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

Colorado School of Mines
President:
Dr. Paul Johnson

Department Head:
Dr. Angus Rockett
arockett@mines.edu

Mailing/Delivery Address:
1500 Illinois Street
Golden, CO
80401

Main Office:
Hill Hall 201

Main Office Phone Number:
303.273.3780

Main Office Fax Number:
303.273.3795

Visit us online at
metallurgy.mines.edu

Design by:
Christina Vessa
cvessa@mines.edu

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Welcome from Dr. Angus Rockett
Looking forward to another great year

Once again, we are starting the academic year with great successes in hand and prospects for a tremendous year ahead. The faculty of the George S. Ansell Department of Metallurgical and Materials Engineering (MME) continue to receive awards for their research, increasing levels of funding of their research, and affection from the students.

As in the past three years we will be hosting an alumni event in conjunction with the MS&T Conference in Portland. This year, the meeting will be on Monday, September 30th at 6 pm at the Spirit of 77 bar, just across from the Oregon Convention Center. If you are in the area, please join us. We encourage you to let us know by contacting Nancy Progar (progar@mines.edu) so that we can plan to see you there. This has been a fun opportunity for some of the current students and faculty to meet and chat with alumni and friends of the Department. We hope to see you there.

Department management is starting the year with something a little different. On August 23rd, six alumni joined us at Hill Hall for the first advisory board meeting. They represent a spectrum of areas of interest, age, and seniority in their workplaces. The meeting reviewed the status of the Department, the undergraduate and graduate programs, the research centers, and allowed time for the alumni to meet with current undergraduate and graduate students. The Board provided many useful comments on current topics that we are working to move forward with. The Department is fortunate to have many engaged alumni and all are encouraged to contact me at arockett@mines.edu with any suggestions or comments you may have concerning the Department.

The Department is planning to interview candidates for two faculty positions this fall and we hope to have new members of our family in place in 2020. These new members will continue our tradition of setting the standards of excellence and driving innovation forward, both on campus and beyond. We can’t say who we are interviewing yet but suffice it to say we are excited with the candidates. Stay tuned for news about these new hires.

As always, please stay in touch and we wish you a great conclusion to 2019.

Dr. Angus Rockett
arockett@mines.edu
Adam Savage Visits Mines

To kick-off his new show “Savage Builds,” Adam Savage enlisted the help of two Materials Science PhD students, Sara Sortedahl and Jesse Adamczyk, to 3-D print a real life Iron Man suit out of titanium.

New Ceramics Fuel Cell Research Makes Waves

Researchers at Colorado School of Mines have shown that protonic ceramic fuel cells can be used reversibly, both to efficiently generate electricity and to store that power in the form of chemical fuel at times of lower demand.

The breakthrough findings, “Highly efficient reversible protonic ceramic electrochemical cells for power generation and fuel production,” were published this past week in the journal Nature Energy. “In this way, our reversible fuel cell device can act like a battery,” said Ryan O’Hayre, professor of metallurgical and materials engineering and co-lead author of the paper with postdoctoral researcher Chuancheng Duan PhD ’18.

“We can use our device to make hydrogen from water when there is excess renewable electricity on the grid that might otherwise go to waste. The hydrogen can be stored for later use or used in the chemical industry for various purposes. If we store some or all of the hydrogen, we can then also run our device in fuel cell mode using this stored hydrogen to produce electricity at times when there is not enough electricity available on the grid.”

The new findings, sponsored by the U.S. Department of Energy’s ARPA-E program, build on research published last year in the journal Nature. In the first long-term study of its kind, the Mines researchers showed that protonic ceramic fuel cells, a relatively new class of fuel cell technology, have both the long-term durability and fuel flexibility needed to become a viable commercial alternative to other existing technologies.

In that study, Duan and O’Hayre used 11 different fuels – hydrogen, methane, domestic natural gas (with and without hydrogen sulfide), propane, n-butane, i-butane, iso-octane, methanol, ethanol and ammonia – demonstrating excellent performance and exceptional durability across all types over thousands of hours of operation.

The new cells would also work in reverse as electrolyzers, efficiently breaking down water into hydrogen and oxygen.

“Hydrogen, if produced from renewable resources, is an environmentally friendly fuel because the only product after oxidation is water, which can be easily recycled,” said Duan, who will join the Department of Chemical Engineering at Kansas State University as an assistant professor in spring 2020. “Renewable hydrogen has the potential to help de-carbonize both the petrochemical industry and electricity generation and it could revolutionize the way we produce and store energy.”

Additionally, researchers showed, the device can be used to make methane instead of, or in addition to, hydrogen, if supplied with a combination of carbon dioxide and water.

“This technology offers opportunities for utilizing and storing carbon dioxide and thereby reduce carbon dioxide emissions,” O’Hayre said. “Methane has the added benefit of being easier to store and higher energy density than hydrogen. Additionally, this technology provides a pathway to manufacture methane fuel on Mars – for which NASA has shown keen interest – by utilizing the abundant carbon dioxide present on the red planet.”

Co-authors on the paper include Mines Mechanical Engineering Department faculty members Robert Kee, Huayang Zhu and Neal Sullivan; Colorado Center for Advanced Ceramics postdoctoral researcher Liangzhu Zhu; Liuzhen Bian, a visiting graduate student from University of Science & Technology Beijing; and Dylan Jennings, a PhD student in materials science.

“Through optimizing materials, we have presented high-performance protonic ceramic electrochemical cells for hydrogen production, CO2 utilization and sustainable fuels production,” Duan said. “These reversible fuel cells will play a key role in long-term energy storage for balancing a renewable energy integrated power grid.”

Two MME faculty recognized by honor societies

Drs. Angus Rockett and Gerald Bourne were awarded by the honor societies Blue Key, Order of Omega, and Tau Beta Pi. Dr. Rockett was voted “Most Likely to Give the Best Advice” and Dr. Bourne was given an award for “Going the Extra Mile.”

Lohmiller Luncheon

The Lohmiller Luncheon recognizes the Outstanding TA’s of the academic year. This year’s winners are Chris Finfrock, Josh Mueller, Elizabeth Palmiotti, Mary O’Brien and Diptak Bhattacharya. They were each awarded $500.

Meritorious Award

https://www.aws.org/about/page/honorary-meritorious-awards

Dr. Zhenzhen Yu received the American Welding Society (AWS) the section Meritorious Award, in recognition of loyalty and devotion to the affairs of the Society, effective service in the advancement of welding, and for generous contributions of time and effort.
Speer Elected to National Academy of Engineering


John G. Speer, John Henry Moore Distinguished Professor of Metallurgical and Materials Engineering at Colorado School of Mines, has been elected to the National Academy of Engineering.

Election to the NAE is among the highest professional distinctions granted to engineers, recognizing those who have made outstanding contributions to “engineering research, practice or education, including, where appropriate, significant contributions to the engineering literature” and to “the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering or developing/implementing innovative approaches to engineering education.”

Speer was cited for his outstanding work on the conception, invention and reduction to practice of quenching and partitioning steel. The director of the Advanced Steel Processing and Products Research Center (ASPPRC), Speer joined the faculty at Mines in 1997 after 14 years of research and research management in the steel industry. He holds a PhD from Oxford University, U.K., and a BS from Lehigh University.

Speer's contributions to and leadership in the steel industry was also recognized in 2017, when he was awarded one of the world’s top prizes in metallurgy and materials, the Institute of Materials, Minerals and Mining’s Bessemer Gold Medal. A distinguished member of the Associate for Iron & Steel Technology (AIST) and a Fellow of ASM International, Speer also serves as past president of the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME).

"Dr. Speer's election to the National Academy is one more indication of his impressive contributions to the steel industry where he has focused his academic career," said Mike Kaufman, vice provost for graduate and research initiatives and dean of energy and materials programs at Mines.

“Since joining Mines, he has been a model faculty member, role model and major contributor to the department and to the institution. We are thrilled that he is receiving this prestigious recognition for his pioneering work in developing the quenching and partitioning process, which has had a major impact on the steel industry.”

Speer is the seventh Mines faculty member in school history to be elected to the NAE, joining a distinguished group whose membership also includes Hossein Kazemi, Chesebro’ Distinguished Chair in Petroleum Engineering; David Matlock, emeritus professor of metallurgical and materials engineering; and Robert J. Weimer, emeritus professor of geology and geological engineering. Speer will be formally inducted during a ceremony at the NAE annual meeting in October in Washington, D.C. Also in the Class of 2019 is Mines alumnus Harry M. “Red” Conger ’77, president and chief operating officer-Americas for Freeport-McMoRan Inc.

A total of 86 new members and 18 foreign members are part of the NAE Class of 2019, bringing the academy’s total U.S. membership to 2,297 and foreign membership to 272.
AWARDS & ACCOLADES

Other Faculty Accomplishments and Awards

AIST GILBERT R. SPEICH AWARD AND THE AIME HUNT-KELLEY OUTSTANDING PAPER AWARD (3RD PLACE)
for the paper “Quenching and Partitioning of Plate Steel: Thermal Gradients and Microstructure Development During Quenching” by Rachael A. Stewart, John G. Speer, Brian G. Thomas, Amy J. Clarke, and Emmanuel De Moor

2019 COLORADO SCHOOL OF MINES JUNIOR RESEARCH EXCELLENCE AWARD
given to Vladan Stevanovic group for High-throughput computations identify new candidate semiconductors for power electronics (Energy & Environmental Science DOI: 10.1039/C9EE01529A) and Theory and experiments join forces to understand operational stability of hybrid perovskite alloys in solar cells (Energy & Environmental Science DOI: 10.1039/c8ee03051k)

FULBRIGHT GLOBAL SCHOLAR’S AWARD
(to Australia and Norway) given to Ryan O’Hayre

2019 AIST PRESIDENTIAL CITATION:
“For demonstrating bold leadership in concert with the AIME Board of Trustees that has transformed and streamlined the AIME Governance model” given to John Speer

AIST ADOLPH MARTENS AWARD,
for recognition of the achievement of significant, broadly known technical accomplishments that have enabled important advances in processing and product application in the field of ferrous physical metallurgy, and have either provided dramatic contributions to the field or made a lifetime of important contributions to the field, given to John Speer
Bald for a Cause

Dr. Kester Clarke participated in the first annual St. Baldrick’s event on the Mines campus to raise funds and awareness around childhood cancer. Dr. Clarke set his goal at $250 and had students help shave his head (in the MME Office!) once that goal had been reached. St. Baldrick’s is the leader in childhood cancer research grants outside of the US Government.

An Oral History of Life and Lessons

Dr. Patrick Taylor, Mines Alumnus and Professor, sat down with Michael Free of AIME as part of their oral history series to talk about his journey to becoming one of the most distinguished metallurgical professors. Dr. Taylor outlines his life from his Boy Scout days to being a student at Mines and his journey around the country, culminating in his professorship at Mines. As an oral history, it is best experienced audio-visually, which you can access here: https://ethw.org/Oral-History:Patrick_R._Taylor

Raising the Profile of Women in Engineering

**INTERNATIONAL WOMEN IN ENGINEERING DAY**

is an awareness campaign, held annually on June 23rd, designed to raise the profile of women in engineering and focus attention on the amazing career opportunities available to young women.

**HERE IS A SNIPPET FROM THE INTERVIEW:**

**Q:** Christina, can you start by telling me how long you've been with Hamilton Precision Metals and what you were doing before you joined the company?

I joined the company about six months ago having previously been at graduate school. My undergraduate degree is in Materials Science and Engineering with a metals focus from Penn State and my Master's is in Metallurgical and Materials Engineering from the Colorado School of Mines.

**Q:** Engineering is still a largely male-dominated discipline. So, what's it like for you, as a woman, to be working in this environment.

You definitely have to make a name for yourself, you have to put yourself out there and show that you are an authority in the field. Only you can speak up for yourself. I've been involved in metallurgy both in and out of the classroom for ten years and so I know what I'm talking about when it comes to solving metallurgical engineering problems. If you don't make your value known, unfortunately you may be overlooked as a woman in engineering. And when the time comes to voice your thoughts, you've got to make sure you are well-researched and you're putting out the right information.

**Q:** What do you think could be done to raise the profile of women working in engineering? What could be done to encourage more girls at school to choose this path for their studies and for their career?

I think just more open encouragement and conversations. Outreach is so, so important. When I was trying to work out where I wanted to go in my career, I didn't have anybody to look to, which made it hard to make some of the most important decisions post-graduate school. So, I think mentorship is a really important thing. We need to go to the colleges and high schools and say, hey, this is how I got here and you can do it too.

Obviously, I have had a lot of mentors who are men but inevitably they have a different perspective and I think having that female perspective is very important. There needs to be more encouragement versus criticism to make female engineers feel more confident in the industry.

The reality is, every decision, everything that we as women, as students, put out reflects us as a population. Because there are so few of us, you are representing every female engineer and you don't want to mess up because you don't want somebody to look at the next female engineer and say, hey, they can't do this as well as a man could. It's a concern I have had every day since starting in undergraduate, but when you can stand firm in your beliefs and your abilities the worries will fade. To get more young women into engineering, we need to share with them that these concerns are normal and you can push past them to reach your goals.

**Q:** And, if you had to give a talk next week to a group of girls at school who were trying to decide what to do with their careers, what advice would you give them?

I'd say, don't be afraid to walk into that room meeting room alone. You might be the only female in a room of 20 engineers but you can't be afraid. You've got to step up, show that you're just as capable. Women are far more prepared and far more researched than they realise. So, you just have to go for it. Don't let people doubt you.

**Q:** Hamilton Precision Metals is one of the six businesses that make up AMETEK Specialty Metal Products. Do you have much contact with other women from across the group?

I've met a couple of women from AMETEK SMP Eighty Four and I was involved in the internship committee comprised of a mix of men and women from HR, sales, ops, and engineering. There has been an effort to increase connectivity across the six locations to make us a more unified business unit, and I've enjoyed working with everybody across the board. Everybody's friendly and welcoming and everyone wants to improve us as an entire unit beyond just the local branches.

**Q:** Any final thoughts?

Just that if you really want to be an engineer, don't let anybody question that, just keep on going. Yes, as a woman you're going to be different, you're going to stand out, but that shouldn't be a problem, it shouldn't hold you back. Just be confident in who you are and go after your goals.
Ceramics Society Hosts Local Middle Schools

Keramos hosted its first annual Material Science and Engineering (or MS&E) day for local middle school, Prairie Middle School. The kids were taken all over campus to watch and participate in various materials related experiments and expositions including casting, 3-D printing, and glass blowing.
SUPPORT MME

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

Gifts can support 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.

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