MINES @150 | 1874-2024

Metallurgical & Materials Engineering

A NEWSLETTER FOR FRIENDS & SUPPORTERS

SPRING 2024

Above, the first cohort from the Ceramic Engineering bachelor's degree program graduated in May 2024

SPRING 2024

A Newsletter
for Friends & Supporters of the
Colorado School of Mines'
George S. Ansell Department of
Metallurgical & Materials Engineering

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COLORADO SCHOOL OF MINES | George S. Ansell Department of Metallurgical and Materials Engineering

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Front cover image: (Front left) Akhil Gupta, Elizabeth Pritchett, Aidan Manjanerrez, Madeline Rivera, Daniel Montes, Amber Lively and Jay Roepe (graduating students). (Back left) Amy Morrissey, Kim Scott, Ivar Reimanis, Brian Gorman, Randel Mercer, Steve Landin, Geoff Brennecka, Jackson Parker, Chloe Cook and Corinne Packard.

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FROM THE MME DEPARTMENT HEAD

Happy Spring MME friends and family!

Welcome to our department's 120th anniversary, which coincidentally coincides with Mines' 150th birthday!

I'd like to start out by thanking our alumni for your engagement and generosity in supporting the next generation of engineers. Now more than ever, the United States needs to train metallurgical and ceramic engineers so we remain globally competitive. MME is one of the best in the world at producing students who know how to make things. This year, with your generosity, many of you have made a significant impact by donating to our general department and/or student scholarship funds, making it possible to sustain what we do. Thank you!

May 10th this year was an exciting day: we had our inaugural class of graduating Ceramic Engineers. Seven students earned the first ever bachelor's degree in Ceramic Engineering from Mines. There are only two other accredited ceramic engineering programs in the country, giving Mines a distinctive status. Looking at the cover of the newsletter, the smiles on the faces of the students reflect how excited they are to be part of history! Three students in this cohort have jobs lined up and four will attend a graduate program. My goal is to have two world-class undergraduate degree programs, Ceramic Engineering and Metallurgical and Materials Engineering for years to come.

Additionally, MME faculty have been amazingly successful in securing grants and contracts with federal, state and industrial sources. Once again, MME leads the university in research ($13 million in research expenditures which is more than any other department). This prominent research influence translates to a high level of education in our graduate program, and directly impacts undergraduate students by providing them with invaluable research experiences.

On another note, I'm proud to announce MME hot shop manager Sarah Harling and Professor Jeff King have been chosen to design and cast a life-size bronze bell in commemoration of Mines@150. As far as I know, we've never made something this big in our foundry and so it will require some work and planning over the summer. The bell will be presented and rung as part of homecoming this fall – exciting times indeed!

Please stay in touch and let us know when you are in Golden. Even if you do not have a chance to visit campus, I'd love to hear how you are doing.

Wishing you a great summer!

Ivar Reimanis

Mines celebrates 150 years as metallurgy turns 120

Kicking off 2024, Colorado School of Mines celebrated its 150th anniversary on February 9, 2024. Mines was founded in 1874, two years prior to when Colorado gained statehood in 1876.

Campus hosted Founders Week from February 5-9th to celebrate the milestone. Events included the annual #idigmines Giving Day and a ribbon cutting ceremony for the grand opening of the Labriola Innovation District. It wouldn't be a celebration without birthday cake and Blaster! The day's events were rounded out with women's and men's basketball games in Lockridge Arena. Coincidentally, the Metallurgical and Materials Engineering Department is also celebrating its 120th anniversary this year.

Not too long ago, Mines celebrated it's milestone 100th year anniversary in 1974. To commemorate the achievement, folks at Mines built their own Mineral City, a replica of an 1874 mining town complete with a café, saloon, jail, two-story outhouse, laundry and horse-mounted police, all constructed by Mines students. **Dr. David Matlock**, 52-year Mines veteran and Professor Emeritus of Metallurgical and Materials Engineering, witnessed the town in all its splendor and said its construction "highlighted the resourcefulness and capabilities of Mines students" and drew such a crowd that "all, including the Governor of Colorado, enjoyed the environment on campus facilitated by the existence of Mineral City."

Speaking of drawing crowds, continuing the Mines@150 celebration, undergraduate student, **Bryn Russell**, with the support of **Dr. Gerald Bourne**, will be building a Mines @ 150 ceremonial blade and hosting a bladesmithing workshop in the coming months. Stay tuned for a future newsletter to see the results of this exciting endeavor!

For more on this story, visit:
campaign.mines.edu/s/840/mc20/home.aspx.

Mines alumni working to create a zero-carbon steel future

Mines Metallurgical and Materials Engineering alumni **Steve Sparkowich '89** and **Daniel Wright '21** work at the green steel startup Boston Metals. They are a part of an inert anode team at the heart of the molten oxide electrolysis process the company has patented to eliminate carbon from steel production. Rather than converting ore to steel through the traditional multi-step, high-heat blast furnace and basic oxygen furnace processes, which are typically powered by coal, Boston Metal's technology converts ore to steel through electrolysis, which can run on renewable energy.

Molten oxide electrolysis, or MOE, cuts out many of the steps in traditional steel production. In a MOE cell, an inert anode is immersed in electrolyte containing iron ore. Then, it's electrified.

"When the cell heats to 1,600 degrees Celsius, the electrons split the bonds in the iron oxide in the ore, producing liquid metal," according to a statement from Boston Metal. "Unlike some alternative solutions being developed, MOE does not require process water, hazardous chemicals or precious metal catalysts."

"It's a unique opportunity to have a lot of impact as a metallurgist," Wright said.

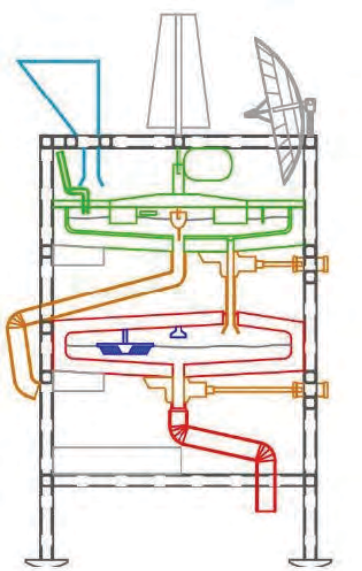
The inert anode is key to fully eliminating carbon from the process: Unlike traditional graphite anodes, which produce CO_2 as a byproduct, the inert anode's only byproduct is oxygen.

Though they graduated more than 30 years apart, Wright and Sparkowich both said their experience in Mines' Metallurgical and Materials Engineering Program provided the solid foundation for their careers in metallurgy.

"Colorado School of Mines has always included the fundamentals of metallurgy in their program," Sparkowich said. "There are very few schools in the U.S. still teaching these things. It's the core, which we use every day."

For more on this story, visit:
minesnewsroom.com/news/mines-alumni-working-create-zero-carbon-steel-future.

Mines develops LAMPP for NASA 2023 BIG Idea Challenge



Colorado School of Mines was selected to participate in the 2023 NASA BIG Idea Challenge with the proposed "Lunar Alloy Metal Production Plan" project.

During this project, the student-led team (including Mines graduate student, **Daniel McConville**), with help from **Sarah Harling** at the Mines Foundry, researched and tested the performance of different refractory materials exposed to simulated molten lunar regolith (moon dirt). These efforts were conducted to help inform system requirements for a potential metal production plant that can be deployed on the moon for future metal fabrication for use in constructing an Artemis Base Camp. Through a number of foundry tests utilizing the natural gas furnace, the team determined a silicon carbide refractory with a boron nitride-wearing surface was able to resist the corrosive behavior of molten lunar regolith and withstand extreme heat with the least amount of degradation.

The team presented these results to NASA during the BIG Idea forum held at Glenn Research Center in October of 2023, where they were given the "Best Verification Demonstration" award.

For more about the challenge, visit: **bigidea.nianet.org**.

Mines and Idaho National Laboratory expand research partnership

Colorado School of Mines and Idaho National Laboratory (INL) have agreed to expand their joint efforts in scientific research for the next five years.

A memorandum of understanding signed in late October 2023 establishes a framework for both institutions to collaborate on projects involved with energy storage, high-temperature fuel cells, geothermal energy systems, nuclear fuel cycle and reactor engineering, environmental science, and next-generation mining science and engineering.

“There’s tremendous overlap in research focus at our two institutions, from generating hydrogen through high-temperature electrolysis using process heat from microreactors to addressing the challenges we face in finding, extracting and processing critical materials for the energy transition,” said **Michael Kaufman**, Mines’ Director of Materials and Energy Initiatives. “They see a lot of potential synergies, as do we.”

"The relationship will bring the two institutions’ strengths together in a way that the whole exceeds the sum of its parts," said Travis McLing, INL’s co-lead for critical minerals research. “Mines of the Future” is a concept in which critical minerals can be extracted more surgically and efficiently, with less energy consumed and less harm to the environment.

“At INL we have the technology, with remote sensors and machine learning,” he said. “Colorado School of Mines is the institution that allows INL to take cutting-edge science and apply it to the actual rock. We don’t have a mine ourselves, but Colorado School of Mines is a global leader. It’s not even debatable.”

Kaufman said the school is also hoping to expand its nuclear energy research program and apply it to mining processes.

For more on this story, visit:
minesnewsroom.com/news/colorado-school-mines-idaho-national-laboratory-expand-research-partnership.

COLORADO SCHOOL OF MINES | Idaho National Laboratory

Professor Francisco Gil Coury co-authors *Nature* paper with former MME colleagues

Professor Francisco Gil Coury (MME PhD 2018) of the Departamento de Engenharia de Materiais at the Federal University of São Carlos in Brazil is the lead author of a paper just published in *Nature* and coauthored by Cody Miller (MME PhD 2016 and now at Los Alamos National Laboratory), Robert Field (former director of Electron Microscopy Laboratory, now fully retired), and **Michael Kaufman** (current MME Professor and Director of Materials and Energy Initiatives in the Office of Research and Technology Transfer).

The article titled "On the origin of diffuse intensities in fcc electron diffraction patterns" explores the diffuse intensities observed in electron diffraction patterns that have been frequently misinterpreted as representing short- or medium-range order in a range of compositionally-complex face-centered cubic alloys.

Coury and his co-authors provide the theoretical foundation to explain these intensities and a framework for determining the nature and location of such intensities that could indicate the presence of short-range order or medium-range order.

Much of the electron microscopy was conducted in the Shared Instrumentation Facility (SIF) here at Mines and is an extension of the work in Miller's PhD dissertation.

For more on this story, visit:
nature.com/articles/s41586-023-06530-6.

Reimanis and Scott awarded $150,000 from NIST to advance standards education

The U.S. Department of Commerce's National Institute of Standards and Technology (NIST) has made eight awards totaling $1.2 million to support standards education in undergraduate and graduate curricula.

Since it began in 2012, NIST's Standards Coordination Office Curricula Development Cooperative Agreement Program has received 255 applications and made 54 awards totaling over $4.3 million. The funding supports curricula development to integrate content on documentary standards and standardization processes into courses, modules, seminars and learning resources, including sustainable approaches that can be replicated and built upon by other educational programs.

This year **Ivar Reimanis** and **Kim Scott**, of Colorado School of Mines, received $150,000 to develop and integrate three modules into the curriculum of a new major in ceramic engineering.

The modules include a range of introductory standards for sophomores; standards in senior capstone projects; and standards for mechanical testing of ceramics for seniors.

For more on this story, visit:
nist.gov/news-events/news/2024/01/nist-awards-funding-8-universities-advance-standards-education.

Findley selected as John Henry Moore Chair

Kip Findley was selected as the John Henry Moore Chair recipient in Fall 2023. The position was previously held by Kester Clarke, now a joint appointee from Los Alamos National Laboratory.

Applicants for the John Henry Moore chair in Metallurgy are solicited from within the George S. Ansell Department of Metallurgical and Materials Engineering. It is expected that the John Henry Moore chair in Metallurgy will be a senior professor in MME engaged and committed to the success of metallurgy at Mines.

The successful candidate will be expected to develop and sustain a substantial and collaborative research program with internationally recognized stature. The position comes with professional development funds provided annually in the amount of $25,000 discretionary funding and a $10,000 stipend.

For more on this story, visit:
metallurgy.mines.edu/project/findley-kip/

Brennecka featured on Ceramic Tech Chat podcast

Training the next generation of ceramic engineers requires engagement on multiple fronts. **Geoff Brennecka**, Herman F. Coors Distinguished Professor of Ceramic Engineering, discusses the importance of having degree programs that focus specifically on ceramics, recalls the history and evolution of ACerS President's Council of Student Advisors, and describes how the Ceramic and Glass Industry Foundation's new Teacher Training Workshops provide K–12 teachers guidance on effective ways to teach materials science.

To listen to the podcast, visit:
ceramictechchat.ceramics.org/974767/14167505-fostering-pathways- for-ceramic-engineers-geoff-brennecka.

Mathaudhu featured on History Channel with Shatner

Suveen Mathaudhu was recently on the History Channel show *The UnXplained* – hosted by none other than William Shatner – talking about the materials science of ancient artifacts, like the Lycurgus Cup, Greek Fire, Damascus swords and more.

It's not Mathaudhu's first time using materials science to explain strange substances, either. He's often interviewed about fictional materials from pop culture as well, from Beskar steel in The Mandalorian to Captain America's shields. Materials in real life can sometimes be linked to materials in the make-believe world, and Mathaudhu can help explain why.

Watch Season 6 Episode 7 (log in with TV provider required):
play.history.com/shows/the-unxplained#episodes.

Brennecka and De Moor promoted to full professors

Geoff Brennecka was promoted to a full professor by the Mines Board of Trustees. His group's research focuses on the development and integration of new piezoelectric and ferroelectric materials for wireless communications and/or high temperature non-volatile memories and on fundamental fabrication and sintering challenges of powder-derived ceramics using traditional and additive manufacturing approaches. For more information, visit: **metallurgy.mines.edu/project/brennecka-geoff**.

Emmanuel De Moor was promoted to full professor by the Mines Board of Trustees. Emmanuel joined Mines in 2008 and works with the Advanced Steel Processing and Products Research Center. Emmanuel's background is in ferrous metallurgy with an emphasis on studying mechanical properties, microstructure, alloying and thermo-mechanical processing interrelationships in steel product metallurgy. He currently teaches metallurgical and materials thermodynamics and iron and steelmaking. For more information, visit: **aspprc.mines.edu/de-moor**.

Gorman wins MME department student award

MME undergraduate students selected **Brian Gorman** for this year's student award. These awards are selected by the members of this year's senior class and recognizes Mines faculty for their dedications to quality teaching, genuine care for students, and a commitment to enhancing the campus community. The awards recognize one member from each academic department.

Lowe receives Distinguished Engineering Alumni Medal

Research Professor **Terry Lowe** was awarded the 2023 Distinguished Engineering Alumni Medal from the UC Davis College of Engineering. Lowe was one of seven UC Davis alumni awarded the medal in 2023. He holds a Bachelor of Science in materials science and mechanical engineering from UC Davis. Lowe was also awarded the 2024 Mines Undergraduate Research Scholar Mentor Award. This award recognizes faculty, postdoc and graduate student mentors who support undergraduate students in having enriching research experiences. Organized by the Office of Undergraduate Research Scholars, this award provides an avenue for undergraduate students to recognize and nominate their outstanding research mentors.

Mines wins top prize at Steel Halligan Bar Competitions

Mines had a great showing at the 2024 Steel Halligan Bar Competitions on April 25th, taking home 1st place in the Additive in Steel Competition and runner up in Forged in Steel. The Cast in Steel team also competed earlier in the week, making Mines the only school to compete in all three competitions: Casting, Forging and Additive. **Additive Team** (top left): **Kate Diamond**, **Yan Ostanin**, **James Newkirk** and **Kathleen Mah** (Not pictured: **Jill Kammann**, **John Greenman**, and **Xocoyoltzin Jimenez**) | **Forge Team** (bottom left): **Albert Ostlind**, **Mason Weems**, **Atlas Rhode** and **Rachel Chase**.

Two MME students win Colorado Engineering Council award, Steel Halligan Bar Competition

Emmelia Ashton (right) won the Colorado Engineering Council Silver Medal Award. This high distinction has been presented for over 100 years to just one top engineer at each of the Colorado's accredited engineering universities. Emmelia was Mines winner this year. **Kathleen Mah**, (left) was on the team that won the 2024 Steel Halligan Bar competition.

Jillian Scott '23 delivers fall undergraduate student commencement address

Jillian Scott '23 graduated with a Bachelor of Science in Metallurgical and Materials Engineering, with a with a minor in Public Affairs.

Scott is originally from Chicago, Illinois and came to Mines in August 2020. Scott served as the student speaker for the December 2023 commencement ceremony.

During her time at Mines, she conducted research on carbon capture ceramic pellets under **Dr. Brian Gorman** and was a Physics I teaching assistant. Additionally, Scott was a development intern at Corning Incorporated and a field engineer for Keller North America where she will continue working full time after graduation. Scott also served as the vice president of fundraising for Club Sports Council and she was a member of the Women's club water polo team.

For more on this story, visit: **youtube.com/watch?v=BjTib_Y3tGQ**.

Kelsey Ferro '23 awarded Dan Fox Outstanding Student Service Award

Undergraduate student **Kelsey Ferro '23** was awarded the Dan Fox Outstanding Student Service Award at the student commencement brunch for December 2023.

The award is presented by the Division of Student Life to the student who, in their tenure at Mines, outside and above their academic role, vigorously participated in activities or projects for the greater benefit of their peers and community to promote excellence and well-being. It was named after Dan Fox in 2021 who served as the VP for Student Life for 17 years.

Read more about this story on Mines Newsroom.

Left: Ryan McGinnis, Daniel Newton and Alec Williamson

Students excel in steel, receive internships and scholarships

Undergraduate students **Ryan McGinnis**, **Daniel Newton** and **Alec Williamson** won the 2024 AIST Foundation Steel Intern Scholarship. McGinnis will be interning at SSAB Montpelier, Iowa; Newton at Carpenter Technology, Reading, Pennsylvania; Williamson at Ellwood City Forge, Ellwood City, Pennsylvania. The AIST Steel Intern Scholarships provide the best of both worlds – valuable industry experience and financial support. Selected candidates will receive a paid summer internship or co-op at a North America Steel Company followed by a $7,500 scholarship. **Alec Williamson** also received the ELLWOOD Scholarship.

Read more about this story by scanning the QR code.

Students in the classroom, athletes beyond

Mines alum and current post-doctoral researcher under Professor Zhenzhen Yu, **Benjamin Schneiderman**, placed 45th overall in the men's U.S. Olympic Marathon Team Trials on February 3rd, 2024.

The Colorado School of Mines football team headed to McKinney, Texas to play in the 2023 NCAA Division II Championship! They faced Harding on December 16 and while Mines didn't take home the trophy, the football team had an amazing season. Special congratulations to football players **Flynn Schiele**, **Carter Forsythe**, **Jameson Kemp**, **Aksel Richard**, **Preston Rose**, **Peyton Rose** and **Christian Peluse**, who are all studying in the MME Department!

Alumni Advisory Board visit an overall success

The department would like to thank our Alumni Advisory Board (AAB) for their visit to the department and continual feedback on our programs. Some members visited the Mines campus, while others attended remotely, on February 8, 2024. A special thank you to **Amy Morrissey** (chair), **Mike Nagorka**, **Hoy Frakes**, and **Patrick Anderson** (above, left to right) for participating on our AAB panel. The visit included meeting with faculty and graduate and undergraduate students. The overall theme for the day was focusing on continuing to develop department programs including the undergraduate curriculum and newer ceramic degree program. The day was rounded out with the board having the option to attend our weekly Ansell Seminar Series and later a social hour with faculty at the Buffalo Rose in downtown Golden. If you are an alum of the MME department and are interested in serving on the AAB, please reach out to Stacey Lucero at srlucero@mines.edu.

For more about the AAB, visit:
metallurgy.mines.edu/alumni-advisory-board.

Mike Nagorka established the **Undergraduate Ceramic Engineering Current-Use Scholarship** in January 2024. Nagorka is a metallurgy alumnus who is currently a member of the MME AAB (Metallurgy and Materials Engineering Alumni Advisory Board). He is so excited about the new ceramic engineering degree that he wanted to reward students who have chosen this major.

Harling welcomes new addition - a future welder?

Sarah Harling, hot shop supervisor and building manager for the MME Department, and her husband, Adam, welcomed a son, Bernhardt "Bear" Markus Zimmer on Saturday, April 6th, 2024. Whether or not Bear will be a part of the next generation of welders has yet to be seen, but we know he will have much experience with the field if it is up to his mama! Wishing Bear and his parents many cuddles and snuggles in the coming months. Congratulations!

Affiliate faculty member Creuziger authors paper on Apollo rocket

Adam Creuziger, Mines MME Affiliate Faculty and NIST Researcher authored a paper titled "Houston, We Have the Engine Remnants: How My Lab Pieced Together a Forgotten Part of an Apollo Rocket." For more on this story visit: **nist.gov/blogs/taking-measure/houston-we-have-engine-remnants-how-my-lab-pieced-together-forgotten-part**.

CSMMAC holds Steel Career Panel

On January 29th 2024, prior to the Spring career fair, a steel industry panel was held where MME students learned more about opportunities within the industry. Many thanks to the panel participants: **Hannah Latham** (AM/NS Calvert), **Chad Gentry** (Steel Dynamics), **Bryce Lakamp** (EVRAZ NA Pueblo), and **Andrew Schless** (Nucor Steel) for sharing their perspectives on the industry and providing valuable insight. The event was supported by the **Association for Iron and Steel Technology Foundation** and thank you to **CSMMAC** (Colorado School of Mines Material Advantage Chapter) for moderating the panel.

CoorsTek, Inc. donation to Graduate Fellows Program: The CoorsTek Research Fellowship has brought 19 extraordinary PhD candidates to Colorado School of Mines since CoorsTek and the Coors family established it in 2014. The program has been so successful that the company and family have extended funding through 2032 with a multi-million-dollar gift.

For more on this story, visit: **minesnewsroom.com/news/coorstek-coors-family-extend-mines-research-fellowship-through-2032**.

Alumni/Student Connections on LinkedIn

Please help grow our network, connect alumni, and foster relationships with current students by connecting with us on LinkedIn at **Mines Metallurgical and Materials Engineering ~ Alumni and Students Connect.**

MME Alumni Scholarship Fund

Our Alumni Advisory Board created the MME Alumni Scholarship Fund, providing scholarship funding for undergraduate and graduate students in our programs. **Donate online at weare.mines.edu/supportmme**

Share your news with us!

We want to hear from you. Please send news to Stacey Lucero: srlucero@mines.edu.

COLORADO SCHOOL OF MINES

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Support Metallurgical & Materials Engineering

A gift to the George S. Ansell Department of Metallurgical and Materials Engineering is an investment in the future.

Your donation supports scholarships, fellowships, professorships, academic programs, faculty research and other initiatives that are not typically supported through state appropriations. Private philanthropy empowers the department to achieve greater excellence in research and education.

To learn more about supporting the Department, contact the Mines foundation.

WEARE.**MINES**.EDU or **303.273.3275**

weare.mines.edu/supportmme

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