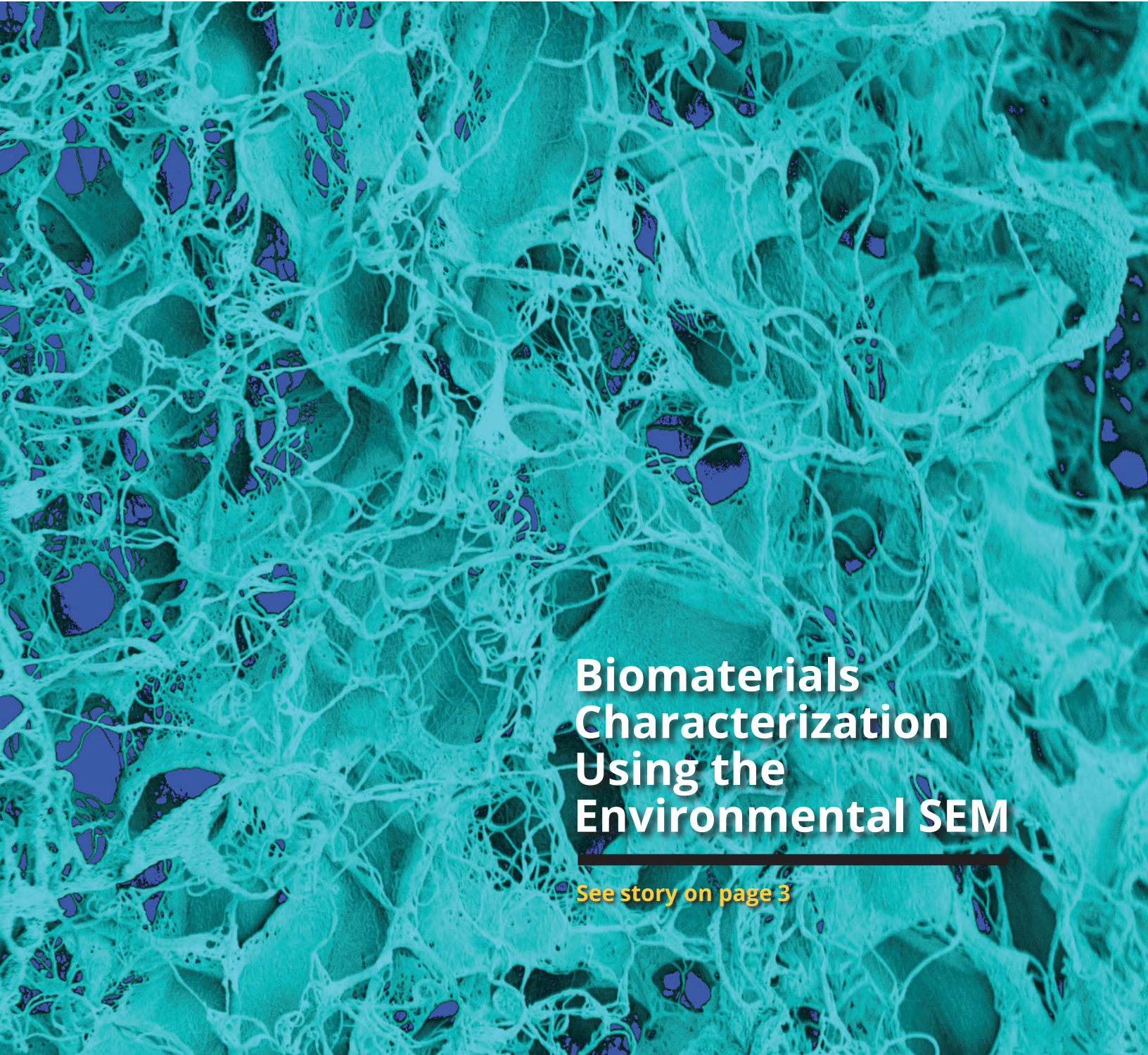


MSE NEWS

MATERIALS SCIENCE AND ENGINEERING

FALL 2018

Carnegie Mellon University

A scanning electron micrograph (SEM) showing a highly porous, interconnected network of fibers or filaments. The structure is light blue and green, with darker, more solid-looking regions interspersed throughout. The overall appearance is that of a complex, three-dimensional lattice or scaffold.

Biomaterials Characterization Using the Environmental SEM

See story on page 3



A NOTE FROM THE DEPARTMENT HEAD

Gregory S. Rohrer

W.W. Mullins Professor

Greetings to all MSE alumni! Each year there are new changes in the Department and, as usual, you will find this issue of *MSE News* packed full of stories about the successes of our students, faculty, and alumni. If you delve into the *MSE News* archive and look at the Spring 2010 issue, you'll find a story describing the launch of a new masters degree program in MSE: the masters in Energy Science, Technology, and Policy (ESTP). With the retirement of ESTP founding director **Dave Landis** this year (see page 4), it is appropriate to update you on the program.

Simply put, the program has been a true success for the Department and the College. This year, ESTP enrolled 47 students who are taking a set of core classes sponsored by the ESTP program, as well as a broad range of classes across the College within the domain of energy, the environment, and sustainability. These courses range from topics such as thermodynamics to environmental life cycle assessment. The program has produced nearly 200 alumni in its first eight classes, including 30 last year. Graduates have accepted positions in established industries (companies such as Alcoa, Boeing, Consol Energy, Entergy, and Siemens Energy); government agencies (including NASA, NETL, and NIST); and start-up companies. Some students have also pursued doctoral degrees.

I congratulate Dave who, with the help of **Associate Director Nora Sieworek** and **Program Coordinator Justin Puglisi**, has built a robust and successful degree program that prepares students for exciting careers and contributes to the intellectual vitality of the Department and the College. **Paul Salvador**, a professor in MSE and ESTP, has taken the position of Interim Director of the program; we are looking forward to its continued success.

The faculty and students of MSE continue to earn external recognition for their work. **Yoosuf Picard** was named the 2018 recipient of the Microanalysis Society's (MAS) Kurt F.J. Heinrich Award. **Noa Marom** received the 2018 Young Scientist Prize in Computational Physics, awarded by the International Union of Pure and Applied Physics (IUPAP). **Tzahi Cohen-Karni** received the Cellular and Molecular Biomedical Engineering (CMBE) Young Innovators Award for 2018. **Robert Davis** was elevated to the rank of Fellow of the Materials Research Society (MRS). **Chris Pistorius** and **Richard Fruehan**, along with recent Ph.D. graduate **Mauro Ferreira**, received the 2018 Jerry Silver Award from the Association for Iron & Steel Technology (AIST).

I hope you enjoy reading about these accomplishments and others in this issue of *MSE News*. Please let us know of any significant developments in your career and life that we can feature in the Alumni News section. As always, if you are in town and have the opportunity, you are welcome to visit the Department.

GREGORY S. ROHRER

Characterizing Biomaterials in Their Natural Form in the Environmental Field Emission SEM

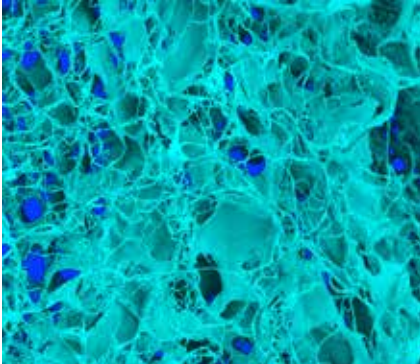



Figure 1: ESEM image of a bioprinted heart valve

At the Materials Characterization Facility (MCF), a variety of samples are characterized using the high vacuum mode of SEM that requires conductive metal coating. While it is simpler to characterize conductive samples, many samples are not conductive. Such samples are sputter coated with a conductive metal such as gold. However other novel materials including biospecimens contain intricate surface features, and coating can obscure these surface features of interest, causing morphological changes. Hence it's important to avoid coating such samples. Also, high vacuum mode can cause tissue rupturing. The ESEM allows us to work with wet and insulating samples without having to coat them, in a gaseous environment and at low vacuum settings, as required. Due to this flexibility, the scope of these microscopes can be extended to characterize a much wider variety of samples including biological specimens, geological samples, polymers, etc.

Priyanka Anand, Research Staff at MCF, is excited about imaging such novel materials under different imaging settings, including biological samples that utilize ESEM imaging mode. The characterization of such samples can be challenging due to very specific image requirements, stringent beam parameters optimization, and different vacuum and stage settings. But the end result is very rewarding and scientifically valuable because with careful controls, the dominant image effects can be identified and used to gain additional information about the specimen. This mode enables users to study specimens and achieves high resolution imaging without effects of charging. Also users can study how the images respond dynamically to changing conditions, and gain insight to important material characteristics and properties that is strongly linked to their microstructural properties.

Figure 1 is an ESEM generated image of a 3D bioprinted heart valve (uncoated) created using the Freeform Reversible Embedding of Suspended Hydrogels (FRESH) technique developed by **Dr. Adam Feinberg** (affiliated with MSE and BME). The fibrous porous morphology of the collagen protein can be seen from the figure, where the fibers can be seen emerging from the scaffolds. This fibrous-rich morphology is essential for enhancing the mechanical characteristics of the organ parts, which is important for tissue repair and regeneration.

We found that many students and researchers are not aware of this facility, so we encourage interested readers who would like to learn more to connect with us at MCF.

 [Areas of Research - MSE](#)

Rollett Named US Steel Professor

Professor Anthony Rollett has been named the US Steel Professor of Materials Science and Engineering. This professorship recognizes his groundbreaking research in the areas of metallurgy and computational materials science.

Rollett came to Carnegie Mellon in 1996 as Department Head, having already established an international reputation in the area of texture studies and the modeling of grain growth. Later, Rollett laid the groundwork for a computational scheme that creates three-dimensional models of polycrystalline microstructures that are statistically equivalent to observed microstructures.

Over the last few years, Rollett has been focusing his efforts on additive manufacturing or, more precisely, modeling and understanding the microstructures that are formed during the additive manufacturing of metallic parts. As part of this work, he has been instrumental in the launching of the Next Manufacturing Center with **Professor Jack Beuth**.

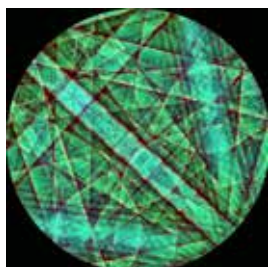




Paul Salvador



Yoosuf Picard



Dictionary indexing of electron channeling patterns

Professor David Landis retired from Carnegie Mellon in May. A College of Engineering alumnus, Landis earned his B.S. in Electrical Engineering in 1969. Beginning in 2010, Landis directed CMU's masters program in Energy Science, Technology and Policy (ESTP). "These past eight years have been a rewarding experience of working with grad students and faculty to bring the College of Engineering M.S. in Energy program to its current level of prominence," says Landis. He plans to work as a private consultant, while also pursuing hobbies that include playing acoustic guitar, riding motorcycles, experimenting with electronics and amateur radio, and restoring and maintaining old vehicles.

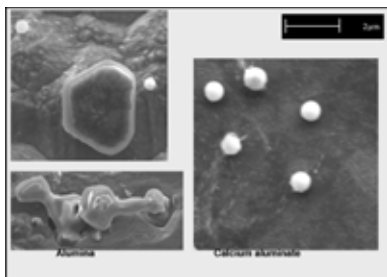
Professor Paul Salvador is currently serving as the Interim Director of the Energy Science, Technology and Policy masters program, following David Landis' retirement. An MSE faculty member for 20 years, Salvador's research is in the domain of materials research for energy applications. He has active research in the areas of solid oxide fuel cells and photochemical energy conversion, while also teaching classes on energy topics that have enrolled many ESTP students.

Associate Professor Vincent Sokalski recently received a \$1.8 million grant from the Defense Advanced Research Projects Agency (DARPA) for his project, "Domain Wall Skyrmions: Topological Excitations Confined to 1-D Channels." Along with CMU **Professors Marc De Graef** (MSE) and Di Xiao (Physics), Sokalski will explore new ways to efficiently process and store information with magnetic materials.

Associate Research Professor Yoosuf Picard has been named the 2018 recipient of the Microanalysis Society's (MAS) Kurt F.J. Heinrich Award. This award honors an early career scientist within 15 years after his or her Ph.D. degree for distinguished technical contributions to the field of microanalysis. Picard was chosen due to his excellent and sustained efforts in various materials characterization from the nano to the meso scale by a range of microscopy techniques, as well as his dedicated service to MAS. Picard received his award at the 2018 Microscopy and Microanalysis meeting, held in Baltimore, Maryland, in August.

Assistant Professor Tzahi Cohen-Karni, who holds appointments in MSE and the Department of Biomedical Engineering, has received the Cellular and Molecular Biomedical Engineering (CMBE) Young Innovators Award for 2018. His submitted abstract, "Graphene Microelectrode Arrays for Electrical and Optical Measurements of Human Stem Cell-Derived Cardiomyocytes," was judged as part of the nomination process and will be published in *Cellular and Molecular Bioengineering*, the official journal of the Biomedical Engineering Society (BMES). Cohen-Karni will present his research at the BMES Annual Meeting in Atlanta, Georgia, in October.

Professor Marc De Graef and **Saransh Singh** (*Ph.D. 2017*) have been honored with a 2018 Paper of the Year Award from the journal *Microscopy and Microanalysis*. De Graef and Singh's paper "Dictionary Indexing of Electron Channeling Patterns" was recognized in the Best Software and Instrumentation category. The pair received their award at the Plenary Session held at the beginning of the Microscopy & Microanalysis (M&M) annual meeting. The event was held in Baltimore, Maryland, in August.



Alumina inclusions (left) transforming into liquid calcium aluminates when at 1600C. A size decrease was observed due to formation of a new inclusion population.

Professors Chris Pistorius and Richard Fruehan, along with recent Ph.D. graduate Mauro Ferreira, have been awarded the 2018 Jerry Silver Award by the Association for Iron & Steel Technology (AIST). The collaborative authors were honored for their work entitled "Inclusion Size Distributions After Calcium Addition in LCAK Steels." Originally established in 1991, then re-established as an AIST award in 2005, this award was named in honor of Jerry Silver in recognition of his leadership in the development of student affairs and programs for the Iron & Steel Society. AIST will present the award to the authors at the AIST Metallurgy Committee meeting, held during the 2018 Materials Science & Technology Conference in Columbus, Ohio, in October.

Associate Professor Adam Feinberg, who holds a joint appointment in MSE and Biomedical Engineering, has been chosen as the inaugural recipient of the Arthur Hamerschlag Career Development Professorship in Materials Science and Engineering and Biomedical Engineering. The Arthur Hamerschlag Career Development Professorships were established by the College of Engineering and proudly named in honor of Arthur Hamerschlag, the first president of Carnegie Mellon. President Hamerschlag served between 1903 and 1922 when the university was then known as the Carnegie Institute of Technology.



2018 MRS Fellows



Robert Davis

Professor Robert Davis has been elected to the class of 2018 Materials Research Society (MRS) Fellows. He was officially recognized at the 2018 MRS Spring Meeting in Phoenix, Arizona, in April. The title of MRS Fellow honors those MRS members who are notable for their distinguished research accomplishments and their outstanding contributions to the advancement of materials research worldwide. The maximum number of new Fellow appointments each year is limited to 0.2% of the current MRS regular membership. Thus, the distinction is highly selective. Davis was cited "for scientific achievements leading to the ubiquitous use of silicon carbide and Group III-nitrides in applications with beneficial societal impact and for selfless mentorship of numerous students and researchers."

Professor Jay Whitacre has been named to the 2018 *Energy Manager Today* 75, a merit-based and peer-nominated recognition program developed by the Environment and Energy Leaders Institute to honor innovative energy leaders. According to the Institute's publication, *Energy Manager Today*, this program "recognizes those industry 'doers' who break trail in creating new solutions, programs, platforms, best practices and products to help their companies—or other companies—achieve greater success in commercial and industrial energy management." At MSE, Whitacre focuses on developing and analyzing new materials and systems for electrochemical energy storage and conversion.



International Union of Pure and Applied Physics (IUPAP) Award

Assistant Professor Noa Marom has received the 2018 Young Scientist Prize in Computational Physics, awarded by the International Union of Pure and Applied Physics (IUPAP). In July, Marom gave an invited lecture at the IUPAP International Conference on Computational Physics, held at the University of California, Davis. She was also presented with a medal, a certificate, and a financial award. The event was part of a conference series hosted by IUPAP to bring together computational scientists working in physics and closely related areas to exchange the latest developments in computational techniques and their applications.

MSE Shines at Annual ASM Meeting

On May 17, the Department of Materials Science and Engineering was in the spotlight at the ASM Pittsburgh chapter's annual meeting, an event that features the Andrew Carnegie Lecture, Past Chair Night, and Award Night.

Professor David Laughlin, the ALCOA Professor of Physical Metallurgy in MSE, gave the 2018 Andrew Carnegie Lecture. His topic was "The Legacy of Edgar Bain to Physical Metallurgy (and therefore to Materials Science!)."

Laughlin reminded the audience that Bain's legacy not only includes the "Bain Strain" and the two-phase constituent in steels denoted as Bainite, but also includes some early work on the use of x-rays to determine atomic ordering, grain size, and coring in solidified alloys—as well as helping to define just what a solid solution is. He also pioneered the use of Time/Temperature and Transformation diagrams to map out various transformation mechanisms in steels, which he used to sort out the confusion which existed in the early 20th century designations of two-phase constituents in steels.

A member of the MSE faculty since 1974, Laughlin has recently published *Introduction to Thermodynamics of Materials* and co-edited (with Hiro Hono) the 5th edition of *Physical Metallurgy*, a comprehensive review of the subject. He is the 2017 Campbell Lecturer of ASM and is a Fellow of ASM International and TMS (AIME).

In addition, Laughlin's former student **Roberto Rioja** (*Ph.D.*, 1979) received the 2018 Edgar Bain Award of the ASM Pittsburgh chapter. Rioja is a former Fellow of ALCOA Inc. and is retired from ALCOA Technical Center. The topic of Rioja's thesis at MSE was "The Precipitation Sequence of Metastable Tetragonal Phases in Metallic Solid Solutions."

Professor Anthony Rollett testified before the US House Committee on Science, Space, and Technology on the opportunities springing from the intersection of machine learning and advanced-scale computing on July 12. The US Steel Professor of MSE and a leader of CMU's NextManufacturing Center, Rollett urged an investment in 3D printing because of its importance in advanced manufacturing. "It is clear to me that this is a seriously revolutionary technology because it forces us to think differently about how to make things," Rollett said in his testimony. "Imagine that in a few years we will be able to build a rocket that is tailored to the particular mission, instead of forcing the payload to match one of a limited set of vehicles. Or that 'mass production' is transmuted into 'mass individualization,' such that Ford's proverbial 'any color so long as black' becomes 'any choice of color and size for dozens if not hundreds of parts of a car.'"



Rioja receives his award from Dharma Maddala from Arconic, who is a member of the ASM Pittsburgh chapter's long-range planning and strategy committee.



Laughlin is seen here receiving his lecture award from Nate Eisinger, the Chair of the ASM Pittsburgh chapter.

Nuhfer Celebrates 50 Years at MSE



Tom Nuhfer, the Founding Director of MSE's Materials Characterization Facility, was recently recognized for 50 years of service to the University. Nuhfer joined CMU's Metallurgy Department as a Technician in 1967. He was promoted to a Technical Engineer and Senior Scientist before becoming Director of the Materials Characterization Facility.

"Our work has changed as the department has evolved," Nuhfer notes. "We've gone from metals and the Metallurgy Department to the Materials Science Department and composite materials, nano-materials, biomaterials, polymers, and nanotubes. But resolution is always the issue."

Nuhfer, who is counted among the inventors, makers, artists, and builders celebrated by Carnegie Mellon, helped build the Materials Characterization Facility into a world-class electron microscopy teaching and research laboratory, where engineers can identify the structures of a material down to the atomic scale.

Located in Roberts Engineering Hall, the Materials Characterization Facility is filled with high-powered technology, including X-ray machines, computing equipment, and ultra-sensitive microscopes. The crown jewels of the lab are the Titan aberration corrected ultra-high-resolution transmission electron microscope and the new Themis 200 probe-corrected high resolution transmission and scanning transmission electron microscope coming in late 2018.

The facility plays a major role in academic research. "We have more than 200 users in the College of Engineering, and many of the published papers on materials science and engineering, electrical engineering, chemical engineering, and biomaterials have microscopy components to them," says Nuhfer, who has authored and co-authored more than 400 papers.

"I love electron microscopy and the technique of characterization. It became quite the passion, and I wanted to build the facility into something special to leave behind," explains Nuhfer. "My hope is that the facility will be maintained and grow when I retire."



[Materials Characterization Facility](#)

MSE Staff Welcomes Visiting Alum



In June, **Ishwar Chand Modi** paid his first visit to the CMU campus in 60 years. This alum was warmly welcomed by **Suzanne Smith**, Manager of Administration and Student Affairs, as well as other Department staff members. Modi completed a one-year program in iron and steel manufacturing in 1958 as part of a joint program sponsored by the Ford Foundation and the Indian government.

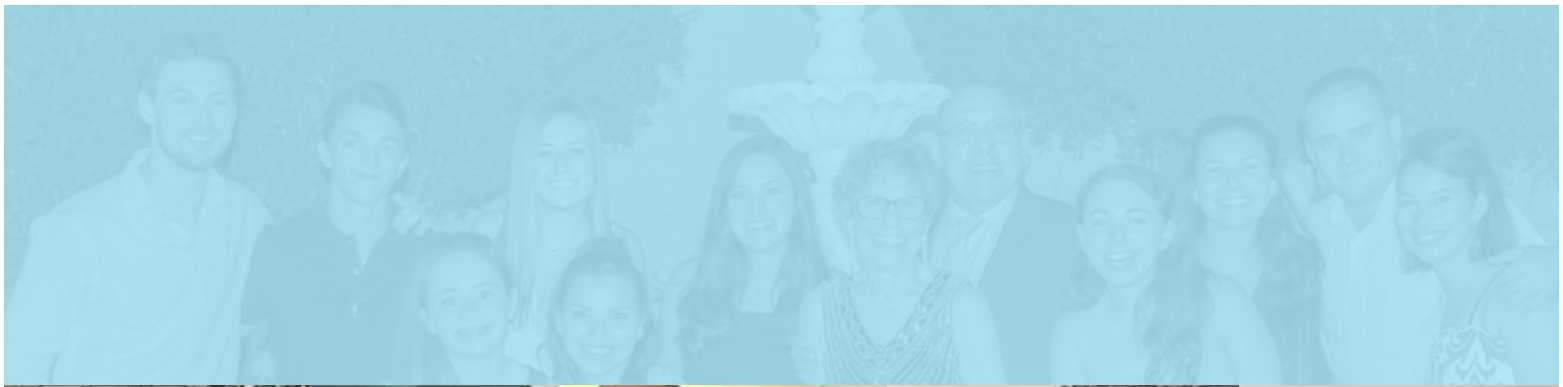
After his return to India, Modi had a long and fulfilling career as a metallurgist and "steel man," laying the foundations of the nation's iron and steel industry and its technological capabilities over several decades. Throughout, he spoke about his year at Carnegie Mellon and the knowledge and perspectives he gained in that period.

During his visit, the now 85-year-old Modi toured the campus, met representatives of the MSE Department, and enjoyed a trip down memory lane. Following the visit, Modi's son Vikram wrote to express his gratitude to Smith and others at MSE. "It was very generous of you to share your time and insights," wrote Vikram. "The technology and buildings were new for my father but the warmth and hospitality were how he remembered it—thanks to you."



Ishwar Chand Modi is shown at center in this photo, which depicts students conducting experiments to assess the suitability of certain refractories for steel plant furnaces.

< Shown left to right are recent MSE Ph.D. recipient Ankita Mangal, visiting alum Ishwar Chand Modi, doctoral student Ajay Pisat, and MSE staff member Adam Wise.



Give strategically, Support generously.

NICK FIORE (MSE '64) rose from a blue-collar background to the top of his field. Over the course of a 50-year career in business and academic leadership, he left an indelible mark on both the manufacturing industry and students alike.

At Carnegie Mellon University, Nick and his wife Sylvia M. Chinque Fiore have created a lasting legacy by establishing a gift in their grandparents' names which will support a deserving undergraduate student in the Department of Materials Science and Engineering. The Fiore family are motivated to give back because Nick says he will forever feel a debt of gratitude to his mentors and to the university which allowed him and his classmates to rise above their modest beginnings.

Learn how easy it is to achieve your philanthropic vision through a planned gift by visiting giftplanning.cmu.edu. Contact the Office of Gift Planning today at 412.268.5346 or askjoebull@andrew.cmu.edu.

Carnegie Mellon University
College of Engineering

Small Scale, Big Success



Inspired by his MSE roots, Matt Jones establishes his own nanoparticles lab at Rice University

From a young age, **Matt Jones** (B.S. 2007) was interested in nanomaterials. “When I was 10 or 11, I read this article about nanotechnology,” he recalls. “I was completely captivated by the idea of studying problems at such a small scale. From that moment, I knew I wanted to be an engineer and work in nanotechnology.”

A heavily recruited football player, Jones chose CMU because it combined an outstanding MSE program with a strong football team. “That’s a combination few schools could offer,” he says with a laugh. Jones moved to Pittsburgh from his native San Diego — a shocking experience. “I didn’t own a winter coat, and I’d never seen snow fall from the sky. That first winter was tough.”

However, Jones felt immediately at home in the MSE Department. His professors encouraged him to do research, and he loved investigating problems at a deep level. A dual major in Biomedical Engineering, he embedded DNA in materials to study their response.

“I realized that I enjoy working at the cusp of what is known and what is not,” he says. “I learned the habits of a good researcher, such as being patient and not easily frustrated. I learned that the result isn’t always what you expected—but you can discover something even more exciting by pure chance.”

After graduation, Jones earned his Ph.D. at Northwestern University, then became a Post-Doctoral Fellow at the University of California, Berkeley. In 2017, he joined the Department of Chemistry at Rice University as an Assistant Professor, as well as the Norman and Gene Hackerman Junior Chair.

In his research lab, Jones focuses on materials engineering at the nanoparticle level. “If you work at the particle level, materials become very tunable and tailorable,” Jones notes. “You can customize their size, shape, and final properties. This is a huge area of research that is unexplored, yet has significant implications. It’s exactly the job my 10- or 11-year old self envisioned.”

In the Money



Alum Miles Hinderliter applies his love of math to a career in finance

After graduating from MSE, **Miles Hinderliter** (B.S. 2002) embarked on a fairly conventional career path: working on stealth fighter jets for Lockheed Martin. But, while there, he began to be interested in finance and management. Hinderliter explains that, at the company, “You could expand, change, and modify your role. As long as you were productive, the company would endorse your work.” He was happiest when managing projects and articulating how they fit into the company’s objectives.

Recognizing his interest in management, Lockheed Martin placed Hinderliter in a leadership development program, where he honed his presentation and management skills. The program also required him to enroll in a masters program, and he chose to pursue an M.B.A. at Emory University. There, he began thinking about a career in finance, inspired by his love of hard math and Wall Street’s incredible success in the early 2000s.

Hinderliter took a risk, leaving Lockheed Martin to intern with Lehman Brothers in 2007. He joined the company as a full-time employee—though on the day Lehman Brothers filed for bankruptcy. Thankfully, Barclays acquired the business, and Hinderliter began a successful financial career.

Hinderliter notes that the perceived gap between engineering and financing is in truth quite narrow. “You know, at Lockheed I did spreadsheets and presentations, and at Barclays I did spreadsheets and presentations,” he jokes. Hinderliter recently accepted a new position at the financial advisory firm Evercore.

Since finance is dominated by Harvard, Yale, and Princeton graduates, Hinderliter says that a Carnegie Mellon MSE degree raises eyebrows. “Engineering is a profession that sticks out on Wall Street,” he says. “But I get a lot of credibility from CMU and Lockheed Martin, and my technical skills never get questioned.”

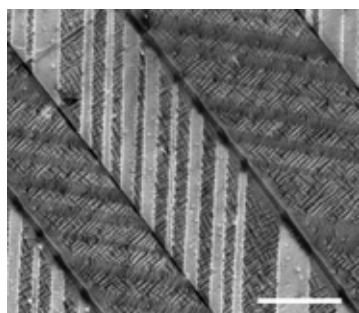
Doctoral student **Immanuel Bier** has received a Graduate Research Fellowship from the National Science Foundation. A member of **Assistant Professor Noa Marom's** research group in MSE, Bier uses computers to study the electron mobilities of organic semiconductors. This research uses a combination of quantum mechanical simulations with machine learning methods to identify correlations between the structure of an organic semiconductor and its electronic properties.



Mari-Therese Burton

Mari-Therese Burton, a senior, has won an Honorable Mention in the annual Goldwater Scholarship competition. The Barry Goldwater Scholarship and Excellence in Education Foundation recently announced 211 scholarships for the 2018-2019 academic year. An additional 281 nominees were named as Honorable Mentions. These students were chosen from a field of 1,280 nominees, including natural sciences, mathematics, and engineering students from over 2,000 colleges and universities nationwide.

Students in **Professor Anthony Rollett's** research group were honored at the 2018 TMS Technical Division Student Poster Contest, part of the TMS annual conference held in March in Phoenix, Arizona. In the category "Coupling Experiments and Modeling to Understand Plasticity and Failure," the third-place prize was awarded to MSE doctoral students **Rachel Lim**, **Yufeng Shen**, **Christopher Kantzos**, and **He Liu**, along with Rollett and Emeritus Physics Professor Robert Suter.



Three-tiered domain structure of tungsten trioxide

Doctoral student **Ajay Pisat** is the winner of the 2018 Krivobok Brooks Award for Excellence in Graduate Student Metallography for his submission, "Three-Tiered Domain Structure of Tungsten Trioxide." Pisat also received a travel grant from the European Ceramic Society to attend the Electroceramics summer school held in Hasselt, Belgium, in July.

Recent Ph.D. graduate **Ross Cunningham** was the featured speaker at ASM Young Members' Night, held in February. Cunningham opened the evening with his presentation, "Materials Challenges in Metal Additive Manufacturing." He discussed in detail his research efforts to study the porosity of additive parts in relation to processing methods. Cunningham has employed X-ray computer tomography to study changes in the porosity of 3-D printed parts before and after heat treatments. He has also used dynamic X-ray radiography at the synchrotron source in Argonne National Lab to capture video of the porosity as it develops during the printing process.

The MSE Graduate Student Advisory Committee hosted the 11th Annual Graduate Student Symposium in April. Third- and fourth-year doctoral students presented a total of 11 posters and 12 podium talks about their research. Based on clarity, content, organization, and other judging criteria, the winners were (left to right): **Siyuan Liu** (runner-up, Best Poster), **Alice Perrin** (Best Poster), **Ross Cunningham** (Best Presentation), and **Natan Aronhime** (runner-up, Best Presentation).



MSE Commencement: Cause for Celebration

On Sunday, May 20, the Department of Materials Science and Engineering hosted its 2018 Commencement ceremony at the Twentieth Century Club in Oakland.

The Department awarded 31 B.S. degrees, 42 M.S. degrees, and 16 Ph.D. degrees. The Department wishes these graduates all the best as they leave Carnegie Mellon!

The following awards—including two new awards this year—were presented during the Commencement ceremony:

- *The William W. Mullins Undergraduate Award*
Recipient: Yushuan Peng
- *The Hubert I. Aaronson Undergraduate Award*
Recipient: Kira Pusch
- *The James W. Kirkpatrick & Jean Kirkpatrick Keelan Award*
Recipient: Lena Vlahkis
- *The William T. Lankford Memorial Scholarship Award*
Recipient: Indorica Sutradhar
- *The ASM Golden Triangle Chapter Outstanding College Senior Award*
Recipient: Stacy Chang
- *The Paxton Award for Best Doctoral Dissertation*
Recipient: Saransh Singh
- *The Philbrook Prize*
Recipient: Professor Christopher Bettinger

NEW AWARDS FOR 2018

- *Award for Academic Excellence in the Masters Program*
Recipient: Zihao Ding
- *Award for Research Excellence in the Masters Program*
Recipient: Xingyu (Alfred) Liu



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Carnegie Mellon University does not discriminate, and Carnegie Mellon University is required not to discriminate, in admission, employment, or administration of its programs or activities on the basis of race, color, national origin, sex, or handicap in violation of Title VI of the Civil Rights Act of 1964, Title IX of the Educational Amendments of 1972, and Section 504 of the Rehabilitation Act of 1973 or other federal, state, or local laws or executive orders.

In addition, Carnegie Mellon University does not discriminate in admission, employment, or administration of its programs on the basis of religion, creed, ancestry, belief, age, veteran status, sexual orientation, or gender identity. Carnegie Mellon does not discriminate in violation of federal, state, or local laws or executive orders. However, in the judgment of the Carnegie Mellon Human Relations Commission, the Presidential Executive Order directing the Department of Defense to follow a policy of "Don't ask, don't tell, don't pursue" excludes openly gay, lesbian, and bisexual students from receiving ROTC scholarships or serving in the military. Nevertheless, all ROTC classes at Carnegie Mellon University are available to all students. Inquiries concerning application of these statements should be directed to the provost, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone 412-268-6684, or the vice president for enrollment, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, telephone 412-268-2056.

Carnegie Mellon University publishes an annual campus security report describing the University's security, alcohol and drug, and sexual assault policies, and containing statistics about the number and type of crimes committed on the campus during the preceding three years. You can obtain a copy by contacting the Carnegie Mellon Police Department at 412-268-2323. The security report is also available online.

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

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