Nation to generate potable water for livestock. In 2011, Frame conducted research at Cardiff University and the Rutherford Appleton Laboratory as a Fulbright Scholar, where she focused on mechanisms of residual stress relaxation in plastically deformed copper alloys using accelerated corrosion testing, traditional metallography, x-ray diffraction, and neutron diffraction methods.

Her impressive background includes participation in organizations such as ASM International, the American Society for Testing Materials (ASTM), and the Association for Iron and Steel Technology (AIST). Additionally, Frame has won several awards for her work including the ASM International Bronze Medal Award (2017), ASTM Award of Achievement (2017), and Thermatool's President's Award (2015). With Frame's strong ties to the steel and heat treat industries, as well as her extensive research experiences and passion for materials science and engineering she will be a welcome addition to our department.

Jasna Jankovic has been serving as an assistant professor since January 2018. She has been teaching students and working on research within her areas of expertise, which include fuel cell materials fabrication and characterization, advanced microscopy techniques, ceramic materials processing, polymer coatings, fuel refining, and catalyst deactivation.

Jankovic brings a wealth of knowledge to this position, having over 20 years of industry and research experience in various areas of engineering. Specifically, her areas of expertise include fuel cell materials fabrication and characterization, advanced microscopy techniques, ceramic materials processing, polymer coatings, fuel refining, and catalyst deactivation.

She completed her doctoral research at the University of British Columbia, where she worked on proton conductive ceramic materials for an intermediate temperature proton exchange fuel cell. Her work provided an understanding of the conductivity mechanisms in these novel materials and opened the door for further development in the future.

More recently, first as a post-doctoral fellow and then as a senior research scientist at Automotive Fuel Cell Cooperation, she acquired profound experience in materials for clean energy applications and skills of advanced materials characterization including tomographic TEM. Her industrial experience and background in advanced materials characterization will be a great asset to the MSE Department in student mentoring, further developing her research portfolio, and solving world challenges especially in the fields of transportation, energy, catalysis, and materials processing.

Stefan Schafföner, an assistant professor who joined our faculty in 2018, brings a global perspective to the department. His primary expertise is ceramics and alloys, especially for high temperature applications. Stefan also studies the metallurgy and kinetics of these materials, and their industrial applications.

Schafföner earned his doctorate in 2015 from TU Bergakademie Freiberg, a premier STEM university in Germany. His thesis focused on calcium zirconate as a refractory material for titanium and titanium alloy melts. While at this institution, he ultimately led a research team of one postdoctoral and two Ph.D. students studying high-temperature ceramics, along with five related projects, funded from several German and European agencies.

He later continued his research and teaching at the Norwegian University of Science and Technology in Trondheim, funded by a research fellowship from the German Research Foundation (DFG).

While at UConn, Stefan intends to research automotive, aerospace, energy and biomedical applications of high-temperature alloys, ceramics and compounds, as well as to develop processing and recycling techniques for these materials. He is eager to form partnerships between the university and industry as well, building on successful efforts he led in Germany and Norway.

Volkan Ortalan joined the MSE department as an Associate Professor in 2018, after over a decade of research and excellence in the field of materials science. His main research goals are to develop the scientific understanding of the mechanisms that control the behavior of materials, and to use that understanding to help design new materials to solve forefront scientific and engineering problems utilizing aberration-corrected, in-situ, and ultrafast transmission electron microscopy.

Volkan earned his Ph.D. in 2010 from the University of California, Davis, with a thesis in atomic-scale characterization of nanostructures in heterogeneous catalysts. He had previously earned two Bachelors of Science from the Middle East Technical University in Turkey; one in mechanical engineering, and one in metallurgical and materials engineering. Ortalan has been a postdoctoral scholar at Physical Biology Center for Ultrafast Science and Technology at California Institute of Technology working with Nobel Laureate Ahmed Zewail and a visiting scientist at the National Center of Electron Microscopy at Lawrence Berkeley National Laboratory, and at the Advanced Microscopy Laboratory at the Oak Ridge National Laboratory.

Following his postdoctoral studies at Caltech, he joined Intel Corporation as a lithography technology development engineer. After his industrial career at Intel, he joined Purdue University and established an impressive research and teaching portfolio as an assistant professor of materials engineering. His group utilizes multiple state-of-the-art experimental and computational techniques in concert to answer challenging questions in the fields ranging from materials science and chemistry to nanoscience and biology, such as phase and structural transformations, materials under extreme conditions, heterogeneous catalysts, chemical reactions of energetic materials, nucleation and growth of nanomaterials, molecular-level dynamic imaging of polymers, and biological structures.

Associate Professor Ortalan brings over 10 years of research and teaching experience with him, as well as a history of winning nearly $3 million in external grants for his prior research efforts. He has published over 40 articles and won numerous awards, including Office of Naval Research Young Investigator Award (2016), for his outstanding dedication to both academics and research. His research on nanotechnology and materials science has been highlighted several times in popular and prominent science news magazines, such as Chemical & Engineering News and ScienceDaily. We are proud to welcome Volkan to our department this fall.

Yuanyuan Zhu brings a diverse set of skills to the table, as well as industry and national laboratory contacts, as she joins our faculty as an assistant professor in 2018. Zhu's research is focused on in-situ and advanced microscopy characterizations of a broad range of energy-related materials including heterogeneous catalysis, functional oxides and nuclear structural alloys.

Zhu understands first-hand what it's like to apply research to a commercial market. She previously worked as a postdoctoral research associate and later as staff scientist at the Pacific Northwest National Laboratory, both in the Physical & Computational Sciences Directorate and the Reactor Materials and Mechanical Design group in the Energy and Environment Division.

Zhu has already published nearly 30 articles on her research, many of which have won Editor's Choice awards or were front page and feature articles. She is also a reviewer for the European Research Council's Scientific Proposals Review Board and for the National Center for Electron Microscopy, Molecular Foundry's Proposals Review Board. She is on the Scientific Advisory Board for The National New Material Industry Development Strategy Advisory Committee in Beijing, as well as an active member in the Materials Research Society, the Microscopy Society of America, and the Minerals, Metals & Materials Society.

Prior to her position at Pacific Northwest, Zhu was a postdoctoral researcher in R&D division at Haldor Topsøe A/S, a leading catalysis research company in Denmark.

Zhu earned her Bachelor's in metallic materials engineering from the College of Materials Science and Engineering in Sichuan University, in Chengdu, China in 2006. Her Master's degree in the Solid Atomic Imaging Division from the Institute of Metal Research Chinese Academy of Sciences was focused on TEM characterization of pyrolytic carbon. Her Ph.D. from Texas University A&M was centered around atomic-scale characterizations of functional heterogeneous thin films.

With her national, industrial, and global experiences, Zhu brings new materials expertise as well as a diverse background to UConn MSE.

Meet Our Advisory Board Members

Comprised of eleven highly reputable industry partners, the Industrial Advisory Board works to augment the visibility of the UConn Materials Science and Engineering Department at the University, state, and national level.

ANGIE CHEUNG
Chief Materials Science Engineer
Stanadyne LLC

PETER CHOMOWICZ
Senior Analyst
General Dynamics Electric Boat

BILL FALLON
Senior Technical Fellow, Materials & Processes Engineering
Sikorsky Aircraft

DAVE FURRER
Senior Fellow Discipline Lead, Materials and Processes Engineering
Pratt & Whitney

DANIEL GOBERMAN
Associate Director Discipline Leader, Materials Characterization
United Technologies Research Center

PETER JARRETT
Chief Technology Officer
Ocular Therapeutix

ALEXANDRA MERKOURIOU
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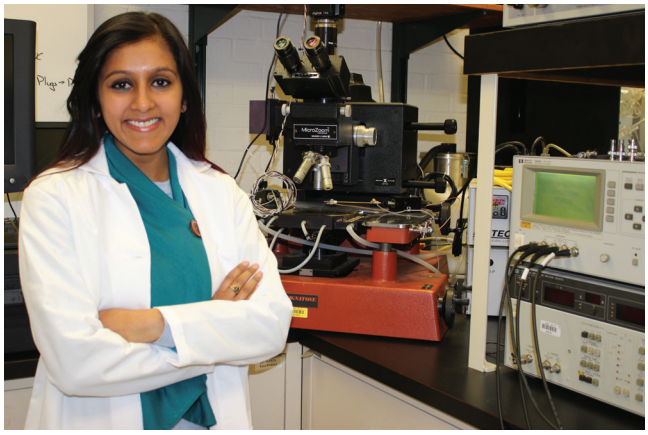
HOWARD ORR
President and CEO
KTI Inc.

KATHY SAINT
President
Schwerdtle Stamp Co.

STEPHEN THOMAS
Structural Engineer II
General Dynamics Electric Boat

VENKAT VEDULA
Executive Director, Additive Manufacturing
UTC Technology

Tulsi Patel Recognized at the 27th Annual Connecticut Symposium



The Twenty-Seventh Annual Connecticut Symposium on Microelectronics and Optoelectronics (CMOC) took place on April 4that the University of New Haven. The event included oral and poster presentations on Materials, Devices, Applications, Bio-sensing/ Nano-Biosystems, and Emerging Technologies.

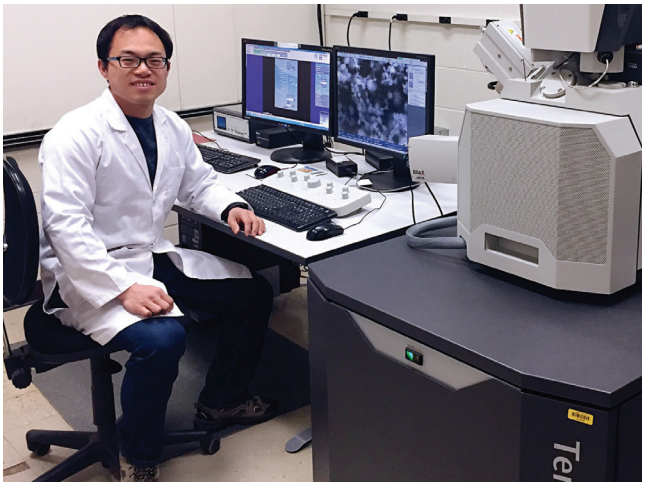
MSE graduate student Tulsi Patel won best oral paper prize for her talk co-authored by Professor Alpay and Professor Hebert, titled, "A Path to Hybrid Additive Manufacturing of Ferroelectric Oxides and Aerospace Alloys" presented in the Materials & Characterization Session.

The event gave attendees the chance to network with renowned experts and discover research and development activities in micro- and nano-technologies applied to electronics, photonics, biosensors, and energy applications. In addition, attendees learned about research and development resources in Connecticut and neighboring states.

The sponsors of the symposium included The Connecticut Microelectronics & Optoelectronics Consortium, SPIE-UConn Chapter, The University of Connecticut's Center for Continuing Studies, and the Yale Center for Microelectronics Materials and Structures.

The overall goal of CMOC is to enhance the collaboration and sharing of resources between Connecticut industries and universities in microelectronics and optoelectronics. It aims to bring recognition to new technologies, trends, and current issues through presentations by nationally and internationally recognized experts.

Xingxu Lu Wins Graduate Student Speaker Contest



The student chapter of the Materials Research Society recently announced Xingxu Lu, a second-year graduate student in Professor Pu-Xian Gao's research group, as the winner of the Graduate Student Speaker Contest. The award recognizes his presentation titled "Microwave-assisted Hydrothermal Synthesis and Manufacturing of TiO_2 Nano-array Integrated Catalytic Converters," as judged by a panel of students.

In his talk, Xingxu reported a microwave-assisted hydrothermal method, which involves the synthesis and manufacturing of TiO_2 nano-arrays rooted to honeycomb monoliths for high performance automotive catalytic converters with mechanical and hydrothermal stability. Xingxu claimed that his research approach opened a new door for low-temperature scalable synthesis and the manufacturing of TiO_2 nano-array integrated catalytic reactors with decent production rates and increased material utilization efficiency. Ultimately, he believes that these nano-array integrated catalytic converters could function well as low-temperature automotive emission control devices.

Before Xingxu Lu began his research at UConn, he had been experimenting with alloy phase diagrams at the Central South University in P.R., China, where he received his Bachelor's and Master's Degrees in materials science and engineering. His desire for new research led him to UConn, where he now studies heterogeneous nanocatalysts in Professor Gao's research group. Xingxu believes this kind of research can aid in understanding reaction mechanisms, modifying materials and improving the performance of catalysts.

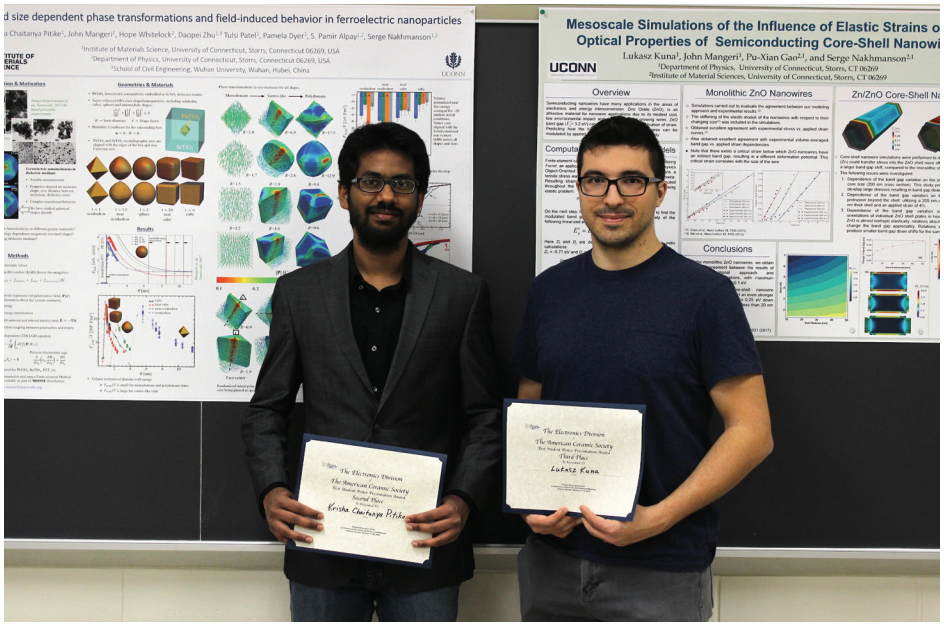
According to Xingxu's Advisor, Professor Gao, "Xingxu has done a very good job in his graduate research and continues to display self-drive, quality and consistency in his work. He will only get better down the road."

Xingxu is devoted to exploring the scientific world and in the future aspires to become a professor.

MSE Students Win at 2018 Electronic and Advanced Materials

"Devising a class project that can be guided through to a publication is a testament to Professor Nakhmanson's commitment to teaching and the hard work he inspires with these bright students." -Bryan Huey

The Electronic and Advanced Materials Conference (EAM) is geared towards engineers, technologists, researchers, and students with an interest in science, engineering and the applications of electroceramic materials. Several MSE students and faculty attended this year's EAM Conference held in Orlando, FL.



Krishna (left) and Lukasz (right) posing in front of their EAM-2018 award winning posters.

MSE Associate Professor and Director for Undergraduate Studies, Serge Nakhmanson, co-organized a symposium at this event titled "Mesoscale Phenomena in Ceramic Materials." Four UConn students including Tulsi Patel, Krishna Chaitanya Pitike, Lukasz Kuna, and Hope Whitlock showcased their research.

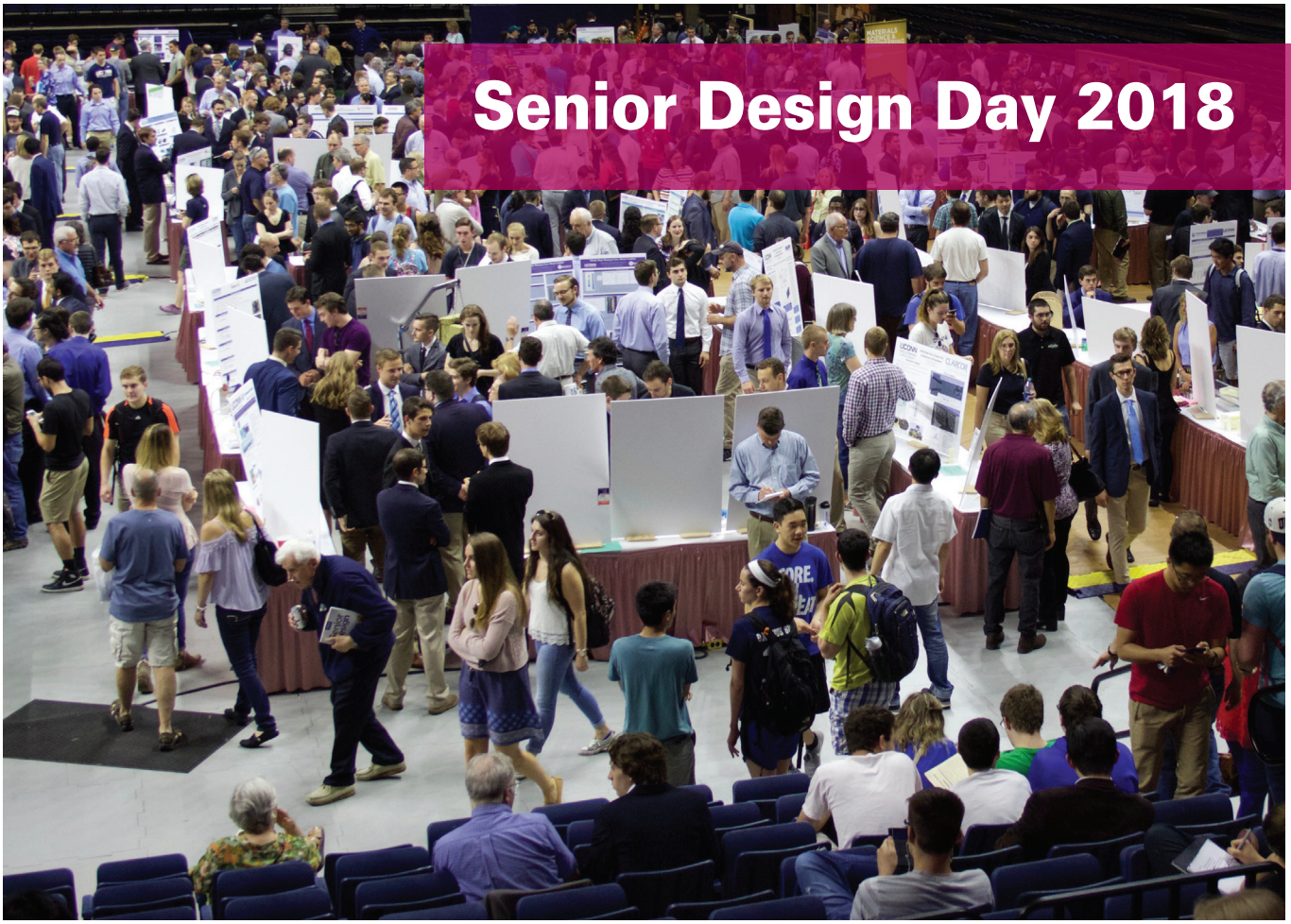
Serge Nakhmnason, Associate Professor

In addition to the oral presentations, two UConn students claimed 2nd and 3rd place in the American Ceramics Society (ACerS) Electronics Division "Best Student Poster Presentation" awards. Lukasz Kuna received 3rd place for his poster titled, "Mesoscale Simulations of the Influence of Elastic Strains on the Optical Properties of Semiconducting Core-Shell Nanowires." Krishna Chaitayna Pitike won 2nd place for his poster, "Shape and Size Dependent Phase Transformations and Field-induced Behavior in Ferroelectric Nanoparticles."

In response to the latter award Serge Nakhmanson said, "This remarkable work involves contributions from five UConn students (including Physics undergraduate Hope Whitelock) and an exchange student from China visiting my group. It started as a team project in the "Phase Transformations in Solids" graduate class (MSE 5305). Since the original results appeared to be significant, we decided to continue this project beyond the end of the semester to generate a publication for a peer-review scientific journal. This is now being finalized for submission. It is relatively rare to see classroom projects successfully transition into publication quality research, but this one is being well received by the community." Department Head Bryan Huey adds, "Devising a class project that can be guided through to a publication is a testament to Professor Nakhmanson's commitment to teaching and the hard work he inspires with these bright students."

EAM, jointly arranged by the Electronics Division and Basic Science Division of the ACerS, focuses on the properties and processing of ceramic and electroceramic materials and their applications in electronic, electro/mechanical, dielectric, magnetic, and optical components and devices and systems.

Senior Design Day 2018



Congratulations to our graduating MSE seniors who presented their Senior Design projects at Gampel Pavilion. As part of the annual MSE Senior Design judging process, students presented 13 Senior Design projects, showcasing the analytical and practical skills they gained from the program. Of the 15 presenting teams, three were selected for monetary awards. A total of $1,700 was distributed among first, second, and third place winners.

1st Prize

Additive Manufacturing of Actuator Bracket
by Haley Hubbell, Alexa Wilcox
Industry Sponsor: Ensign Bickford
Industry Advisor: Robert Morlath, John Graham
Faculty Advisor: Rainer Hebert

2nd Prize

Design of a Method for Better Predicting CMAS Infiltration into Thermal Barrier Coatings
by Michael Gingrave, Greg Ladestro, Ryan Dibiase
Industry Sponsor: Pratt & Whitney
Industry Advisor: Dr. Elisa Zaleski
Faculty Advisor: George Rossetti

3rd Prize (split)

Rocker Engine Brake Roller Pin Development
by Manjoor Vahora
Industry Sponsor: Jacobs Vehicle Systems
Industry Advisor: Matei Alexandru
Faculty Advisor: Rainer Hebert

3rd Prize (split)

Optimized Post Processing Treatment of AlSi10Mg
by Carissa DiBattista, Carl Rizzo
Industry Sponsor: Sikorsky-Lockheed Martin
Industry Advisor: Thomas Derco, Bill Harris, Paul Inguanti
Faculty Advisor: Seok-Woo Lee

Other Capstone Design Projects

Characterization of Tensile Mechanical Properties of Biodegradable Polymers
by Gabrielle Joseph, Amber Levasseur, Brian Whooley
Industry Sponsor: Medtronic
Industry Advisor: Darlene Nebinger, Michael Morsches
Faculty Advisor: Rainer Hebert

Finite-Element Modeling of Magnetic-Coil Operated Fuel Control Valves
by Steven Churchill, Matthew Brown
Industry Sponsor: Stanadyne LLC
Industry Advisor: Richard Pellini, Angie Cheung
Faculty Advisor: Harold Brody

Polymer Reclamation for In-Space Manufacturing (PRISM)
by Zane Grady, Andrew Nguyen
Industry Sponsor: NASA & Tethers Unlimited Inc.
Industry Advisor: Dr. Rachel Muhlbauer
MSE Advisor: Adam Wentworth

Performance Testing of TEC Cables
by Claudia Chavez, Francis Cielo, Florencio Topete, Wei Fang
Industry Sponsor: KX Technologies
Industry Advisor: Mark Stouffer, William Li, Peter Cook
MSE Advisor: Paul Nahass

Qualification of 3D Printed Polymer Parts
by Francis Almonte, James Doppes, Michel Santivanez
Industry Sponsor: Electric Boat
Industry Advisor: Stephen Thomas, Peter Chomowicz
Faculty Advisor: Bryan Huey

High-Density Polyethylene Product Development through Cast Film Extrusion
by Mariel Colby, Tony Dean
Industry Sponsor: Web Industries
Industry Advisor: Sarah Ware
Faculty Advisor: Montgomery Shaw

JUST PUBLISHED

Strain Generation and Energy-conversion Mechanisms in Lead-based and Lead-free Piezoceramics,
D. Damjanovic, G. A. Rossetti
MRS Bulletin Cover Story, 2018

3D Printed Polyamide Membranes for Desalination,
M. R. Chowdhury, J. Steffes, B. D. Huey, J. R. McCutcheon
Science, 2018.

Additive Manufacturing of Ceramic Molds for Complex Titanium Castings
by Drew Cietek, Truman Strodel, Ryan Vernlund
Industry Sponsor: United Technologies Aerospace Systems
Industry Advisor: Diana Giulietti
Faculty Advisor: Rainer Hebert

Paint Adhesion Modelling and Evaluation
by Courtney Dawless, Keara Frawley
Industry Sponsor: Sikorsky Aircraft
Industry Advisor: Karen Williams, Kingsley Iwu
Faculty Advisor: Rainer Hebert

Modeling the Flow Stress Behavior of Inconel 718 Under Hot Forging Conditions
by Kenan Jasavic, Sebastian Salazar
Industry Sponsor: Pratt & Whitney
Industry Advisor: Dr. Jean Phillipe Thomas
Faculty Advisor: Harold Brody

Educating
The Next Generation of Engineers

Seize the unique opportunity to become a Senior Design industry partner and tap into the exceptional student talent, distinguished faculty, and state-of-the-art materials processing and characterization laboratory equipment that the UConn Department of Materials Science and Engineering has to offer!

Our MSE program was established to meet the high local demand for materials engineering professionals. Our students enjoy excellent employment opportunities, a choice of five academic concentrations (biomaterials, energy materials, nanomaterials, metallurgy, and electronic materials), first-rate faculty instruction, and hands-on laboratory experience and research opportunities. UConn MSE is the number one public MSE program in the Northeast, boasting a student-to-faculty ratio of 13 to 1, industry co-ops, internships, and departmental scholarships.

The UConn MSE experience culminates with Senior Design, a two-semester project that provides students with exposure to real-world engineering problems, stimulating design challenges, collaboration with local companies, and potential future employment opportunities.

As an industry partner, you can expect collaborative impact with UConn MSE and the Institute of Materials Science, project updates and documentation, secure proprietary information, and the opportunity to hire skilled, engaged engineering students. Visit our Senior Design webpage for more information!

Materials Science & Engineering

University of Connecticut
Department of Materials Science & Engineering
97 North Eagleville Road, Unit 3136
Storrs, CT 06269-3136

www.mse.engr.uconn.edu

www.mse.engr.uconn.edu/undergraduate-program/senior-design

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Congratulations to the Class of 2018!

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Rares Barbu
Landon Ronald Bassett
Ryan Alexander Betz
Thomas Paul Catricala
Priya Marie Chanda
Cameron Mark Collinge
Zane Roman Cooke
Jeffrey Costa
Norah Julie Cowley
Eric David Ell
Julia Nicole Goldstein
Christopher Dan Haynes
Kyle Hoffman
Declan Patrick Hussey
Kyle Joseph Jonas
Simran Jit Kaur
Alex William Keane
Danish Zameer Kidwai
Amy Hua McKinstry
Hayley Elizabeth Page
Christopher Maron Rizkallah
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Naseem Salmeh Sardashti
Antonio Marco Scarvaglieri
Sana Suhail
Bryan Timothy Sweeney
Jenna Lynn Taormina
Rima Viradia
Bianca Rose Wyman

MASTER OF ENGINEERING GRADUATES

Alexander Leif Jorgensen
Vincent Mangino
Christina Marie Powell

MASTER OF SCIENCE GRADUATES

Terry Ng
Manuel Rivas
Diana Giulietti

PH.D. GRADUATES

Jin Wang
Major Advisor: Avinash Dongare
Doctoral Dissertation: Strain Engineering of Two-Dimensional (2D) Materials at the Atomic Scales

Alan Harris
Major Advisor: Eric Jordan
Doctoral Dissertation: Cyclic Durability of Thermal Barrier Coatings Subject to CMAS Attack

Drew Clearfield
Major Advisor: Mei Wei
Doctoral Dissertation: Multizonal Scaffolds for Osteochondral Tissue Engineering

Haibo Yu
Major Advisor: Mark Aindow
Doctoral Dissertation: Microstructural Studies of Ag/W and Ag_3Sn/Cu_3Sn alloys for Electrical Circuit Breaker Contacts

Manuel Rivas
Major Advisor: Bryan Huey
Doctoral Dissertation: Iridium Oxide (IrO_2) as a Top Electrode for Ferroelectric Micro-Electro-Mechanical Systems (MEMS) Devices for Radiation Rich Environments

Rishi Kumar
Major Advisor: Eric Jordan
Doctoral Dissertation: Low Thermal Conductivity YAG-Based Thermal Barrier Coatings with Enhanced CMAS Resistance

UConn Grad Student Takes Home Gold at National Engineering Conference

John Sypek, a graduate student from UConn's School of Engineering, was amongst a small group of students from across the country who received top honors from the Materials Research Society (MRS).

John Sypek with past president of the Materials Research Society Susan Trolier-McKinstry

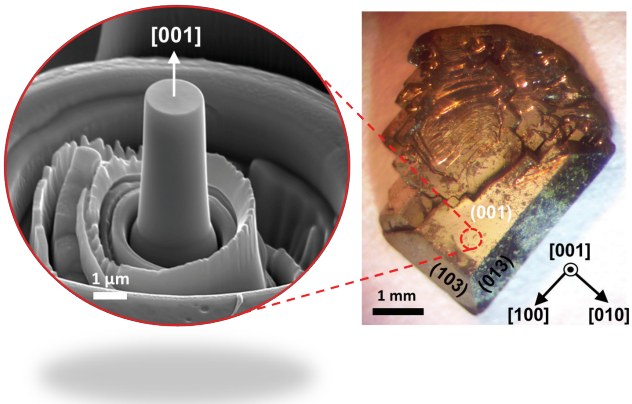
A Ph.D. candidate at the University of Connecticut has received the Materials Research Society's (MRS) Gold Graduate Student Award for its fall 2017 meeting.

"It's a huge honor. MRS is an esteemed organization and this meeting is one of the biggest conferences in the world for researchers in the field," Sypek said. "To even be a finalist and then to win the Gold Award is really wonderful, especially to represent UConn and the Materials Science and Engineering Department."

John Sypek from the Department of Materials Science and Engineering has been recognized for his outstanding contributions to the progress of materials research through work to identify an intermetallic compound with his advisor, Soek-Woo Lee. The compound has remarkable shape-memory properties that can potentially be used for a range of purposes including deep space travel.

The calcium-iron arsenide alloy Sypek is studying exhibits super-elasticity and shape memory effect, meaning it is highly compressible and it can "remember" its shape after being subject to extremely cold cryogenic temperatures of 30 to 40 degrees Kelvin, which is around minus 400 degrees Fahrenheit.

Dr. Seok-Woo Lee, Sypek's supervisor, has received a $586,648 grant from NASA to study the mechanical properties of the compound in hopes of unlocking the potential of using it to create a cryogenic actuator, a mechanical component of many kinds of spacecraft.



Depicted is a single crystal crystal of CaFe2As2 in which micropillars are milled using a focused ion beam and then compressed using a Nanomechanics, Inc. Nanoflip in order to study the mechanical properties and response at small length scales.

"John's work in this discovery speaks to his capability as a researcher in his own right and within a team," Lee said. "His results open a new direction for materials research on super-elasticity and shape memory effect. We have high expectations for his future career successes."

This research is Sypek's first venture in materials science after he graduated from UConn in 2014 with a degree in mechanical engineering.

A team Sypek was working with began studying this compound and other similar materials as a superconducting material, one that produces no electrical resistance and expels magnetic flux fields, when they discovered its astounding shape resilience.

Sypek said he looks forward to studying the function of this compound on a larger scale that is required for practical development.

"I'm excited for the opportunity to explore further into this material through testing based on the small nano and micro scale, and to size up our discoveries to get an actual working device," he said.

Sypek is expected to graduate in 2019 and plans to pursue a career in industry working in aerospace or renewable energy once he has earned his degree.

By Anna Zarra Aldrich, Office of the Vice President for Research

Two MSE Graduate Students Participate in Civic Engagement at the Nation's Capital

"The CASE workshop helped me develop into a more well-rounded engineer with more to offer than just my technical skills..." -Manuel Rivas

UConn graduate students with Congressman Courtney's legislative director in Washington D.C. Left to right: Alexa Combelic, Tulsi Patel, Tanisha Williams, Manuel Rivas

MSE graduate students Tulsi Patel and Manuel "Manny" Rivas were invited to attend the 2018 Catalyzing Advocacy for Science and Engineering (CASE) Workshop in Washington, D.C. in late March.

CASE is an innovative program run by the American Association for The Advancement of Science that provides information about Congress, the federal budget, and appropriations processes to upper-classmen and graduate students who are studying science, mathematics, and engineering. This opportunity is specifically geared towards STEM students who want to learn more about science policy. Students are taught the federal policy-making process and how to voice their research throughout their careers.

The three-and-a-half-day program provides participants with the tools for effective science communication and civic engagement. The students who attended this year's workshop actively participated in interactive seminars about policy-making and communication. On the last day, students formed teams and held meetings with their elected members of Congress and congressional staff.

Tulsi described, "Participants had the opportunity to voice their passion for science to members of Congress. The students from UConn had the pleasure of meeting Congressmen Courtney's legislative director and talk about research and tenure as graduate students. This experience has not only taught me how to be a better advocate for science, but also a more engaged citizen in our democracy."

This dynamic program bridges the gap between science and government policy. Instead of working in the classroom or the lab, MSE students Tulsi and Manny were granted the unique opportunity to explore the world of science through government involvement.

"It was an incredible experience learning about the federal budget process, how science policy is made, and communicating science to a broader audience. I gained insight on how to pave a career path in science policy, but more importantly, appreciate the process of how science is funded in this country," Tulsi said.

Manny added, "Attending this workshop has provided me with a greater understanding of how policies are made and the vital role we as citizens and engineers play. It also emphasized the importance of how science influences policy, how policy influences science, and how the ability of communicating the importance of your work to a non-technical audience is needed." These MSE students are not only making an impact for developments in materials science but also science communication through civic engagement.

Manny, who has since earned his doctorate, is now working at Amazon CEO Jeff Bezos' space exploration company Blue Origin. He is a Radiation Effects Engineer for the New Glenn project, a 2 and 3 stage orbital rocket expected to launch in 2020. His responsibilities include performing radiation effects simulations on avionics hardware, designing and performing irradiation tests, and helping formulate avionics hardware.

Manny added that the workshop was critical to him landing his current job, and in broadening his horizons both in the job market as well as for how he tackles engineering problems. "The CASE workshop helped me develop into a more well-rounded engineer with more to offer than just my technical skills, making me a great advocate and representative for Blue Origin," Manny said. "The CASE workshop was a vital reason why I obtained more than one job offer, including in the science policy field."

STEM Scholar Ryan Cordier's Learning Has No Borders

"Engineers Without Borders forces us to look at every aspect of solving a problem- design, budgeting, raising funds, implementation logistics, trying to predict failure and working with teams." -Ryan Cordier

Undergraduate and STEM Scholar Ryan Cordier was initially interested in attending medical school once he completed his degree in biomedical engineering. However, after he attended the Engineering 1000 seminar, he added materials science and engineering as his second major the following week.

MSE undergraduate student Ryan Cordier in Peru with Engineers Without Borders

Engineering 1000 is a first-class seminar class, where professionals give presentations on the various areas of engineering. Professor Huey spoke at the seminar about MSE's vital role in space applications, which often lead to huge advancements in science. "The quest for the exploration of science isn't just a technological marvel, but a fantastic symbol of global cooperation to advance humanity as a whole," Ryan said, recalling that seminar. This talk deeply resonated with Ryan, and led him to pursue materials science and engineering as his primary field of study.

Two areas of materials science Ryan finds fascinating are functional materials and biomimicry. Functional materials are materials that have exceptional innate properties, like piezoelectricity or high-energy radiation absorption. Meanwhile, biomimicry involves finding naturally occurring materials that nature has perfected through millions of years of evolution and recreating them artificially.

Ryan got to explore these various topics first-hand when he joined Professor Huey's lab the summer after his freshman year. The work he currently does in the lab focuses on memory storage technology. Huey's research group engages in a novel process, in which they are able to tomographically characterize ferroelectric domain switching by using atomic force microscopy.

Not only has research had a profound impact on Ryan's success, but also his involvement in the organization Engineers Without Borders (EWB). When he first heard about EWB, he was keen on joining due to his strong interest in sustainable international development.

When Ryan joined EWB, they were beginning their Ethiopia Project. He was able to get involved in the project early on and eventually served as the Ethiopia Project Lead. In Ethiopia, EWB paired with a small farming community, hoping to add an irrigation water storage and distribution system. However, due to political instability that was occurring in the area they were working in, they were denied travel for two years following their initial assessment trip, so they were unable to complete their project. Although this project was shut down, EWB is still looking for alternative ways they can help this community.

Ryan currently serves as chapter president of Engineers Without Borders, in which his role involves overseeing their projects in Peru, India, and in a local community garden in Willimantic. In addition, he hopes to add a project in Africa in the near future.

EWB's current flagship project is located in Peru, in the Andes Mountains, where they are designing composting latrines for a rural community that has had reoccurring issues with contaminated water. During the summer of 2017, Ryan led a UConn team to the community to make initial contact and measurements for their Phase I implementation, which will take place in August 2018.

NEWS

Professor Mark Aindow announced as UConn's first Executive Director for Innovation, External Engagement, and Industry Relations

He is tasked with identifying and promoting initiatives that provide growth opportunities for applied research through technology transfer and industry partnerships.

STEM Scholar Ryan Cordier's Learning Has No Borders

As opposed to classroom learning, Engineers Without Borders has provided Ryan with a hands-on understanding of engineering. "EWB forces us to look at every aspect of solving a problem- design, budgeting, raising funds, implementation logistics, trying to predict failure and working with teams," Ryan explained. Instead of working hard for a grade, Ryan and his team work to improve the quality of people's lives, which is all the more motivating to the group.

Engineers Without Borders has shaped Ryan's experience at UConn. He gained positive leadership and interpersonal skills from interacting and working with many different people. Ryan said, "By sending out students to explore and interact with foreign cultures, we are not only physically building solutions for those without the means to do it themselves, but also establishing personal connections and breaking down pretenses on both sides." He enjoys how EWB brings people from unique cultures together to form strong connections and create progress.

You may be interested in helping future MSE students participate in activities like Engineers Without Borders. Please consider making a donation through the UConn Foundation and identify MSE's account (22156) to enable more such opportunities for our next generation of engineers and leaders.

Professors, Professionals a

"Professors and graduate students are doing a lot of research that is being supported by the university. This banquet is a good opportunity to acknowledge all the hard work and commitment put forth by everyone."

Students, alumni and faculty of the University of Connecticut Department of Materials Science and Engineering celebrated their, and their peers', accomplishments at the annual MSE banquet, held at the Alumni Center at the end of the Spring semester.

The event featured speeches, awards and connections between students and their instructors, as well as graduated professionals working within the field of materials sciences. Over two dozen graduate students also joined in, bringing the attendance total to 100.

MSE department head and professor Dr. Bryan D. Huey said that it was "gratifying" watch the event grow, and that the involvement of the department's alumni helped to make the night both successful, and a learning experience for the students attending.

"One of the highlights of the night was when everyone in the banquet hall doing some form of research stood up. That was a telling moment of just how actively involved so many of our students are in their education," Huey said. "Compounded with widespread participation in other clubs and sports, and of course extensive outreach through the materials student chapters, Engineering Ambassadors, Engineers Without Borders and related programs, you really began to understand why our students are so well positioned to make a difference during and beyond their years at UConn."

The event was organized by the UConn Material Advantage Student Chapter (UCMA) and UConn Chapter of the Materials Research Society (MRS), two student-based organizations who help create outreach events and activities based on materials science and engineering.

The banquet was first held in 2013, Huey said, and has since expanded with further innovation and attendance from students, faculty and alumni.

"I am especially grateful to all of our banquet organizers since the event began in 2013, as this really has been a student-driven event all along" Huey said. "I am especially grateful to all of our banquet organizers since the event began in 2013, as this really has been a student-driven event all along. And while 100

nd Students Mingle and Celebrate at MSE Banquet

attended on Friday, this can easily double, given our strong alumni base—we hope many more of them join this MSE family gathering next year."

UCMA was the primary organizer of the event this year, said organization president and rising senior Kenna Ritter.

"We worked very closely with the Department and the Materials Research Society, but we were involved in almost all aspects of planning this event from catering, venue booking, program planning," Ritter said. "All the UCMA officers were dedicated to doing the best work we could put forward so that we could host an event we were proud of."

While previous banquets have focused on, and featured, keynote speakers from alumni and industry professionals, this year student and department accomplishments were at the forefront, Ritter said.

"Last year, we invited Fred Anderson, founder of Advantec Engineering LLC to speak to us about failure analysis in the legal system and we also invited Dr. Prabhakar Singh to speak about his experiences in material science and engineering, "Ritter said. "This year… we spoke about all the events and clubs that our members participate in both with Material Advantage and with the School of Engineering. In addition, we had a representative from MRS speak about the achievements of graduate students."

Alumni were encouraged to attend, and invited to the event by way of networking, Ritter said. "We reached out to alumni through the MSE Alumni LinkedIn Page, we collaborated with the UConn Foundation to email alumni invitations, and we also used word of mouth to encourage alumni to attend," Ritter said.

While this year's attendance, on both the student and alumni part, was successful, Ritter said that she would like to increase attendance in the future and continue to emphasize the importance of celebrating the department's achievements.

"This banquet is important to the department because it gives professors and students a chance to interact with each other in a different environment," Ritter said. "Professors and graduate students are doing a lot of research that is being supported by the university. This banquet is a good opportunity to acknowledge all the hard work and commitment put forth by everyone."

Alumna Katie Read Develops Ceramic Matrix Composites as a Senior Engineer

Whether developing material characterization methods, evaluating material properties, or correlating material properties with processing parameters Alumna Katie Read (MSE BS '11, MS '17) is constantly putting her skills to the test as a Senior Engineer at Pratt & Whitney. She works on the development of new processing methods and standards, which include a range of sample sizes from lab-scale test coupons through full-scale development engine hardware.

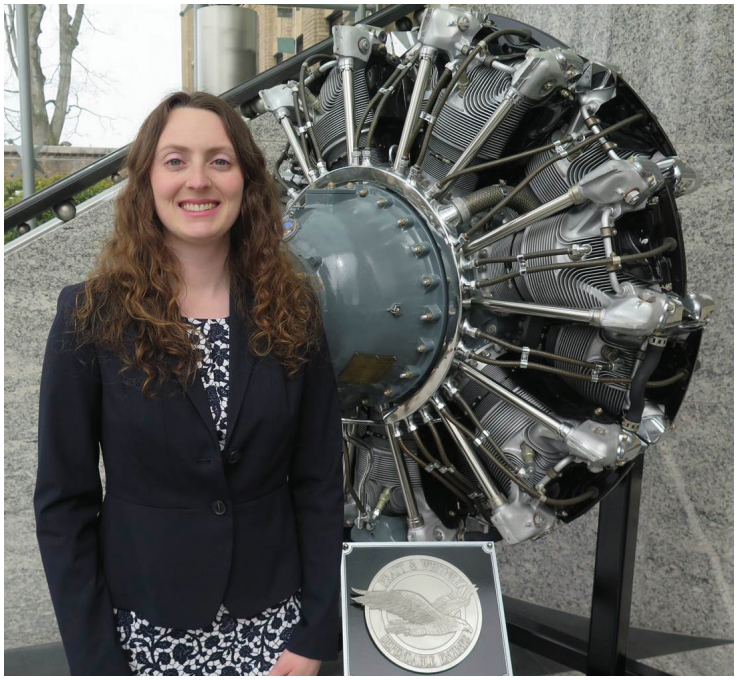
Katie's primary focus is the research and development of ceramic matrix composites (CMC's), which facilitate higher operating temperatures for next-generation commercial and military gas turbine engines. Ultimately, these higher operating temperatures enable improved engine efficiency.

After attending a summer program at UConn called Engineering 2000, Katie became interested in pursuing materials science & engineering as a career. Engineering 2000 presented the many unique areas of engineering UConn has to offer. In the materials science and engineering portion of the seminar, Katie had the opportunity to make and test composite materials. "I was fascinated by the variation that could be achieved in the simple composites I made in this program," Katie said. This experience ultimately determined Katie's career path developing advanced composite systems for aerospace.

As part of her participation in the Engineering 2000 program, Katie was able to utilize the UConn laboratory equipment and meet the MSE faculty. She was impressed with UConn's excellent facilities and the many research opportunities for students. In addition, she liked that UConn's large campus allowed her to become involved in a broad range of extracurricular activities.

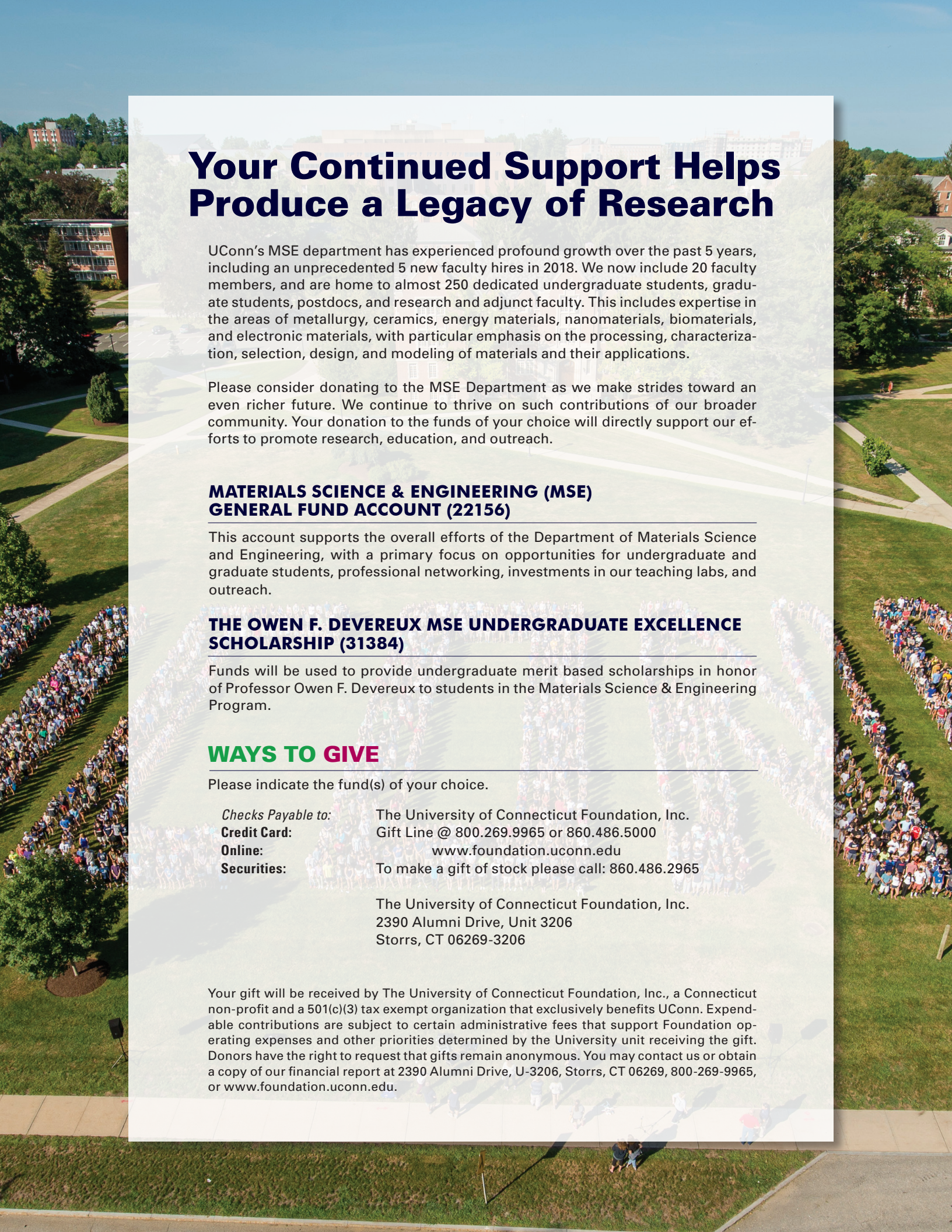
As an undergraduate, Katie was widely involved with research, internships, and clubs. She furthered her knowledge in the field through the Material Advantage Chapter, ultimately as the chapter president for two years. She even became a student representative on the ASM International Board of Trustees. "As part of this experience I learned about how a professional society works and was able to network with many experienced professionals," Katie said.

One of her favorite aspects of her undergraduate days was participating in undergraduate research. "I was able to gain some insight into graduate school, which often focuses on foundational material properties and behavior," she explained. Katie completed both her undergraduate and graduate research with Professor Bryan Huey's guidance, where he helped her develop technical writing skills and an analysis technique for ceramic fiber surface roughness. Professor Huey's advice helped her determine her early career path. "Like so many of our undergraduates, Katie has a passion to learn, try, and do. Students like Katie, who commit their time to schoolwork, research, leadership, and yes some fun along the way too, position themselves well for that dream job or grad school after graduation," Professor Huey said.



MSE alumna Katie Read in front of the Pratt & Whitney Wasp Engine

According to Katie, the most important thing students can do is take advantage of learning opportunities. "There is always something to learn from an experience, whether it is a new way to approach a challenge, a new perspective on a problem, details about a new characterization technique, or how to improve important career skills like communication and organization," she explained. Katie believes students should go for opportunities that enable them to expand their knowledge even if that takes them down a different career path than what they originally imagined.



Your Continued Support Helps Produce a Legacy of Research

UConn's MSE department has experienced profound growth over the past 5 years, including an unprecedented 5 new faculty hires in 2018. We now include 20 faculty members, and are home to almost 250 dedicated undergraduate students, graduate students, postdocs, and research and adjunct faculty. This includes expertise in the areas of metallurgy, ceramics, energy materials, nanomaterials, biomaterials, and electronic materials, with particular emphasis on the processing, characterization, selection, design, and modeling of materials and their applications.

Please consider donating to the MSE Department as we make strides toward an even richer future. We continue to thrive on such contributions of our broader community. Your donation to the funds of your choice will directly support our efforts to promote research, education, and outreach.

MATERIALS SCIENCE & ENGINEERING (MSE) GENERAL FUND ACCOUNT (22156)

This account supports the overall efforts of the Department of Materials Science and Engineering, with a primary focus on opportunities for undergraduate and graduate students, professional networking, investments in our teaching labs, and outreach.

THE OWEN F. DEVEREUX MSE UNDERGRADUATE EXCELLENCE SCHOLARSHIP (31384)

Funds will be used to provide undergraduate merit based scholarships in honor of Professor Owen F. Devereux to students in the Materials Science & Engineering Program.

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Alumnus Kai Song Explores the "Unseen World" at Apple

From UConn MSE graduate to Apple employee, alumnus Kai Song has come very far since his time at the University of Connecticut. As a senior hardware engineer at Apple, Kai's current work focuses on microstructural analysis. Their team performs analysis and routine monitoring of engineering processes and procedures in support of Apple production and research and development.

Microstructural analysis was always an area of interest for Kai due to his curious nature. "Any ordinary object, when magnified thousands or millions of times will exhibit all kinds of features and structures at the micro and nanometer scale," Kai stated. "It is the mystery of the unseen world." However, he claims the function of an object is closely related to elements of this "unseen world". Kai enjoys that his position allows him to explore the various mysteries this world offers.

The training in metallurgy and microscopy he received at UConn helps him in his current role at Apple. "To help build the cutting-edge features of the iPhone, Apple Watch, and iPad, we as hardware engineers must have an excellent understanding of materials engineering, tools and ways to investigate the materials, and innovative ideas to put them together, so that the device can have the desired function," Kai explained. "Lots of times we are exploring an unknown field, which often reminds me of the research hours spent at UConn."

Kai graduated from UConn in 2006 with a Ph.D. in metallurgy and materials engineering. His thesis topic was "Grain Growth Phenomena in Powder Metallurgy Ni-base Superalloys." Kai chose to pursue his Ph.D. at UConn because of its strong materials science program and the extensive research opportunities available. He described UConn as a "flagship institution in New England" and appreciates the opportunity he was offered to pursue his Ph.D. there.

At the time Kai was working towards completing his Ph.D., he was also involved in a DARPA-led AIM project (Accelerated Insertion of Materials). The goal of this project was to create a materials development methodology that expedites the insertion of new materials in order to attain consistency with the engine/platform/development/design cycles.

His advisor at the time was Professor Mark Aindow and he helped Kai transition from a successful student to a motivated researcher. Aindow guided Kai through the scientific research process from initial literature review to final publication. "This training not only enabled me to obtain my Ph.D. but has given me a continuous edge in the industry where analysis and innovation are valued," Kai claimed. Professor Aindow recalls: "Kai was a remarkable student who was able to detect subtle trends in complex microstructural data. This allowed him to make significant sci-

entific contributions in areas of technological importance."

Although years have passed, Kai still remembers two specific MSE classes that stood out to him. "Transmission Electron Microscopy" taught by Professor Aindow was one of his favorites. In one semester the class covered topics that take most people about ten years to truly master. Kai still uses the four-volume textbook from this class, which was written by UConn MSE Professor C. Barry Carter, as a valuable reference in the workplace. The other class that Kai particularly enjoyed was "Transport Phenomena" with Professor Harold Brody. Kai was impressed at how Professor Brody rarely used pre-prepared materials, such as textbooks and presentations. However, the explanations were so sharp and clear that no such materials were needed and learning was made simple.

The classes Kai took at UConn provided him with a deep understanding of the field. He stated, "Often a true understanding of a subject is what makes an engineer stand out among peers." Kai encourages current students to develop a mindset towards this true understanding in order to advance in the field. He advises them to think deeper. "It is not enough to know what is happening, but also why it is happening," Kai stated.

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