



MATERIALS SCIENCE AND ENGINEERING

FALL 2019

Carnegie Mellon University

The background of the lower half of the cover is a vibrant, abstract, and colorful pattern. It consists of numerous irregular, overlapping shapes in a wide range of colors including red, orange, yellow, green, blue, purple, and pink, creating a complex, textured effect.

ADDITIVE MANUFACTURING:

Solving the Materials Challenge

See story on page 3



A NOTE FROM THE DEPARTMENT HEAD

Gregory S. Rohrer

W.W. Mullins Professor

Greetings to our MSE alumni! I am happy to report that the Department of Materials Science and Engineering continues to grow and thrive. As always, you will find this issue of *MSE News* packed full of the successes of our students, faculty, and alumni.

I am happy to be able to deliver some especially good news. In recent years, the Department has been striving to develop more “center level” research activities — i.e., research projects that involve groups of faculty, supported by a single large grant or contract. Earlier this year, two such grants were awarded, led by faculty in MSE. One project is sponsored by NASA and the other by the Air Force Research Laboratory (AFRL).

The NASA-sponsored center is a University Leadership Initiative in additive manufacturing (AM). The project team, led by **Professor Anthony Rollett**, will explore new methods for using AM to reduce the cost and increase the speed of mass-producing aircraft — without sacrificing quality, reliability, or safety. The key challenges to accomplishing this are creating a scientifically sound basis for qualifying the resulting AM-produced parts and demonstrating that the efficient large-scale production of parts is feasible. You can read more about Rollett’s groundbreaking additive manufacturing research on page 3.

The AFRL-sponsored project is a Center of Excellence project entitled “Data-Driven Discovery of Optimized Multifunctional Material Systems.” **Professor Elizabeth Holm** has assembled a team of materials and computational scientists focused on developing machine intelligence (MI) to support materials research, to integrate MI into the research workflow to address problems relevant to aerospace materials, and to prepare a materials science workforce that is fluent in MI methods and applications. This project has four main thrusts: characterizing and predicting rare events in materials systems, multimodal materials data fusion, adaptive experimental design, and adaptive materials design in complex environments. The cover story of the next issue of *MSE News* will focus on Holm’s innovative research.

I began my 15th year as MSE Department Head at the end of the past academic year. At that time, I informed **Jon Cagan**, the Interim Dean of Engineering, that the 2019-2020 academic year will be my final one as Department Head. While I have enjoyed fulfilling this role in MSE, it is time for new leadership in the Department. A search committee has been formed to identify a new Department Head and is already at work. I urge you to suggest all qualified candidates, both internal and external. I hope that by the time the next *MSE News* is published, a new Department Head will have been identified.

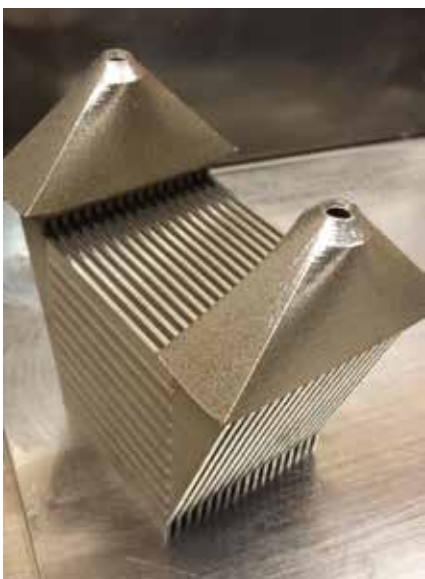
As always, please let us know of any significant developments in your career and life that we can feature in the Alumni News section. And, if you are in town and have the opportunity, you always have an open invitation to visit the Department.

GREGORY S. ROHRER

ADDITIVE MANUFACTURING: *Solving the Materials Challenge*



ON THE COVER:
Electron backscatter diffraction inverse pole figure map of a cross sectioned 316L stainless steel cube, which was additively manufactured with laser powder bed fusion (where the build direction is vertical)



Additive manufacturing enables the production of complex shapes such as the one shown here.

Professor Anthony Rollett leverages a range of funding and collaborations to identify new materials and processes for 3D printing

While additive manufacturing — popularly known as 3D printing — holds the promise to revolutionize production processes, there are obstacles to its widespread adoption. Chief among these is identifying new materials that can withstand the extreme heat and stress associated with the additive manufacturing (AM) process.

MSE's own **Professor Anthony Rollett** is leading this effort to solve the AM materials challenge. As the US Steel Professor in MSE and Co-Director of CMU's NextManufacturing Center, Rollett focuses on microstructural evolution and microstructure-property relationships. One of his primary goals is illuminating the changes that occur in metal alloy powders as they undergo a thermal change of 1 million degrees per second during 3D printing — and how those changes can produce defects.

LEADING A REVOLUTION

While Rollett has spent 24 years at CMU and another 15 years at Los Alamos National Laboratory, he calls this new area of materials science “the Wild West” — and is excited to help lead this revolution. “Unlike conventional manufactured products, 3D-printed products have a completely different internal composition from what you see on the surface, caused by the stresses that occur during production,” says Rollett. “It’s like we’ve opened a Pandora’s Box. Everything we thought we knew about materials is changing.”

Understanding materials composition, and preventing defects, is an urgent engineering problem because of the demand for proven 3D printing practices. According to Rollett, AM is widely sought after because it offers many advantages over conventional methods, including the ability to make parts quickly or produce them one at a time. “AM also offers an incredible degree of design freedom,” Rollett notes. “Product developers can come up with crazy geometries, test them, and make immediate modifications. 3D printing is supporting a new era of extreme engineering innovation.”

A SPECTRUM OF INDUSTRY APPLICATIONS

Because of these benefits, nearly every industry is exploring the potential of AM. Rollett is leading eight high-profile collaborative projects aimed at advancing the state of materials science as it relates to AM. His sponsors and collaborators include NASA, the Office of Naval Research, the US Department of Energy, the Advanced Projects Research Agency, Lockheed, and Honeywell. These projects are aimed at perfecting AM materials and processes for a range of applications, including industrial heat exchangers, nuclear equipment, and aircraft.

Rollett also enjoys a close relationship with Argonne National Laboratory, which allows his team to utilize Argonne's Advanced Photon Source (APS), a Department of Energy Office of Science User Facility. This advanced equipment produces extremely bright, high-energy X-rays that reveal the intricacies of the 3D printing process, including how lasers melt and fuse metal powders together. By observing these processes at the micro scale, Rollett and his team are increasing the shared understanding of how gas pockets, fractures, and other materials defects form during AM.

Because of the skyrocketing interest in AM, Rollett leads a team of nine Ph.D. students and three post-doctoral researchers in MSE — and plans to add more students to manage the workload. “I can’t imagine anything more exciting than revolutionizing the basic manufacturing processes that have been in use for decades,” concludes Rollett. “Ten years ago, I would have laughed if someone had told me about the materials challenges I’m studying today.”

McHenry Wins Global Recognition — and a Patent

In June, **Professor Michael E. McHenry** was recognized by the North Atlantic Treaty Organization (NATO), an international alliance that consists of 29 member states from North America and Europe.

NATO honored McHenry for outstanding technical achievement as part of a team studying the issue of “Rare Earth Criticality” at the NATO Applied Vehicles Technology (AVT) meeting in Liptovski, Slovakia. This MSE professor has long been at the forefront of exploring the important contributions of rare earth materials in addressing global energy concerns. In 2014, he served as the technical evaluator at a NATO AVT specialist meeting called “Scarcity of Rare Earth (RE) Materials for Electrical Power Systems.” Since then, he has served as a NATO Distinguished Lecturer on this topic and participated in working groups focused on rare earth materials. In April 2019, Carnegie Mellon hosted an AVT exploratory team from NATO, resulting in new recommendations for efforts related to rare earth criticality.

In addition, McHenry is a member of a team of researchers, including two MSE alumni, that received the Carnegie Science Award for Advanced Manufacturing and Materials in recognition of their work on permeability engineering through strain annealing. The team was honored at the 23rd annual Carnegie Science Awards celebration on May 10 at the Carnegie Science Center in Pittsburgh. The researchers include McHenry, MSE alum **Paul Ohodnicki** of NETL, MSE alum **Alex Leary** of NASA Glenn, Kevin Byerly of NETL, and Vladimir Keylin of NASA Glenn. Working together, these experts from Carnegie Mellon, National Energy Technology Laboratory (NETL), and NASA Glenn Research Center are developing a novel manufacturing process to create electromagnetic cores that will revolutionize technological innovation for power electronic applications.

In collaboration with Magnetics, a Division of Spang and Company, the team recently was awarded patent number US 10,168,392, “Tunable Anisotropy and Resulting Permeability in Co-Based Metal Amorphous Nanocomposite Materials.” Thanks to partnerships with industry, the technology has a clear path into the marketplace, where it will benefit society by reducing the footprint of electric operations, driving down the cost and increasing the reliability of electricity, and improving the performance of electronics technology in the aerospace, aviation, automotive, military, and other growth industries.



AIME Publishes Harold W. Paxton's Oral History

The American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) has honored MSE's Professor Emeritus, **Harold W. Paxton**, by publishing his oral history. In capturing oral histories via videos and live interviews, AIME hopes to preserve significant milestones shared by key leaders within the mining, metallurgy, and petroleum engineering disciplines. In his colorful recollections, Paxton reflects on his childhood attending a two-room village school in the UK, his move to Pittsburgh for college, his family, and his long career at Carnegie Mellon's Department of Materials Science and Engineering. Watch Paxton's video or read the transcript at



https://ethw.org/Oral-History:Harold_W._Paxton.

Holm Garner's Attention from ASM and *Science*

Professor Elizabeth Holm has been selected as the ASM Edward DeMille Campbell Memorial Lecturer for the year 2021. The lecture is scheduled for presentation during the International Materials and Technologies (IMAT) conference, to be held in September 2021 in St. Louis, Missouri. In keeping with the ASM tradition, Holm's lecture will be published in *Metallurgical and Materials Transactions* immediately following her presentation.

ASM International is the preeminent association for engaging and connecting materials professionals and their organizations to the resources necessary to solve problems, improve outcomes, and advance society.

Established in 1925, the lectureship honors the memory of Edward DeMille Campbell, a distinguished Honorary Member of ASM, by the selection committee's choice of a person of high stature and achievement in the field of materials science and engineering, and of demonstrated lecturing ability.

Holm has also published a perspective piece about the value of black boxes in the April 5, 2019, edition of *Science*. Holm's article looked at the value of using artificial intelligence (AI) methods, including machine learning, to study complex problems in the physical sciences and engineering. Many experts argue that the human brain may be incapable of understanding the results of AI — the black box — because, by nature, its algorithms are too advanced for our comprehension. However, Holm argues that AI is useful in three instances: (1) when the cost of failure is low, (2) when AI produces results that are far superior to human analysis, and (3) when AI can serve as an inspiration and point of study for human inquiry. "Although AI thought processes can be limited, biased, or outright wrong, they are also different from human thought processes in ways that can reveal new connections and approaches," writes Holm.

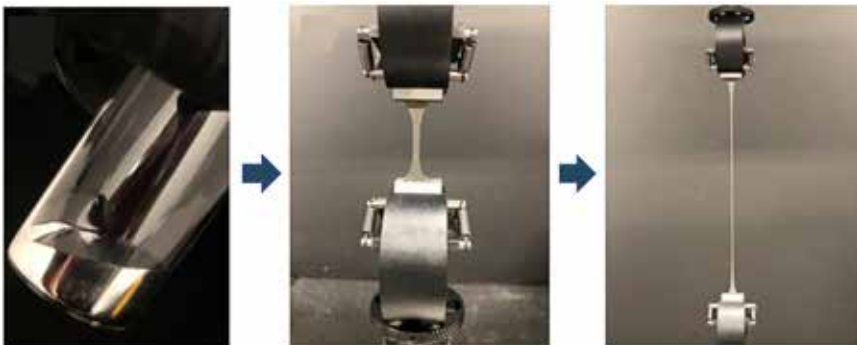


[In defense of the black box](#)

Bockstaller and Lu Publish Findings

Professor Michael Bockstaller and doctoral student Zhao Lu co-authored an article in the May 20 issue of *Nature Nanotechnology* describing a new methodology for creating stretchable polymer composites with enhanced electrical and thermal properties. Defined by a collaborative, interdisciplinary team, the new process enables the one-step processing of liquid metal nano droplets into compliant polymeric hybrid materials — with potential applications in areas such as soft robotics, self-healing electronics, medical devices such as neural interfaces, and power generation. The participating polymer chemists and engineers — all from Carnegie Mellon — combined their expertise in foundational science and engineering to devise a method that

uniformly incorporates eutectic gallium indium (EGaIn), a metal alloy that is liquid at ambient temperatures, into an elastomer. This created a new material — a highly stretchable, soft, multi-functional composite that has a high level of thermal stability and electrical conductivity. In addition to Bockstaller, CMU faculty researchers included Carmel Majidi (Mechanical Engineering) and Krzysztof Matyjaszewski (Chemistry). Also on the team were CMU doctoral students Jiajun Yan, Mohammad H. Malakooti, Zongyu Wang, Navid Kazem, and Chengfeng Pan.



Transformation of a liquid metal into a low modulus rubber hybrid material with large strain elasticity

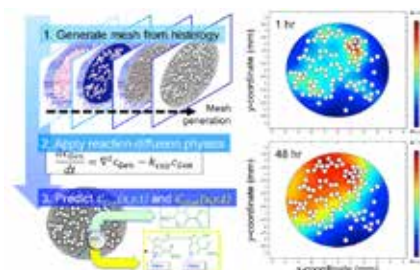
Feinberg Elected to ARMI



With joint appointments in both Materials Science and Biomedical Engineering, **Professor Adam Feinberg** has been elected to the Leadership Advisory Committee for the Advanced Regenerative Manufacturing Institute (ARMI). Located in Manchester, New Hampshire, ARMI is a nonprofit organization that supports the commercialization of engineered tissues and tissue-related technologies, including tissues- and organs-on-a-chip. ARMI's mission is to make practical the large-scale manufacturing of engineered tissues and tissue-related technologies, to benefit existing industries, and grow new ones. Feinberg's research focuses on the development of materials-based, regenerative strategies with the goal of engineering the self-organization and self-assembly of various cell types into tissue structures and understanding the emergence of higher-order function in neuromuscular and cardiovascular systems. His specific focus is on understanding the interaction of cells and tissues with engineered materials, in order to determine how cells sense, respond to, and modulate their environment.

Bettinger Receives Funding for Aneurysm Research

Supported by a grant from the Pennsylvania Infrastructure Technology Alliance (PITA), **Professor Christopher Bettinger** is leading an interdisciplinary team that aims to make brain aneurysm treatments more successful and more permanent. Aneurysms — which occur when weakened blood vessels bulge, causing blood to pool — can happen at any age. When they rupture, the mortality rate is almost 60 percent without treatment.



Current aneurysm treatments involve endovascular therapy, in which surgeons insert a platinum coil through a catheter and directly into the vasculature defect, causing a blood clot and sealing off the defect. Unfortunately, this treatment fails 30 percent of the time because the human body breaks down and absorbs the tissue clot — allowing the aneurysm to form again. Because this model isn't sustainable, Bettinger partnered with Ancure, a Pittsburgh-based company that specializes in medical device coatings, as well as Michael Horowitz, a neurosurgeon at the Pennsylvania Brain and Spine Institute. With financial support from PITA, the team has been testing GeniCoat, a chemical compound derived from gardenia fruit extract that serves as an extremely successful cross-linker for proteins. This material creates a much more stable clot. The initial PITA-funded *in vitro* component of this study has been successful, and now the team is partnering with Mayo Clinic for the *in vivo* component.



[Revolutionizing brain aneurysm treatments](#)

Pistorius and Assis Recognized by IOM3

Professor Chris Pistorius and doctoral student **Karina Assis** have been nominated by the Institute of Materials, Minerals and Mining (IOM3) for the Adrian Normanton Medal for their paper, "Improved Cold-Finger Measurement of Heat Flux Through Solidified Mould Flux," published in *Ironmaking & Steelmaking*. The Adrian Normanton Award is given to the best technical paper on the topic of steelmaking or casting. *Ironmaking & Steelmaking* editors consider all papers published in the journal in the previous two years, based on recommendations received from the journal's editorial board. The final award nomination is approved by the IOM3 Iron and Steel Society.

The award will be presented to the co-authors in November at the Application Steel Alloy Development Conference, held in Sheffield, UK.



MSE Ranked #10 by US News & World Report



Department Adds Masters Degree Programs

US News & World Report has released its rankings for undergraduate engineering programs for 2020. The Department of Materials Science and Engineering is ranked #10 among materials science programs in the United States, up from #11 in 2019. The engineering department rankings are based on peer assessment surveys sent out to engineering school deans and faculty members in spring 2019.

Five undergraduate departments in CMU's College of Engineering received a top 10 ranking: MSE, Computer Science, Electrical and Computer Engineering, Mechanical Engineering, and Environmental Engineering.

Overall, Carnegie Mellon's College of Engineering was ranked #6 for the second year among US engineering schools. The University maintained its #25 ranking among all national universities.

In recognition of the increasing role of computational tools and approaches, the Department of Materials Science and Engineering is offering a new masters degree. The Master of Science in Computational Materials Science and Engineering (CMSE) degree will equip students to leverage computational science to enhance their understanding of the structure, properties, and processing of materials. They can then apply this knowledge to solve complex materials science problems.

A full-time, coursework-based degree, the new CMSE masters covers core MSE topics, while also allowing students to take advanced courses in computational methods. Students will normally complete the degree in three 15-week academic semesters.

In addition, MSE is joining with CMU's School of Computer Science to offer an optional M.S. in CMSE and Integrated Study in Computer Science. The CMSE + ICS degree program is a four-semester curriculum that combines graduate study in Computational MSE with a focus on core and emerging skills in Computer Science.

Learn more about these new degree programs at:



https://www.cmu.edu/engineering/materials/graduate_program/master-of-science-programs/master-of-science-in-materials-science-and-engineering/index.html

Movers and Shakers

- **Dr. Neetha Khan**, former Director of MSE Masters Programs, has joined the CIT Dean's Office Engineering Research Accelerator Team as a Research Development Associate. Khan joined MSE in the summer of 2008 when she accepted a position with the Materials Research Science and Engineering Center. The Department is grateful for her 11 years of service and wishes her the best in this exciting new position.
- MSE Undergraduate Academic Advisor **Paige Houser** has been promoted to MSE Senior Academic Advisor. In addition to continuing in her undergraduate advising duties, Houser will now be advising all masters students in the Department. In addition, she will assist with the implementation and management of new and ongoing M.S. programs in MSE.
- **Daniel Flaherty** has joined the MSE technical staff as a Materials Characterization Specialist. Flaherty joins MSE after a 26-year career with electron microscopy leader Gatan, where his most recent role was as a Field Service Engineer. He graduated from Rochester Institute of Technology with a B.S. in Imaging Science.
- Also joining the Department's technical staff is **Logan Solotky**, a new Materials Characterization Specialist. Solotky previously worked at RJ Lee Group as a Geologist/Petrographer and at PPG Industries as a Lab Technician. He holds a B.S. in Geosciences from Boise State University.



[US News best colleges](#)

Catching the Wave

Michelle Wolf's company, New Wave Foods, reels in success with its plant-based seafood products



Michelle Wolf

San Francisco-based entrepreneur **Michelle Wolf** (B.S. 2014, M.S. BME, 2015) has a closer connection to MSE than most alums. She is the daughter of **Jason Wolf** (M.S. 2004), whose 25-year CMU career included 17 years as Supervisor of the X-Ray Laboratory.

"Growing up, it was fun going to work with my dad because he would give my brother and me these cool demonstrations about materials science. Over the years, I became friends with the other MSE kids at the Christmas parties," says Wolf. "As an undergrad, I was a work-study in the administrative offices. I have many fond memories of the MSE Department."

When Wolf enrolled at CMU in 2010, she initially considered a medical career. "I was reluctant to admit my interest in materials science, because that was my dad's area," she says with a laugh. "But I realized I was drawn to the problem-solving and systems-level thinking done by engineers. The Materials Science/Biomedical Engineering (BME) double major was the perfect intersection of my interests."

After earning a masters in BME, Wolf found herself at a crossroads. "After working as a corporate R&D intern, I realized that environment was not right for me," she notes. "I'm drawn to projects that can have a positive global impact. I enjoy energizing teams to give life to breakthrough ideas. I wanted to build something meaningful."

MAKING SEAFOOD MORE SUSTAINABLE

Wolf was presented with an entrepreneurial path when she met Bay Area oceanographer Dominique Barnes, who described the devastating environmental impact of the world's seafood supply chains. "The plant-based burger market was beginning to take off, as consumers were recognizing the beef industry's negative environmental impact," Wolf recalls. "But there wasn't the same awareness about the impact of seafood supply chains — and no high-quality plant-based seafood products."

Together with Barnes, Wolf founded New Wave Foods in 2015 and later brought on Mary McGovern, an experienced consumer foods executive. The company's first product is a plant-based shrimp substitute. "We chose shrimp because it is the number-one seafood in America — and 90% of shrimp are imported via somewhat blurry supply chains," explains Wolf. "Our product represents a way for people to enjoy the experience of eating shrimp without any questionable labor policies, harvesting practices, or environmental impacts."

As Chief Technology Officer, Wolf used her MSE background to get the product's look and feel right. "Applying knowledge of polymer interactions and protein science was critical to perfecting the shape and texture," Wolf says. "Materials characterization techniques help quantify our product's similarity to shrimp and ensure best-in-class quality control."

SWIMMING IN EARLY SUCCESS

The start-up recently earned a vote of confidence from Tyson Foods when it awarded venture capital to New Wave. The company plans to start large-scale production later this year, then launch its product to the food service industry in 2020.

Wolf has found her time at MSE and CMU to be priceless. "I learned to tackle a complicated problem and solve it, whether that meant finding the right technical solution or reaching to the right external resources for guidance. It was all about being innovative and collaborative. Those qualities have been the foundation of the culture at New Wave and will continue to fuel the company's future growth," Wolf concludes.



Growing up, Wolf was a familiar face in MSE — including this visit when she was an eighth grader.

Lee Semiatin Elected to NAE



Sheldon "Lee" Semiatin

Sheldon "Lee" Semiatin (*M.S. 1972, Ph.D. 1977*) has been elected to the National Academy of Engineering (NAE), one of the highest honors in the profession. After 27 years at the Air Force Research Laboratory (AFRL) at Wright-Patterson Air Force Base in Ohio, Semiatin retired in 2018. A former Research Leader and the Senior Scientist for Materials Processing and Processing Science, today he has assumed emeritus status.

The NAE recognized Semiatin for his contributions to the thermomechanical processing of aerospace alloys and emerging intermetallic materials.

During 14 years at Battelle and his tenure at AFRL, Semiatin developed and applied fundamental knowledge for the thermomechanical processing of metals — e.g., forging, rolling, and extrusion — to enhance processability and control microstructure. His research has helped reduce costs, increase reliability, and improve the performance of components in airframe, propulsion, spacecraft, and power systems.

"Election to the NAE is a wonderful recognition of the work performed by myself and my colleagues in government labs, academia, and industry," says Semiatin. "I have been fortunate to participate in the evolution of processing from an art to a firmly established discipline, both in the US and worldwide."

According to Semiatin, his passion for developing and applying scientific concepts to solve industrial problems began when he was a graduate student in MSE. "I was lucky to work with **Henry Piehler**, who was an associate professor at the time specializing in mechanical metallurgy with an emphasis on deformation processing," Semiatin recalls. "For my doctoral thesis, Henry got me interested in the forming of clad sheet metals, which led to cooperative work with Clad Metals Corp in Canonsburg and the ALCOA Tech Center. The work was fairly broad, allowing me to learn the basics of processing, as well as the importance of quantitative models for use in industrial environments."

Rusty Gray Honored by APS

George T. "Rusty" Gray III (*Ph.D. 1981*) is the 2019 recipient of the American Physical Society's (APS) George E. Duvall Shock Compression Science Award. This honor, one of the highest in physics, recognizes an APS member's contributions to understanding condensed matter and non-linear physics through shock compression.

As a Scientist 6 — the highest ranking for scientists — at Los Alamos National Laboratory, Gray investigates the structure/property behavior of materials under extreme conditions. His work on shock compression and shock-wave deformation supports the Laboratory's national security mission by bringing insight into how materials respond under high strain rate and high shock loading.

This is only the most recent honor for Gray. In 2017, he was elected to the National Academy of Engineering, and in 2018 he received the DYMAT association's John S. Rinehart Award, which recognizes outstanding and creative work in the science and technology of dynamic processes in materials.

In his 35 years at Los Alamos, Gray has made breakthroughs in understanding the behavior of materials subjected to dynamic loading, which has obvious implications for national security and defense. But his research has also helped create more crash-resistant cars and more damage-tolerant jet engine blades.

"I enjoy living on the fence between fundamental research and applied materials science and engineering," notes Gray. "Beginning with my doctoral research at MSE, I've always wanted to make a real difference in the world." Gray credits his mentor, **Professor Jim Williams**, with instilling a practical, outcome-driven mindset. "All research should have a final purpose," he emphasizes.

Gray, who considered becoming a university professor at several points in his career, has passed on this same lesson to 36 post-doctoral students over the years at Los Alamos — all of whom have made their own positive impact.

< George T. "Rusty" Gray III (center)





Yumin Zhang

ZHANG WINS POSTGRADUATE SCHOLARSHIP

Ph.D. candidate **Yumin Zhang** has received a Postgraduate Scholarships-Doctoral (PGS D) from the Natural Science and Engineering Research Council of Canada. The PGS D program provides financial support to high-caliber doctoral students in the natural sciences or engineering. Zhang was offered the fellowship based on her academic excellence and research abilities, as well as her communication, interpersonal, and leadership qualities. Zhang's advisor is **Professor Venkat Viswanathan**.

HELSEL NAMED PERRYMAN SCHOLAR

Junior **Lindsey Helsel** has been selected as a 2019 Perryman Scholar by the Perryman Family Foundation to support her education at CMU. With a dual major in Materials Science and Engineering and Biomedical Engineering, Helsel plans to work in research or industry to help develop treatments for multiple sclerosis, which has affected her own family. The Perryman Scholarship is designated for students in technology, engineering, math, or metals who live within 150 miles of Pittsburgh. Helsel is from Altoona, Pennsylvania.



Thomas Matson

MATSON AWARDED GRADUATE RESEARCH FELLOWSHIP

Thomas Matson, who graduated in May, has won a Graduate Research Fellowship from the National Science Foundation to support his work in the Ph.D.-track graduate program at the Department of Materials Science and Engineering (DMSE) at MIT beginning this fall. While at MSE, he was an undergraduate researcher in **Professor Elizabeth Holm's** group, focused on using computer vision and machine learning to measure grain size from microstructure data. Matson plans to continue pursuing computational materials research at MIT.

WU RECOGNIZED AT ADDITIVE MANUFACTURING CONFERENCE

Dino Ziheng Wu, a doctoral student in **Professor Anthony Rollett's** research group, won second place in the student poster conference at RAPID + TCT 2019, held in Detroit in May. Sponsored by SME, RAPID + TCT is the world's most influential conference and exposition focused on additive manufacturing. Wu presented a poster titled "Study of the Spreadability and Printability of Hydride-Dehydride (HDH) Ti-6Al-4V Powder in an Electron Beam Additive Manufacturing Process." The poster represents collaborative research with Professor Jack Beuth in CMU's Mechanical Engineering Department and Professor Sneha P. Narra from Worcester Polytechnic Institute.

ROLLETT GROUP WINS AT TMS 2019

Seven students in the research group of **Professor Anthony Rollett** won recognition at the 148th Annual Meeting & Exhibition of the Minerals, Metals & Materials Society (TMS), held in March in San Antonio. **Po-Ju Chiang, Runbo Jiang, Ross Cunningham, Niranjan Parab, Cang Zhao, Kamel Fezzaa, and Tao Sun** were awarded the first-place prize for the best oral presentation, as well as the third-place prize in the manuscript competition. The students' research presentation was entitled "*In Situ* Characterization of Hot Cracking Using Dynamic X-Ray Radiography."

TANG RECEIVES TWO AIST AWARDS

Ph.D. candidate **Dai Tang** was honored with two awards at this year's AISTech 2019 Conference. Sponsored by the Association for Iron & Steel Technology, AISTech was held in Pittsburgh in May. Tang received the Ladle & Secondary Refining Best Paper Award for her paper, "Nitrogen Removal From Manganese-Alloyed Advanced High-Strength Steel in a Tank Degasser: Kinetic and Thermodynamic Model." She also placed second in the graduate student poster contest. Tang's advisor is **Professor Chris Pistorius**.

< Dai Tang



MSE Celebrates Commencement 2019

The Department of Materials Science and Engineering hosted its 2019 Commencement ceremony on Sunday, May 19, at the Twentieth Century Club in Oakland.

This year, MSE awarded 25 B.S. degrees, 27 M.S. degrees, and 10 Ph.D. degrees. As these 62 graduates leave Carnegie Mellon, the Department wishes them all the best.

The following awards were presented during the Commencement ceremony:



- *The William W. Mullins Undergraduate Award*
Recipient: **Xuanyu (Leon) Min**

- *The Hubert I. Aaronson Undergraduate Award*
Recipient: **Thomas Matson**

- *The James W. Kirkpatrick & Jean Kirkpatrick Keelan Award*
Recipient: **Kira Vargas**

- *The William T. Lankford Jr. Memorial Scholarship*
Recipient: **Mari-Therese Burton**

- *ASM Golden Triangle Chapter Outstanding College Senior Award*
Recipient: **Gaurav Balakrishnan**

- *Award for Academic Excellence in the Masters Program*
Recipient: **Bo Lei**

- *Award for Research Excellence in the Masters Program*
Recipient: **Maituo Yu**

- *The 2019 Krivobok Brooks Award for Excellence in Graduate Metallography*
Recipient: **Siyuan Liu**

- *The 2019 Krivobok Brooks Award for Excellence in Undergraduate Metallography*
Recipient: **Zhuri Solan**

- *The 2019 Paxton Award for Best Doctoral Dissertation in Materials Science & Engineering*
Recipient: **Caroline Gorham**

- *The Philbrook Prize*
Recipient: **Professor Anthony Rollett**

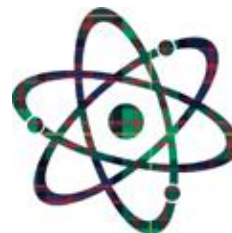


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In addition, Carnegie Mellon University does not discriminate in admission, employment, or administration of its programs on the basis of religion, creed, ancestry, belief, age, veteran status, sexual orientation, or gender identity. Carnegie Mellon 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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CMU-CIT-MSE