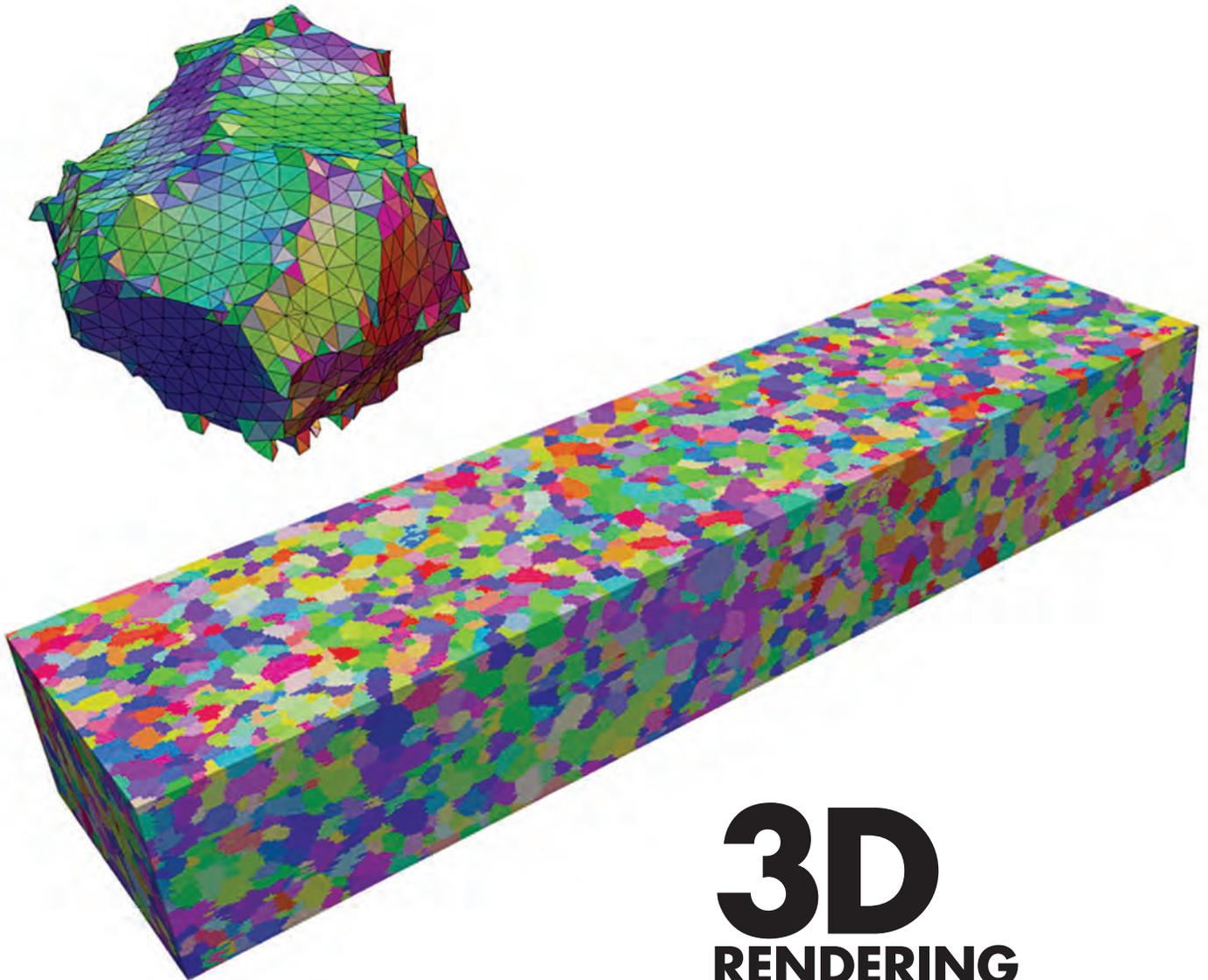


MSE NEWS

MATERIALS SCIENCE AND ENGINEERING

VOLUME 12 | NUMBER 2 | SPRING 2016

Carnegie Mellon University



3D RENDERING OF AN ALPHA TITANIUM MICROSTRUCTURE

See "Focused on the Future," page 3

A NOTE FROM THE DEPARTMENT HEAD
GREGORY S. ROHRER W.W. Mullins Professor



Greetings to our MSE alumni! I'd like to use this forum to share some exciting news. We have formed a new Materials Science and Engineering Alumni Council. This group has been convened to foster a richer dialogue with our alumni, while also creating a venue for our students to benefit from the experience of our alumni in industry, government, and academia.

This Council will meet annually, and members will have three-year rotating memberships. At our meetings, we'll review MSE's education and research programs, with the goal of gaining alumni feedback. We'll also formulate strategies for strengthening our alumni network in ways that will impact the student experience.

The inaugural MSE Alumni Council has eight members, and we met for the first time on April 7 and 8. The current members are **Janel M. Browning** (B.S. 1993), **Carolyn R. Duran** (B.S. 1992), **Ronald Gibala** (B.S. 1960), **Jeremy L. Gilbert** (M.E. 1983, Ph.D. 1987), **Jennifer Giocondi** (B.S. 1988, M.S. 1999, Ph.D. 2003), **John Perepezko** (Ph.D. 1974), **Clare Rimnac** (B.S. 1978), and **Todd Steyer** (B.S. 1988).

We are working to identify our initial objectives, which will be announced in a future edition of *MSE News*. I will also be seeking a few new volunteers to join this group each year.

Looking toward the future, this summer we will welcome two new faculty, **Tzahi Cohen-Karni** and **Noa Marom**. Tzahi conducts research in the area of nano-electronics for bio-interfaces, and Noa's research focuses on computational materials science and engineering. Both just received National Science Foundation CAREER Awards that will help fund their research. Profiles of each will be featured in the next issue of *MSE News*.

While we are proud of our newest faculty, the accomplishments of our veteran faculty are also worth noting. **Marc De Graef** has been named a National Security Science and Engineering Faculty Fellow, and **Tony Rollett** was named a Member of Honor of the French Society of Metallurgy and Materials. **Jay Whitacre** has been named a Fellow of the National Academy of Inventors, while **Chris Pistorius** has received the 2016 John F. Elliot Lectureship Award. **Mike McHenry** is part of a consortium focusing on next-generation electric machines that recently won a \$22 million grant. Finally, **Liz Holm** received the University of Michigan's first MSE Distinguished Alumnus Lecture Award. See our "Faculty News" section on pages 4-5 to learn more.

We recently hosted our annual MSE Deck Party during Spring Carnival (see photos on page 6) and I was reminded, once again, that the Department of Materials Science and Engineering really is a closely knit community. It's always good to see our graduates and hear about their most recent successes. Please don't hesitate to reach out and tell us your story.

“The MSE Alumni Council will formulate strategies for strengthening our alumni network in ways that will impact the student experience.”

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ON THE COVER

Focused on the Future

With a new dual beam, focused ion beam scanning electron microscope, MSE reinforces its leadership in materials science

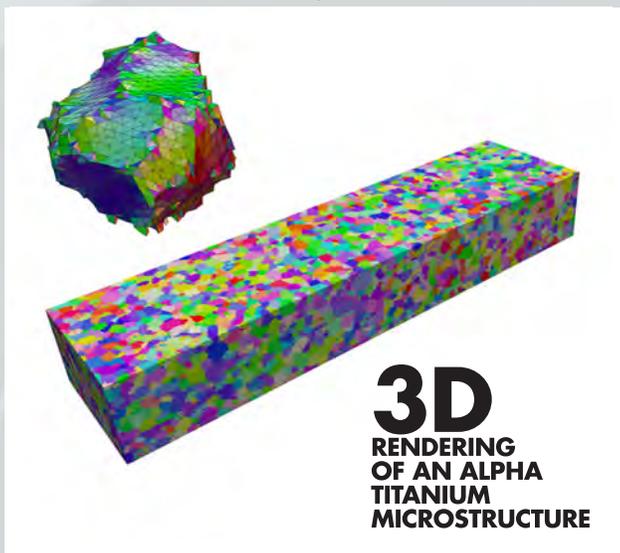
A dual beam (DB) focused ion beam (FIB) scanning electron microscope (SEM) is an instrument that combines all the functionality of a conventional SEM for imaging structure, composition, and orientation—along with the ability to remove material in a highly controlled fashion and with nano-scale precision.

It can be stated without exaggeration that the DB-FIB SEM has revolutionized materials characterization by enabling experiments that were impossible before. For example, by analyzing a surface with this instrument, and then systematically removing parallel layers with the ion beam, it is now possible to visualize the internal structure and composition of three-dimensional volumes of opaque material with a resolution in the nanometer range. Another example can be found in the study of defects and other features at atomic-scale resolution. Equipped with a DB-FIB, the SEM can be used to locate the region of interest, and then the ion beam can be used to cut and remove an electron transparent sample for analysis in a transmission electron microscope (TEM).

For the last 10 years, MSE researchers at Carnegie Mellon have used a conventional DB-FIB that removes material with a Ga-ion beam. However, there has recently been a breakthrough in DB-FIB technology: Instruments are now available that use Xe-ion plasma sources, with beam currents much larger than possible with a Ga-ion source. This makes it possible to remove material at rates as much as 50 times greater than currently possible with conventional instruments. In other words, an experiment that requires 12 hours of milling using Ga-ions can be completed in about 15 minutes with an Xe-ion plasma FIB.

Last year, Carnegie Mellon became the first university in the United States to install an Xe-ion plasma DB-FIB in our Materials Characterization Facility. Funding for the instrument was provided by the National Science Foundation (DMR 1428480), the College of Engineering, and the Department of Materials Science and Engineering. The new instrument was installed and tested by **Tom Nuhfer**, Director of Electron Microscopy and Materials Characterization. He remarked, “The speed and power of this instrument are very impressive. The DB-FIB-SEM

will produce faster, more accurate results for our researchers. The fact that we are the first university in the US to install this piece of equipment reinforces Carnegie Mellon’s leadership in materials science.”



student **Madeleine Kelly**, “The larger-volume 3D reconstructions with orientation information give us more statistically significant grain boundary character distributions, especially for lower-symmetry materials. This means we will be able to analyze more types of materials than before.”



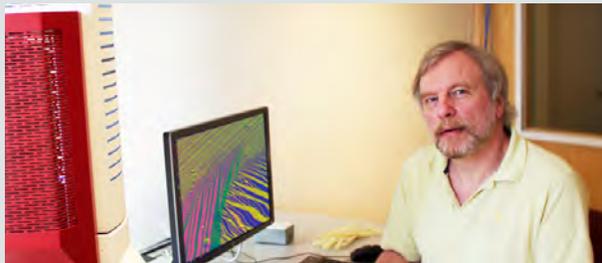
The new DB-FIB SEM is housed in the Materials Characterization Facility.

The image on the cover of this edition of *MSE News* was produced using the new DB-FIB SEM. It shows a three-dimensional rendering of an alpha titanium microstructure. This data set, which contains the shapes and orientations of 14,000 grains, is the largest of its kind ever to be recorded. This image was made possible by the increased milling rate of the Xe-ion plasma DB-FIB — which is more than 10 times the rate achieved with conventional instruments. These first results were published in a recent paper in *Acta Materialia* (Kelly et al. *Acta Mater.* 111 (2016) 21).

According to MSE graduate student **Madeleine Kelly**, “The larger-volume 3D reconstructions with orientation information give us more statistically significant grain boundary character distributions, especially for lower-symmetry materials. This means we will be able to analyze more types of materials than before.”

FACULTY NEWS BRIEFS

Professor Marc De Graef has been named a 2016 *National Security Science & Engineering Faculty Fellow* by the US Department of Defense (DoD). He is one of 15 distinguished scientists and engineers selected for this fellowship, which is



designed to support long-term fundamental research that has the potential to lead to important technology developments. This fellowship provides a five-year, \$3 million grant. De Graef plans to create an open source computational framework that will offer scientists a standard way to quantify and validate microstructure images of materials. This standard framework will make it easier and faster for researchers to design new materials which can be used in a variety of different industry applications, including improved turbines for jet propulsion and energy generation, stronger aviation alloys, advanced steel for ship hulls, and multi-functional materials. “I want to take the guesswork out of the current characterization process,” explains De Graef. “This framework will create a far more structured way to measure and validate microstructure images.” Recognizing that education is critical to accelerate the design of novel materials, De Graef also plans to create a new Integrated Computational Materials Science and Engineering Master of Science program at Carnegie Mellon. “My goal is not only to perform research, but to train the next generation of students who will eventually be working in labs that will use these types of computational tools,” he notes.

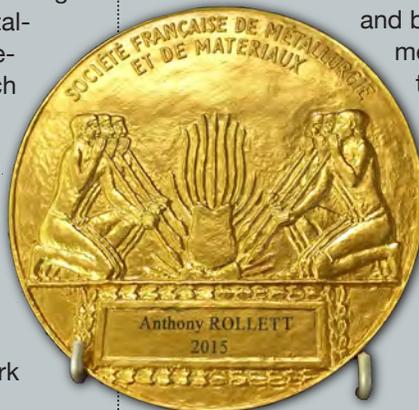


Professor Anthony Rollett has been presented with the *Member of Honor* award by the French Society of Metallurgy and Materials for his outstanding

contributions to the field of metallurgy. This is an honor that is bestowed on only one person each year. The award recognizes Rollett’s strong collaborations with metallurgists throughout French universities. “I am deeply honored to be the recipient of the Member of Honor award this year,” says Rollett. “I am particularly proud to be acknowledged for my work

as a metallurgist. I often interact with the broader scientific community, for which the term ‘metallurgist’ evokes images of a blacksmith laboring over a hot forge. We are rightly proud of our hands-on skills. Nevertheless, we have moved far beyond ‘heat and beat.’ The work of my colleagues at the French Society of Metallurgy and Materials demonstrates the depth

and breadth of metallurgy today, and I am honored to be recognized by such an elite group of scientists.”



Professor Elizabeth Holm has been chosen to receive the inaugural University of Michigan *MSE Distinguished Alumnus Lecture Award*. This new

award recognizes alumni who have made a seminal contribution to materials research as evidenced by published scholarship, patents/technology transfer, mentoring of early career materials researchers, and service to the materials profession. Award recipients are University of Michigan MSE

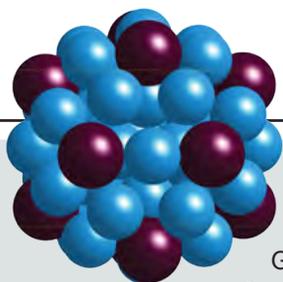


alumni who are active researchers with a distinguished career in academia, government, or industrial research and development. Holm received her award in Ann Arbor on April 19 during the MSE program’s graduation dinner. She also gave a lecture at a graduate research seminar held earlier that day.



Professor Michael McHenry is a subcontractor on a grant from the US Department of Energy (DoE) to support next-generation electric machines

for manufacturing. The DoE is awarding \$22 million in funding for five projects aimed at merging wide-bandgap technology with advancements for large-scale motors to increase energy efficiency in high-energy consuming industries, products, and processes. McHenry is part of a team that includes Carnegie Mellon, the NASA John H.



Glenn Research Center (NASA GRC), the National Energy Technology Lab (NETL), North Carolina State University, and power management company Eaton. The project is entitled “Combined PV/Battery Grid Integration With High-Frequency Magnetics-Enabled Power Electronics.” The goal of the work at Carnegie Mellon is to demonstrate high-efficiency magnetic nanocomposite systems in high-frequency power transformation.



Professor Chris Pistorius has been selected by the Association for Iron & Steel Technology (AIST) to receive the *2016 John F. Elliott Lectureship Award*. Pistorius

will receive the award at the AIST President’s Award Breakfast on May 17 in Pittsburgh as part of AISTech 2016, the 13th annual Iron & Steel Technology Conference and Exposition. The AIST John F. Elliott Lectureship Award was established in 1990. According to AIST, this honorary lectureship is designed to acquaint students and engineers with the exciting opportunities in chemical process metallurgy, inspire them to pursue careers in this field, inform the public of the contributions of chemical

process metallurgy and materials chemistry to the association, and honor the late Professor John Elliott of

the Massachusetts Institute of Technology for his many accomplishments and leadership.



Professor Jay Whitacre has been named a *Fellow* of the National Academy of Inventors (NAI). According to the NAI Fellows Selection Committee,

Whitacre was chosen for induction because he “demonstrated a highly prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society.” Only four other Carnegie Mellon faculty members have received this prestigious award. Whitacre was honored at the Fellows Induction Ceremony on April 15 at the United States Patent and Trademark Office in Alexandria, Virginia. In addition, Whitacre is this year’s recipient of the *Arbor Networks Ph.D. Research Impact Lecture and Award*. This honor goes to a University of Michigan Ph.D. graduate who has applied his or her research findings outside academia — for example, to found a nonprofit organization or start-up, or to apply research results in existing companies and governmental agencies. The award is sponsored by Arbor Networks, a global leader in network security that was founded out of groundbreaking research conducted at the University of Michigan. In addition to his advanced research within Carnegie

Mellon MSE, Whitacre is the founder and chief technology officer of Aquion Energy, which manufactures clean and sustainable saltwater batteries that outlive and outperform traditional battery chemistries.



“The Department of Materials Science and Engineering (MSE) is a distinguished department with a long history of leadership in education and focused research.”





MSE Hosts Deck Party

A fun annual tradition, the MSE Deck Party was held on Friday, April 15, during Spring Carnival. Alums gathered with faculty and staff to reminisce and reconnect. Beautiful weather made the 2016 event even more enjoyable! To learn about similar events, please make sure we have up-to-date information. Contact **Kelly Rockenstein** at krockens@andrew.cmu.edu



IN MEMORIAM:

Paul Shewmon

Paul G. Shewmon, Professor Emeritus, died on November 26, 2015. He was 85 years old and living in Columbus, Ohio. Paul earned his B.S. in metallurgical engineering at the University of Illinois in 1952 and his M.S. and Ph.D. in metallurgical engineering at Carnegie Mellon University in 1954 and 1955, respectively. From 1955 to 1958, he worked in the Metal Physics Group at Westinghouse Research Laboratory. In Fall 1958, he accepted an appointment as Assistant Professor of Metallurgy at Carnegie Institute.

He joined Argonne National Labs in 1967 and served in various positions, including associate director for metallurgy, associate director of the experimental breeder reactor-II project, and director of the Materials Science Division. In 1973, he became director of the Division of Materials Research at the National Science Foundation. He joined the faculty at Ohio State University in 1975 and served as chair of the Department of Metallurgical Engineering. In 1977, he was also appointed to the Nuclear Regulatory Commission's Advisory Committee on Reactor Safeguards, and he served on this committee for the remainder of his career. In 1979, he was elected to the National Academy of Engineering for his "contributions to metals science and engineering in the areas of diffusion and phase transformations."

Many of us know Paul as the author of two popular texts, *Transformation in Metals* and *Diffusion in Solids*. But we also remember him as a friend and colleague. Paul demonstrated the ability to home in on the key scientific and practical issues at hand, and he had a knack for asking some of the most direct, insightful questions at departmental colloquia. We will miss him, and we extend our thoughts and prayers to his family.

A Sporting Chance

Elise Hall (B.S. 2014) jumpstarted her career in athletic footwear by networking with other MSE alums



During her junior year in MSE, **Elise Hall** (B.S. 2014) was struggling to find a career niche that excited her. “Many of the traditional areas of MSE, like metallurgy, just didn’t seem to suit me,” she recalls. “I was already debating what to do after graduation...where did I want to work? Should I continue on to earn an M.S. and a Ph.D.? Nothing seemed like the right choice.”

Then Hall read an article in the Winter 2013 edition of *MSE News* that changed everything. The story described how a team of MSE alums were now working together as doctoral students in the Sports and High-Performance Materials research program at the University of Southern Mississippi (USM). Their doctoral research was focused on using innovative materials to solve pressing challenges in athletic equipment – for example, creating footwear that mitigates overuse injuries and understanding how headwear can reduce concussions.

“Something just clicked,” says Hall. “As a runner and an athlete, these were materials challenges I found fascinating and relevant to my own life. I knew this was the career niche I had been looking for.”

Hall emailed one of the alums, **Nadine Lipka** (B.S. 2008), who quickly introduced her to **Dave Krzeminski** (B.S. 2007), also profiled in the MSE newsletter story. After learning of Hall’s excitement about athletic apparel engineering, Lipka and Krzeminski wanted to help jumpstart her career. The two helped Hall secure a summer internship at USM, funded by the National Science Foundation under its Research Experiences for Undergraduates (REU) program.



“For the 10 weeks I was in Mississippi, I couldn’t wait to get to work every morning,”

Hall states. “I was studying the degradation of ethylene-vinyl acetate materials in running shoes. I knew I had finally found my niche.” Based on this research, Lipka and Hall co-authored a paper that won the *Student Investigator Prize* and the *Adidas Footwear Prize* at the International Sports Engineering Association (ISEA) conference.

Following her graduation from Carnegie Mellon, Hall interned at Under Armour. Then, on the recommendation of Lipka and Krzeminski, she completed a master’s degree in Sports Engineering at Sheffield Hallam University in the United Kingdom. Meanwhile, both Lipka and Krzeminski defended their Ph.D. degrees and accepted positions as graduate placement engineers at Adidas World Headquarters in Germany.

In September 2015, Hall began work as a mechanical engineer at Adidas’ US headquarters in Portland, Oregon. Though Hall, Lipka, and Krzeminski work on separate continents, all are assigned to the company’s “Future Team,” focused on next-generation improvements to athletic apparel and footwear.

“The three of us are using our Carnegie Mellon MSE roots to work together at the same sports company, in the same department – focusing on projects and products that are three to five years down the road from being released to consumers,” explains Hall. “For me, it’s like a dream come true. We have weekly video conferences with Nadine and Dave and the rest of the German engineering team. It’s amazing that we are all able to work together again.”

Looking back, Hall is glad that she reached out to connect with Lipka after reading the article in *MSE News* and grateful for the relationship that was built. She says, “From what I’ve observed, MSE alums are incredibly passionate about what they do. They want to achieve their goals. But they’re always willing to help other members of the MSE community achieve their goals, too. I’m so grateful for the support I’ve received from Nadine and Dave. And I’m grateful to MSE for bringing us together.”





Employee Spotlight: Betsy Clark Joins MSE



Betsy Clark

In January, **Betsy Clark** joined MSE as a Materials Characterization Facilities Specialist. In this role, she helps students master the advanced equipment in the Materials Characterization Facility. This facility is open to all research groups within the University for structural and microstructural characterization using electron, x-ray, and scanning probe methods. Clark provides hands-on assistance and training, enabling research groups to achieve their research objectives.

Clark has a B.S. in materials science and engineering from the University of Pittsburgh. In 2013, she earned her Ph.D. in materials from the University of California, Santa Barbara (UCSB). She worked as a post-doctoral researcher at UCSB before moving back to Western Pennsylvania in 2014 to accept a position as a materials engineer with Elliot Group.

A Pittsburgh native, Clark enjoys being back in the city and taking advantage of cultural resources. An avid reader, she regularly attends the Pittsburgh Contemporary Writers Series lectures at Carnegie Music Hall, which feature world-renowned authors.

"Everyone in the MSE Department has been so welcoming and easy to work with," says Clark. "I am happy to be close to science and research activities again, and I really enjoy seeing students achieving their project goals."

MSE Ranked Highly by QS

British education company Quacquarelli Symonds (QS) has released its 2016 World University Rankings by subject. The QS rankings are among the top three most influential and widely observed international university rankings. In the QS assessment, the MSE program at Carnegie Mellon was ranked 27th among materials science programs worldwide.

"It's always gratifying to see our department recognized for its academic reputation and scholarship," says MSE Department Head and Professor Gregory S. Rohrer. "This ranking demonstrates that the work of our faculty and students is known and highly respected around the world."



IN MEMORIAM:

Bonnie (Marion) Fruehan, wife of 58 years to **Professor Richard J. Fruehan** (Co-Director of the Center for Iron and Steelmaking Research and Associate Editor of *Metallurgical and Materials Transactions*) passed away on December 24, 2015.

She was born in Scranton to parents Thomas Langan and Doris Dickson. Bonnie is survived by her children, Scott, Elizabeth, and Rebecca, as well as several grandchildren.

Thomas J. Gambal, retired MSE Undergraduate Lab Tech, died on January 22 at the age of 73. He was the son of Helen (Suchta) Gambal and the late Joseph Gambal. He is survived by his wife Carolyn (Sikora) Gambal; son Eric Gambal; brother Donald (Grace) Gambal; aunt, uncle, and cousins; and nieces and nephews. Tom was a member of Holy Trinity Church.

Dana Landis passed away on January 17. She was the wife of **Professor David L. Landis**, Executive Director of MSE's master's program in Energy Science, Technology and Policy. Dana was born in Altoona to C. Wallace and Shirley Stump. Dana and Dave had been together for 48 years, and married for 38 years. Dana is also survived by daughters Sara and Emily, siblings Curtis Stump and Linda Mangan, and her mother, Shirley Stump.

100 YEARS IN THE MAKING:

From Mao Yisheng to great-granddaughter Patricia Xu

By Adam Dove

Anyone who has walked through the Mall on Carnegie Mellon's Pittsburgh campus has seen him. Nestled in an inlet between Baker and Porter halls, surrounded by stone benches and an elaborate plaque, a bronze statue of a man stands proud, bronze vest fitted under his bronze suit coat, leg extended, hand outstretched.

To many of today's students, it's just one more statue to shuffle past on the way to this class or that test. But to mechanical engineering and materials science and engineering senior **Patricia Xu**, it's more than just a statue: it's a statue of **Mao Yisheng**, recipient of the first Ph.D. ever given by the Carnegie Institute of Technology. It's a statue of her great-grandfather.

Born in China, in the city of Zhenjiang, Jiangsu province, Yisheng received his bachelor's degree in civil engineering from Jiaotong University's Tangshan Engineering College. From there, he went on to earn his master's degree from Cornell University, and finally his Ph.D. from the Carnegie Institute of Technology, now Carnegie Mellon University, in 1919.

His world-class education set him on a path of renown—he designed two of China's most famous modern bridges, the Qiantang River Bridge and the Wuhan Yangtze River Bridge, and to this day is regarded as the father of modern bridge engineering.

"I first heard of CMU when my dad was invited to attend the unveiling of my great-grandfather's statue," Xu explains. "Then when I was applying to colleges, my parents suggested I apply because it has a really good engineering school, and a well-known robotics program, both of which I was very interested in."

Xu came to Carnegie Mellon in 2012 with dual ambitions in Mechanical Engineering and Materials Science, and quickly began work in the lab of **MSE Professor Michael McHenry**. She spent her freshman year working on the creation of nanocomposite,

magnetic, nanocrystalline ribbons. These ribbons are being used in the development of more efficient power generators.

By her sophomore year, Xu was ready to take her research to the next level. She applied for, and received, an SRC-URO grant to research the use of these nanocrystalline ribbons in motors. Through computer simulation and prototype testing methods, she was able to determine that these ribbons are able to create motors that are more efficient and more powerful than any currently on the market.

She has also begun working on a project to study high-entropy alloys for their magnetocaloric effect, which would allow them to be used in magnetic refrigeration.

Now in her senior year, Xu is looking to the future. Like her great-grandfather, she is excited to dedicate her life to moving the world forward. But where Yisheng's time needed bridges, the modern world has a slightly more high-tech future.

"I hope to be able to use my knowledge of both materials science and mechanical engineering to someday make robots that will be able to effectively interact directly with the public."

But while her path may be her own, Xu knows she is a part of an illustrious legacy—the legacy of Carnegie Mellon and the legacy of her family. And every time she walks past her great-grandfather's statue, she is reminded that she stands on the shoulders of giants.

"If I could speak to him now," she says, "I would tell him, 'Thank you for inspiring me to come to CMU, to work harder, and to make a difference in other people's lives.'"



STUDENT NEWS BRIEFS



Jorge Gibson

Two doctoral students from MSE, **Jorge Gibson** and **Ajay Sudhir Pisat**, have been named *Presidential Fellows* by Carnegie Mellon University. **President Subra Suresh** launched the Presidential Fellowship and Scholarship program in 2014 to provide critical financial support to outstanding undergraduate and graduate students across all of CMU's seven colleges and schools. An endowment of more than \$150 million helps to support students' academic expenses, such as tuition and graduate research stipends. The inaugural class of Fellows includes 90 undergraduate and 55 graduate student recipients.



Ajay Sudhir Pisat



Rachel Freer

Seniors **Rachel Freer**, **Joshua Kubiak**, and **Patricia Xu** were recently named *Andrew Carnegie Society (ACS) Scholars*. These students are selected each year by their deans and department heads to represent their class in service and leadership. These undergraduate seniors embody CMU's high standards of academic excel-



Joshua Kubiak



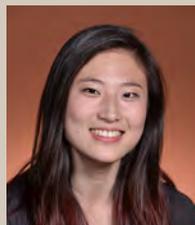
Patricia Xu

lence, volunteerism, and leadership, as well as involvement in student organizations, athletics, or the arts. Since its inception in 1975, the program has recognized nearly 1,000 students. All

ACS Scholars receive a monetary award that supports their academic and personal growth.

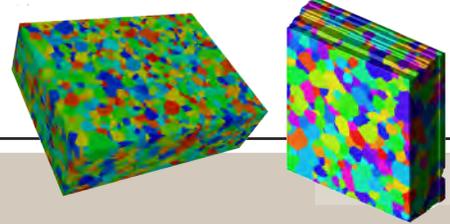


Eileen Ge



Sabrina Liu

Eileen Ge and **Sabrina Liu** have received *Materials Science Scholarships* from the Pittsburgh Foundation.



Ivan Batalov



Jenifer Hajzus

The following MSE doctoral students have been awarded fellowships for the 2015-2016 academic year. **Ivan Batalov** and **Jenifer Hajzus** won the *John and Claire Bertucci Fellowship*. **James Pellegren** was recognized with the *Neil and Jo Bushnell Fellowship in Engineering*. And **Alexander Mohamed** was awarded the *Phillips and Huang*



James Pellegren



Alexander Mohamed

Family Fellowship in Energy. These fellowships are awarded by the Carnegie Institute of Technology, School of Engineering.



David Ott

Three MSE undergraduates have been recognized as *Boeing Scholars*: junior **Nikita Budwal**, junior **David Ott**, and sophomore **Kira Pusch**. Awarded annually to students from across the US who are interested in a career in the aerospace industry, Boeing Schol-



Kira Pusch

arships include a financial grant. This program was created to help Boeing build relationships with the nation's top engineering programs, as well as with

especially promising students who may seek internships or entry-level positions with Boeing in the future.



Nikita Budwal

Recent Ph.D. Dissertations

Karina Lara Santos Assis

"Heat Transfer Through Mold Fluxes: A New Approach to Measure Thermal Properties of Slags"

Advisor: Chris Pistorius

Matthew Curnan

"Investigating Transition and Rare Earth Metal Oxide Relative Energetics Predictions for Improving Materials Selection Processes in Clean Energy Applications Using First-Principles Methods"

Advisor: John Kitchin

Rachel Ferebee

"Elucidation of the Structure Formation of Polymer Conjugated Proteins in Solution and Block Copolymer Templates"

Advisor: Michael Bockstaller

William Frazier

"A Potts Model Investigation of Complexion Transitions and Abnormal Grain Growth"

Advisor: Anthony Rollett

Yeon Joo (Chloe) Jeong

"Growth and Stability of Nanocrystalline Metal Domains Within Nanoporous Carbon Nanotube Aerogels"

Advisor: Mohammad F. Islam

Michael Kurniawan

"Low-Cost Soft Magnets for Giant Magnetoimpedance-Based Sensors"

Advisor: Michael McHenry

Clare Mahoney

"Elucidating the Parameters Governing Thermal Transport In Polymer Nanocomposites"

Advisor: Michael Bockstaller

Ratiporn "Noey" Munprom

"Effects of Crystal Orientation and Ferroelastic Domain Structure on the Photochemical Reactivity of $BiVO_4$ and Related Compounds"

Advisors: Gregory Rohrer and Paul Salvador

Lily T. Nguyen

"Quantification of Microstructural Evolution Using Moment Invariants"

Advisor: Marc De Graef

Carolyn Norwood

"The Effect of Nickel Content on the Mechanical Properties and Microstructure of a High Toughness Secondary Hardening Steel"

Advisor: Warren Garrison

Michael Schmitt

"Physicochemical Properties of 'Particle Brush' Materials: Using Polymer Graft Modification to Tailor Particle Interactions"

Advisor: Michael Bockstaller

Clayton Stein

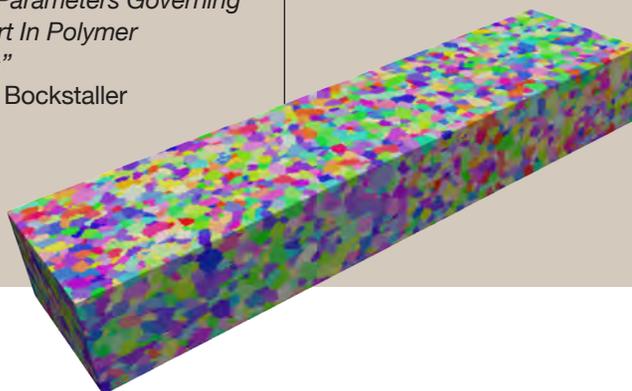
"The Role of Twin Boundaries in Fatigue Microcrack Initiation in an Advanced Nickel-Based Alloy"

Advisor: Anthony Rollett

Vignesh Sundar

"Templated Growth of Magnetic Recording Media"

Advisor: David Laughlin



MSE STUDENTS EXCEL AT ASM YOUNG MEMBERS NIGHT

On February 18, the Pittsburgh Golden Triangle Chapter of ASM International hosted its 2016 Young Members Night at the University Club. Jon Tirpak, President of ASM International, served as the guest speaker for the evening. Doctoral candidate **Whitney Schoenthal** of MSE was the student speaker at the event.

A number of MSE students were honored at this annual event. Senior **Joshua Kubiak** won the award for *Outstanding Senior*. Junior **Kate Beittenmiller** won the *Past Chairperson's Education Assistance Scholarship* for juniors. And sophomore **Indorica Sutradhar** won the *Past Chairperson's Education Assistance Scholarship* for sophomores.

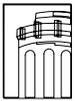
In the undergraduate poster contest, **Rekha Schnepf** won first place for her poster called "Structural and Optical Characterization of Electron Beam Evaporated SNS Films."

In the graduate student poster contest, first place went to **Luke Klosterman** for his poster entitled "The Metal-Melanin Bond: Making It and Breaking It." The third-place award was given to **Jenifer Hajzus** for her research, "Contacts to Layered Semiconductors With 2D Applications."



**DEPARTMENT OF MATERIALS
SCIENCE AND ENGINEERING**

Carnegie Mellon University
Pittsburgh, PA 15213-3890



Carnegie Mellon University
College of Engineering

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Obtain general information about Carnegie Mellon University by calling 412-268-2000.

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