

# MSE

Materials Science and Engineering | Missouri S&T | Fall 2019

THE POWER  
PLANT OF THE  
FUTURE

page 2

# 150 YEARS:

## LET'S CELEBRATE MSE AND MISSOURI S&T

Metallurgical engineering has been a part of the Rolla curriculum from our founding in 1870 as a pioneering technical school to our 21st-century standing as a national technological university. The Missouri S&T story — and the materials science and engineering legacy — span a century and a half of remarkable change.

Get set to celebrate 150 years of Miner pride!

A year of special events kicks off with MinerFest 150 in October 2020 and concludes with the Alumni of Influence celebration in November 2021. In between, mark your calendar in green for our biggest best-ever festival — or “Bestival” — over St. Pat’s Weekend in March 2021.

Watch for the publication launch in October 2020 of a commemorative book by Curators’ Distinguished Teaching Professor emeritus Larry Gragg. His history of the university covers 150 years of Miner milestones, memories and mischief.

150.mst.edu

## DEAR ALUMNI, COLLEAGUES AND FRIENDS

On behalf of the students, staff and faculty of materials science and engineering (MSE), I welcome you to our 2019 newsletter.

MSE continues to grow, in just about every metric, and all is well in the best department, with the best students, staff and faculty, at Missouri S&T. Most importantly, our students are continuously sought by employers, and they are getting jobs.

We are the seventh-largest undergraduate MSE department in the country, graduating roughly 60 students each year. We had over 60 master's and Ph.D. students for last year, and judging by our increasing research productivity, I estimate we will average over 70 graduate students in the coming years.

We had over \$4.5 million in research expenditures this past fiscal year, and we landed a number of major, multiyear research awards, among them Prof. **David Lipke's** \$1.8 million ARPA-E grant to develop ultra-high-temperature ceramic heat exchangers and Prof. **Laura Bartlett's** \$3.95 million Army Research Office grant to develop advanced high-strength steels. And Prof. **Ron O'Malley** has directed the PSMRC to a record 19 industrial members and over \$1 million in annual research funding. I want to give a shout out to all of our faculty and staff for working very hard to raise our level and productivity.

Prof. **Robert "Bob" Schwartz** officially retired in September after 16-plus years of service. Bob did a lot for our department over the years, but also took on several administrative positions both at



Missouri S&T and at the University of Missouri System, serving as vice provost for academic affairs at Missouri S&T, chief of staff to the UM System president, and most recently as interim vice president for both academic affairs and for research and economic development at Mizzou.

Our newest faculty member, Prof. **Yijia Gu**, started in January 2019. He came to us from the Arconic Technical Center in Pittsburgh, after earning his Ph.D. in materials science and engineering from Penn State in 2014. Part of the campus's Advanced Manufacturing Signature Area, he brings a wealth of experience in computational materials science, additive manufacturing of metals and alloys, alloy design, and microstructural modeling of metallurgical processes.

There are many more activities and accomplishments of our students, staff and faculty highlighted on the following pages.

We would not be where we are today without you, our alumni, colleagues and friends. Please stop by so we can thank you in person and show you around MSE.

Warm Regards,

**Greg Hilmas**  
Curators' Distinguished Professor  
of ceramic engineering, chair of  
materials science and engineering



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# THE POWER PLANT OF THE FUTURE

he power plant of the future could be smaller, highly efficient and even portable, and S&T MSE researchers are helping make this transformation happen.

With \$1.45 million from the U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E) **David Lipke** and his fellow researchers are developing more-efficient heat exchangers for energy production. The devices are used to transfer heat between two or more fluids and are commonly used in systems like chemical plants, petroleum refineries, and refrigeration and air-conditioning systems.

Researchers at S&T will use advanced manufacturing processes to construct compact heat exchangers from ceramic materials that can operate in the extreme environments of next-generation power cycles.

"Operation of a heat exchanger under these extreme conditions has never before been attempted," says Lipke, an assistant professor of ceramic engineering and the project's principal. "Missouri S&T is uniquely poised to overcome long-standing materials challenges because of our expertise in ceramic additive manufacturing and joining methods and our unique facilities to test materials in extreme environments."

Future power plants will be designed to operate at extremely high temperatures and pressures. Lipke says the high temperatures will maximize thermal efficiency, thereby reducing emissions and water consumption, while high pressures will increase power density and dramatically reduce the size of turbomachinery components.

The researchers will use the ARPA-E grant funding to build recuperative heat



## NASA ALUMNA RETURNS TO DELIVER O'KEEFE LECTURE

**Lucie Johannes Sommer**, MetE'02, PhD MetE'06, the International Space Station (ISS) Visiting Vehicle chief engineer for NASA at the Johnson Space Center in Houston, returned to campus last fall to deliver the 10th annual Dr. Thomas J. O'Keefe Lecture.

Sommer, who also holds a master of engineering degree in materials science and engineering from MIT, talked about her personal path to NASA and what led to her success. She shared what's going on at Johnson Space Center, what she and her teammates have done as metallurgical engineers at NASA, and how she was able to impact the Orion Multi-Purpose Crew Vehicle program and the International Space Station.

Working at NASA was not part of her career plans when she started as a metallurgical engineering student at S&T, but keeping her mind open to new opportunities and experiences led her to a career that was a lot more fun and fulfilling than she could have possibly imagined.

**Thomas J. O'Keefe**, MetE'58, PhD MetE'65, taught in the metallurgical engineering department from 1953 until his death in 2008.

The lecture series was funded by **Sally and Joe**, MetE'72, **Rupp**, who was a student of O'Keefe's, to maintain the strong academic environment and technical education that O'Keefe helped to establish over his 40-year career.



**LUCIE JOHANNES SOMMER**  
ISS Visiting Vehicle chief  
engineer for NASA at the  
Johnson Space Center

exchangers that operate at higher temperatures from current levels of 700 degrees Celsius (1,292 degrees Fahrenheit) up to 1,100 degrees C (2,012 degrees F) by replacing high-strength metallic superalloys with ultra-high-temperature ceramics.

Working with Lipke on the project are **Greg Hilmas**, Curators' Distinguished Professor of ceramic engineering and chair of materials science and engineering; **Bill Fahrenholtz**, Curators' Distinguished Professor of ceramic engineering and director of Missouri S&T's Materials Research Center; **Ming C. Leu**, Keith and Pat Bailey Professor of mechanical and aerospace engineering and director of Missouri S&T's Intelligent Systems Center; and **Jeremy Watts**, research

assistant professor of materials science and engineering.

The Missouri S&T team is partnering with researchers at the National Renewable Energy Laboratory and Echogen Power Systems to develop marketable technologies based on the outcomes of this project.

Funding comes from ARPA-E's High Intensity Thermal Exchange through Materials and Manufacturing Processes (HITEMMP) program, which seeks to develop new approaches and technologies for the design and manufacture of high-temperature, high-pressure, and highly compact heat exchangers and components.



# S&T OFFERS RESEARCH OPPORTUNITIES FOR STUDENTS FROM HISTORICALLY BLACK UNIVERSITIES

Six undergraduate students from Tennessee State University in Nashville and Tuskegee University in Tuskegee, Ala., spent two months this summer conducting engineering research at Missouri S&T as part of S&T's Summer Engineering Research Academy (SERA), which ran from May 28 through July 27. The program is sponsored by S&T's College of Engineering and Computing.

**Kelley R. Wilkerson**, CerE'07, PhD CerE'12, assistant teaching professor of materials science and engineering, is the program director.

"Each of the students worked with an S&T research group based on their expressed

interest areas of metallurgical engineering, automation or advanced manufacturing," Wilkerson says. "Each student spent about 30 hours a week on their research project, and spent their remaining time exploring the university, touring labs, attending personal development workshops and participating in social activities."

"This was a new program, and it was a tremendous success," says **John Myers**, CEC associate dean and a professor of civil, architectural and environmental engineering. "We wanted to introduce more undergraduate students from underrepresented groups to the exciting research going on here at Missouri S&T, in

hopes of generating interest in going on to graduate school after they finish their bachelor's degrees. We plan to continue to offer this program in the future."

Myers credits much of the program's success to the involvement and support of the Missouri S&T faculty research mentors and their research teams, along with the engineering deans at Tennessee State University and Tuskegee University, both historically black colleges and universities (HBCUs). The deans are **S. Keith Hargrove**, MS EMgt'87, of Tennessee State, and **Heshmat Aglan** of Tuskegee.

# FACULTY NEWS

**Laura Bartlett**, MetE'08, PhD MetE'13, Robert V. Wolf Associate Professor in Metallurgical Engineering, received the Research Catalyst Award from the S&T College of Engineering and Computing.

**Dick Brow**, Curators' Distinguished Professor of materials science and engineering, received the Outstanding Educator Award from the Education and Professional Development Council of the American Ceramic Society.

**Greg Hilmas**, Curators' Distinguished Professor of ceramic engineering and chair of materials science and engineering, presented the fall 2019 Distinguished Alumni Lecture at the University of Michigan's materials science and engineering department in Ann Arbor on Oct. 25.

**Mike Moats**, MetE'92, MS MetE'95, professor of materials science and engineering, received the 2017-18 Outstanding Teaching



Schlesinger (right)

Award, the AIME James Douglas Gold Medal and the SME-MPD Millman of the Year award.

**Ron O'Malley**, the F. Kenneth Iverson Chair Professor in Steelmaking Technologies, was elected president of AIST. He is only the second academic to serve as president. The first was the late **Kent Peaslee**, PhD MetE'94.

**Mary Reidmeyer**, CerE'78, MS CerE'84, PhD CerE'93, teaching professor emeritus of ceramic engineering, received the Greaves-Walker Lifetime Service Award from the Education and Professional Development Council of the American Ceramic Society.

**Von Richards**, professor emeritus of metallurgical engineering, received the Thomas W. Pangborn Gold Medal from



VanAken

the American Foundry Society. This is the highest honor AFS awards.

**Mark Schlesinger**, MetE'80, professor of metallurgical engineering, was inducted as a 2018 Fellow of ASM International at MS&T in Columbus, Ohio.

**Jeff Smith**, MS CerE'91, PhD CerE'93, professor of ceramic engineering, received the 2018 Faculty Teaching Award and the 2017-18 Outstanding Teaching Award.

**David VanAken**, professor emeritus of materials science and engineering, received the Barlow Award from the Steel Founders Society of America, and the Julia and Johannes Weertman Educator Award from TMS.

## 'SUPERALLOY' EXPERT DELIVERS GOLICK LECTURE AT S&T



Seidman

**David Seidman**, the Walter P. Murphy Professor of materials science and engineering at Northwestern University and an expert on high-strength materials known as "superalloys," delivered the 26th A. Frank Golick Lecture in Materials Science and Engineering on March 20.

In his talk, titled "Correlative study of the chemical and electrical dopants in ex-situ

doped Si nanowires," Seidman discussed how research on the properties of atomic-scale materials known as nanowires has yielded unexpected results, and how his expertise has helped to advance understanding of these materials and their potential applications.

Seidman is known for applying field-ion microscopy (FIM), atom-probe FIM and atom-probe tomography to a wide range of scientific and technological problems. His current research

is focused on superalloys – high-performance alloys that possess superior mechanical strength at high temperatures as well as good surface stability and corrosion resistance. He is working to develop high-temperature cobalt-based superalloys and high-temperature aluminum alloys.

Superalloys are widely used in extreme environments where tremendous heat or corrosion may occur, like power plants, aerospace applications, and the oil and gas industries.

Seidman is a member of the National Academy of Engineering, the EU Academy of Sciences, a fellow of the American Academy of Arts & Sciences, the American Association for the Advancement of Science, the American Physical Society, ASM International, TMS and the John Guggenheim Memorial Foundation.

The **A. Frank Golick** Lecture Series, named after Golick, MetE 1918, was created in 1969 through a memorial fund established by Golick's widow, **Loree**, to attract nationally recognized metallurgical engineers to the campus to interact with students and faculty and to present a guest lecture.

# ALUMNI UPDATES

» **Delbert Day**, CerE'58, was honored with a Distinguished Alumni Award from Penn State, the highest honor the university bestows on its alumni. Day holds master's and doctoral degrees from Penn State's College of Earth and Mineral Sciences.

Day was also honored during a symposium named for him in Toronto as part of the Global Forum on Advanced Materials and Technologies for Sustainable Development and the Fourth International Conference on Innovations in Biomaterials, Biomanufacturing and Biotechnologies.

» **Dwight Viehland**, CerE'84, Chem'84, MS CerE'87, professor of materials science and engineering at Virginia Tech, was reappointed as the Jack E. Cowling Professor of Engineering. He has held the Cowling Professorship since 2014.

» **Rhonda Pautler**, MetE'87, serves as Area 1 director and **John Burgess**, MetE'85, serves as Area 4 director for the Miner Alumni Association

» **Steve Jung**, CerE'05, MS CerE'07, PhD MSE'10, chief technology officer for MoSci Corp., received the Alumni Achievement Award from the Miner Alumni Association during Homecoming 2019.

» **Bill Hallett**, MetE'55, retired senior business analyst for Truck Engine Marketing in the Engine Division of Caterpillar Inc., received the Frank H. Mackaman Alumni Volunteer Service Award from the Miner Alumni Association during Homecoming 2019.

» **Ted Planje**, director of executive communications for Eli Lilly, visited campus recently to tour McNutt Hall and see the updates to the Planje Auditorium. The auditorium was named for his father, the late **Theodore J.M. Planje**, CerE'40, PhD CerE'50, former head of ceramic engineering and director of the School of Mines and Metallurgy.



MSE undergraduates, master's and Ph.D. students, and faculty at May 2019 commencement. Our department is the seventh largest in the nation.





# AN OFFER SHE COULDN'T REFUSE

Destinee Rea, CerE'15, knew she wanted to pursue a career in the STEM field. The problem? She had no idea which one. Drawn to S&T because of her interest in science and engineering and the flexibility it offered through the freshman engineering program, she says her decision was finalized when she received the Chancellor's Scholarship.

After considering engineering and later chemistry, Rea landed on ceramic engineering. She knew she wanted to be in a manufacturing environment after a summer internship in the glaze preparation department at Dal-Tile, a porcelain floor tile manufacturer.

"In manufacturing, the process of whatever you are manufacturing is essentially the same every day, but there is always a new

challenge," she says. "Whether you are trying to solve a quality problem that cropped up overnight or you're trying to make something run faster or better for your operators, every day feels like something new."

Today she is a process engineer in nuclear fuel manufacturing for Framatome, a nuclear energy company that designs, builds, advances and maintains the world's current nuclear fleet. The fuel produced

at Framatome accounts for around 5% of the total electricity generated in the United States, according to Rea.

"To me, the most rewarding part of working in manufacturing is that what I do every day contributes to something tangible," she says. "I can just go out on the manufacturing floor and see the fuel pellets that we are making and know that we are contributing to carbon-free electricity"

Rea encourages S&T students to remember that their path won't always be linear.

"It's easy to have certain expectations coming in to college as a freshman, but who really has life figured out at 18? Or 19? Or 20?" she says. "Finding a support system in the ceramic engineering department was key, really. My professors cared about whether I succeeded or not, and there was always a group of students that I could study with in the McNutt commons area."



## BROW TO LEAD NEW GLASS SCIENCE CENTER

**Richard Brow**, Curators' Distinguished Professor of materials science and engineering, will lead S&T's Center for Glass Science and Technology (CGST), one of four research centers established at S&T as part of a UM System multicampus research initiative.

The CGST will provide equipment and lab space to support research across the UM System related to the NextGen Precision Health Initiative and Institute. NextGen is expected to accelerate medical breakthroughs for patients in Missouri and beyond. The CGST builds on Missouri S&T's previous success in glass research, including the development of bioactive glasses to treat cancer and open wounds. Other faculty involved are **Ming C. Leu**, the Keith and Pat Bailey Professor of Integrated Product Manufacturing; **Julia Medvedeva**, professor of physics; **Julie Semon**, assistant professor of biological sciences; and Dr. Yezaz Ghouri, assistant professor of clinical medicine at MU Health Care.



Brannon



Gross



Rawlins

# MSE GRADS

## INDUCTED INTO ACADEMY

Three MSE graduates were inducted into the Academy of Mines and Metallurgy at a ceremony in the McNutt Hall Commons this past April.

**C. John Brannon**, Phys'85, CerE'85, Psyc'86, MS CerE'86, PhD CerE'89, of Noblesville, Ind., is executive director and CEO of Brannon Sowers and Cracraft PC. He earned a J.D. from the Chicago-Kent College of Law.

**Michael Gross**, MetE'88, MS MetE'94, of Owensboro, Ky., began his career in 1990 at ALCOA Warrick Operations and later held positions with Commonwealth Aluminum and Daicel Safety Systems America, as well as self-employment opportunities. A member of the Miner Alumni Association

board of directors since 2013, he is an Honorary Knight of St. Patrick.

**Charles "Hank" Rawlins**, MetE'91, MS MetE'92, PhD MetE'08, of Butte, Mont., is technical director of eProcess Technologies in Houston and managing director of Montana Process Research in Butte.

**Ronald O'Malley**, the F. Kenneth Iverson Endowed Chair of Steelmaking Technologies, received the Senior Faculty Award.

**Rebekah Blatt**, a senior in ceramic engineering, and **Caroline Hawickhorst**, a senior in metallurgical engineering, received scholarship awards from the academy.

# STUDENT UPDATES

- » A team of MSE students placed third and received the Judges' Choice Award in the ASM Geodesic Dome Design Competition. S&T's team members were **Ryan Van Dyke**, a senior in metallurgical engineering; **Kyle Dunsford**, a senior in metallurgical engineering; **Perrin Habecker**, a junior in metallurgical engineering; **Maalavan Arivu**, a Ph.D. student in materials science and engineering; and **Hans Pommerenke**, a Ph.D. student in ceramic engineering.
- » The S&T chapter of Keramos won the Diamond Award and the James I. Mueller Outstanding Chapter Award at the annual Keramos Convocation.
- » **Cameron Burky**, a senior in ceramic engineering, took home third place in the Keramos Disc Golf Competition.
- » **Parker Freudenberger**, a Ph.D. student in ceramic engineering, received the inaugural College of Engineering and Computing Graduate Educator Award.
- » **Alissa Reynolds**, a senior in ceramic engineering, won the Keramos-sponsored Mug Drop Competition with a 450-centimeter drop without failure. Watch Reynolds' mug drop at [Rol.la/MugDropAlissa](#).
- » Material Advantage, a student organization dedicated to the personal and professional growth of MSE students, sponsored an undergraduate speaking contest. **Bailey Ricketts**, a senior in ceramic engineering, took second place.
- » **Jamie Young**, a Ph.D. student in metallurgical engineering, received the Outstanding Graduate Student Award and Scholarship from the Mineral and Metallurgical Processing Division of SME.



## TESTING THEIR METAL

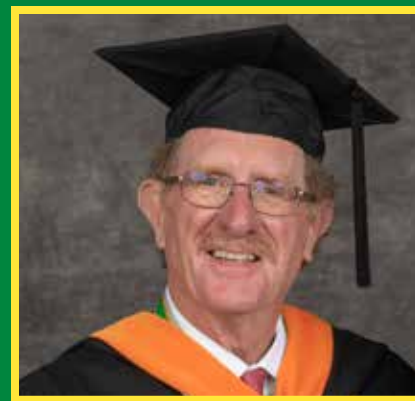
For the first time, a group of S&T students presented a hand-forged sword to demonstrate their bladesmithing skills as part of the TMS (The Minerals, Metals & Minerals Society) Bladesmithing Competition.

The competition was held in conjunction with the TMS 2019 Annual Meeting and Exhibition held in March at the Henry B. Gonzalez Convention Center in San Antonio, Texas.

Students had to produce a sword blade by hand-hammering or trip-hammer forging. Our students used campus blacksmithing and forging equipment to create their blade. They also created a leather scabbard as well as an intricate pattern on the blade.

The competition is designed to help students better understand concepts like heat transfer, coke combustion, forging, welding and quenching, says team advisor **Joseph W. Newkirk**, professor of metallurgical engineering.

The team had to produce a short video, a technical report, a poster presentation, and photographs of the blade and team with their creation.



## GIELOW HONORED AT COMMENCEMENT

**Kenneth D. Gielow**, MetE'70, MS MetE'71, of Festus, Mo., president of Imrie-Gielow Inc., received the Award of Professional Distinction during commencement ceremonies in May 2019.

Following graduation, Gielow spent nine years with the St. Joe Minerals Corp. as blast furnace superintendent, refinery superintendent and project manager for the construction of a lead strip caster and rolling mill. In 1980, he joined J. Imrie Sales Co., where he became a full partner in the refractory and corrosion-resistant materials distribution business, and the company name was changed to Imrie-Gielow.

Imrie-Gielow maintains two warehouses in St. Louis, an office in Omaha, and offices and warehouses in Baton Rouge, La., and Denver. The company distributes and fabricates refractory and corrosion-resistant materials to industrial customers in the minerals, power, foundry, steel, petrochemical, non-ferrous and chemical industries.

Gielow served as president of the St. Louis section of the American Institute of Mining, Metallurgical and Petroleum Engineers and on the boards of various organizations. In 2013, he was inducted into the Missouri S&T Academy of Mines and Metallurgy.



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# GRADUATION DOESN'T MEAN GOODBYE

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earned, job promotions  
and other family  
or professional news.**

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Tell us what you're doing with a  
degree in materials science and  
engineering so we can feature your  
accomplishments among our alumni  
achievement stories.