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A Message from the Interim Department Head

Prof. Ivar Reimanis

Greetings from Hill Hall in Golden! I have the pleasure to serve as interim Department Head while our Department Head Mike Kaufman serves at interim Dean of our college (the College of Applied Science and Engineering). This is currently a one-year arrangement, and I look forward to working with all the excellent people in MME for the coming year as well as interacting more with our outstanding alumni and students.

MME has seen a number of exciting developments during the past six months. In August 2014, Dr. Geoff Brennecka joined us as assistant professor. Geoff served as a staff member for eight years at Sandia National Laboratory. He is very active in ceramic engineering particularly in the area of electronic ceramics. Also in August, Professor Emmanuel de Moor joined our faculty as an assistant professor. Emmanuel has been a part of the Advanced Steel Processing and Products Research Center (ASPPRC) at Mines for the last few years; prior to that he comes from Ghent University where he earned his PhD. We currently have two faculty searches: one for a chair endowed by the American Bureau of Shipping, and the other for an assistant professor.

Several of our senior faculty are on transitional retirement, but we continue to benefit for their continued presence on campus.

These include University Professor Emeritus David Olson and University Professor Emeritus David Matlock.



Professor and Interim Department Head, Ivar Reimanis

Faculty in the department won several big research awards recently. On October 1, 2014 Prof. O'Hayre's multidisciplinary team officially started on our \$1M, 2-year ARPA-E project on the Protonic Ceramic "Flex Fuel Cell". They are in the process of filing several patents to protect the IP that led to the successful ARPA-E grant award. Prof. Gorman is one of the PIs for the recently awarded DOE/EFRC award for which NREL is the lead. This \$3.5 M award with several institutions is titled "Center for Next Generation of Materials by Design: Incorporating Metastability". ASPPRC is finalizing the contract for American Lightweight Materials Manufacturing Innovation Institute, a \$140M multi-institution program that is part of the White House National Network of Manufacturing Institutes initiative. Prof. Matlock has been instrumental in assuring CSM's participation in this activity. With the

(Continued on page 2)

New Faculty: Assistant Professor Geoffrey Brennecka

A Message from the Interim Department Head

(Continued from page 1)

new funding from the DOE Critical Materials Institute, Professors Anderson, Mishra and Taylor are leading efforts to recover critical element from ores and recycled materials; about \$1.2M for new research equipment has been added to Hill Hall this year. Professor Corinne Packard is playing a major role in a new \$1.5M US Department of Energy program to develop next generation solar photovoltaic technologies.

Our student CSM Materials Advantage Chapter (CSMMAC) ([web link](#)) was awarded the national Outstanding Chapter award. Several students traveled to Pittsburgh in October to accept this award as part of the MS&T 2014 meeting. Our graduate students have become very active in professional societies with Ginny Judge serving a one year term on the ASM International Board and Lee Rothleitner serving a one year term on the Heat Treating Society Board.

As you will verify by reading this newsletter, our faculty, postdocs and students continue to excel at the highest level. The hard work and dedication can also be verified by stepping into Hill Hall on a weekend or the middle of the night to see the continual activity. The dedication of the staff is particularly remarkable. We were pleased that Kelly Hummel, our Graduate Educational Specialist, received the distinguished award of Classified Employee of the Year at Mines for 2014.

If you happen to be visiting Golden for business or vacation, please do not hesitate to visit the department. You would be pleased to see the energy and activity that makes our field so appealing to students.



Asst. Professor Geoff Brennecka

Geoff Brennecka joined the Department of Metallurgical and Materials Engineering (MME) as an Assistant Professor in August 2014. He received his PhD degree from the Department of Materials Science and Engineering at the University of Illinois at Urbana-Champaign under the guidance of Prof. David A. Payne and his MS and undergraduate degrees from the Department of Ceramic Engineering at the University of Missouri-Rolla under the guidance of Prof. Wayne Huebner.

He most recently was Technical Staff with Sandia National Laboratories in Albuquerque, New Mexico where he had worked for 8 years, first as post-doctoral appointee, then Senior Member of the Technical Staff, and finally as a Principal Member of the Technical Staff (2006-2014). He has served as an Adjunct Professor in the Departments of Materials Science and Engineering at the New Mexico Institute of Mining and Technology, Missouri University of Science and Technology, and Boise State University.

Dr. Brennecka has received several awards in recognition of his research and service. In particular, he earned the Karl Schwartzwalder-PACE (Professional Achievement in Ceramic Engineering) Award from the American Ceramic Society and National Institute of Ceramic Engineers (ACerS/NICE), which is given to the nation's outstanding young ceramic engineer in 2013. In addition, Dr. Brennecka received the IEEE-UFFC Ferroelectrics Young Investigator Award in 2014, which is given to the top international researcher in the ferroelectrics field under the age of 40.

Dr. Brennecka is very active in the American Ceramic Society and just began a three-year term on the Board of Directors. He was also just elected to the Administrative Committee of the Ultrasonics, Ferroelectrics, and Frequency Control Society of the IEEE.

Dr. Brennecka joined the Colorado Center for Advanced Ceramics at CSM, and his work tends to focus on materials that do something interesting under an applied electric field (e.g., dielectrics, piezoelectrics, ferroelectrics). He is especially interested in the dynamic response to electric field, from nanosecond processes (e.g., ferroelectric polarization reversal and domain wall dynamics) to long-term defect migration and associated degradation and reliability issues, particularly under challenging (e.g., high temperature, high electric field) operating conditions.

Welcome Dr. Brennecka!

New Faculty: Assistant Professor Emmanuel De Moor

Department Assistant wins 2014 Employee of the Year

MME Graduate Education Specialist Kelly Hummel received Colorado School of Mines' 2014 *Classified Employee of the Year* award. In addition to taking on extra duties during administrative restructuring, Kelly facilitated the rebirth of the "Women in Materials, Metallurgy, and Nuclear" organization ("WiMMN") to provide additional support to women in each of these three focuses.



Awardee Kelly Hummel in her decked out office.

She was nominated based on her teamwork, sound judgment, and going beyond the call of duty. The certificate was awarded in "recognition of valuable contributions to the Colorado School of Mines" by President Scoggins. After the ceremony, the graduate students and faculty surprised her with an amazing display of decoration in her office with balloons, flowers and a big cake. Kelly started at Colorado School of Mines on February 28, 2013. Congratulations Kelly!



Above: (L to R): Department Head Mike Kaufman, Materials Science Director Brian Gorman, Kelly Hummel, Philipp Hummel, Nuclear Science and Engineering Director Jeff King, Associate Professor Kip Findley.

Emmanuel De Moor joined the Department as an Assistant Professor in the fall of 2014. He had been a Research Assistant Professor with the Advanced Steel Processing and Products Research Center (ASPPRC) at the George S. Ansell Department of Metallurgical and Materials Engineering at the Colorado School of Mines for over three years.

Dr. De Moor obtained his PhD, MS and undergraduate degrees in Materials Engineering-Metallurgy from the University of Ghent, Belgium where he was

born and raised. He earned his PhD in 2009 in the area of quenching and partitioning to make advanced high strength martensitic steel grades (a process initially developed at CSM by Prof. Speer, director of ASPPRC). Dr. De Moor joined ASPPRC as a postdoctoral research associate in 2008 and became a research assistant professor in 2010.

His research interests pertain to microstructure, properties, and processing inter-relationships in ferrous alloys. Dr. De Moor holds over 40 publications and is a recipient of the 2014 and 2013 American Iron and Steel Institute Medal Finalist, Manufacturing Technology; the SAE/AISI 2012 Sydney H. Melbourne award for Excellence in the Advancement of Automotive Sheet Steel; the International Wire and Machinery Association Educational Trust Fund Grant; and an honorary fellowship of the Belgian American Educational Foundation. He leads research programs funded through the Department Of Energy Advanced Manufacturing Office and the Colorado Office for Economic Development and International Trade in addition to industrially funded projects.

Dr. De Moor's research focuses on physical metallurgy and the study of the effect of heat treating on microstructural development and mechanical properties. Previously he was involved in low carbon TRIP steel research, notably on strain ageing (bake hardening), mechanical stability of retained austenite and high strain rate testing of these grades. More recently he studied the Quenching and Partitioning process by assessing mechanical properties, such as tensile and hole expansion, as well as by a study of the physical metallurgy of the process through dilatometry and differential scanning calorimetry analysis. He is currently involved in wire, sheet, rail and plate steel research.

Welcome Dr. De Moor!



Asst. Professor Emmanuel De Moor

CSMMAC Wins Material Advantage “Most Outstanding Chapter” in 2014

Highest Award offered by the Materials Advantage Student Program goes to CSM



Above: Undergraduates in metallurgy show their skills. Grant Bishop, senior and Doug Smith, sophomore, watch Anthony Linenberger, senior, demonstrate the low thermal conductivity in a refractory brick.

Top: Metallurgy graduate and undergraduate students enjoy a CSMMAC barbeque to celebrate the fall semester start.

The Colorado School of Mines Material Advantage Chapter (CSMMAC) ([web link](#)) received the Material Advantage Most Outstanding Chapter Award for the 2013-2014 academic year.

Material Advantage is an international student organization for students to join and participate in four of the most preeminent materials professional societies: the American Ceramics Society; Association for Iron and Steel Technology; ASM International; and The Minerals, Metals, and Materials Society.

CSMMAC is open to all majors, however most partici-

pants are in the Metallurgical and Materials Engineering department.

The Most Outstanding Chapter award is based on the chapter's programming, career development activities, service, social activities, and chapter management. Last year, CSMMAC had numerous activities in each of these areas including several outreach events with local elementary schools, middle schools, and high schools; co-organization of the local ASM chapter Barrett Award night and other department social events; and participation in nation-

al conferences including the annual MS&T and TMS meetings and Congressional Visit Days.

CSMMAC was in competition with more than 75 other international chapters for this award.

The chapter was led by the executive council; President Madeline Hatlen, Vice President Ginny Judge, Secretary Amanda Ross, Treasurer Luke Sands, Outreach Chairs Will Ash and Adam Iñurria, and Social Chairs Tyrel Jacobsen and Ryan Peck.

Well done, CSMMAC!



Above: Acceptance of the Outstanding Materials Advantage Chapter Award at MS&T 2014 in Pittsburgh, October 2014. Clockwise starting at top left: Marissa Reigel (Mines PhD 2009), Anthony Linenberger, Prof. Kip Findley, Ginny Judge, Research Prof. Bob Cryderman, Tyrel Jacobson, Grant Bishop, Prof. David Matlock, Lee Rothleitner, Ryan Peck, Prof. Geoff Brennecka, Allison Loecke, Kerry McQuaid, and Adam Iñurria .

Research Center Highlights

Colorado Center for Advanced Ceramics

Prof. Ivar Reimanis, Director
ceramics.mines.edu

The Colorado Center for Advanced Ceramics (CCAC) is a focal point for exciting technological developments in advanced ceramics. Ceramics are critical materials in a wide range of



Associate Professor Brian Gorman receives the Microanalysis Society's W. F. J. Heinrich Award from society president Kristin Bunker in Hartford, Connecticut, July 2014.

technologies in virtually all industrial sectors. The Center actively pursues ceramics research and education and serves as a national resource of expertise and facilities that industry can draw upon to make decisions on the synthesis, processing, and performance of advanced ceramics and composites. Current ceramics research is funded by industry, national labs and federal government and includes membranes for gas separation, new fuel cell

and battery materials, nanoionics, synthesis and properties of photovoltaic materials, atomic level manufacturing, transparent ceramic armor, fracture and deformation of ceramics and composites.

Brian Gorman is the recipient of a DOE/EFRC award with NREL and MIT for \$3.5 M titled "Center for Next Generation of Materials by Design: Incorporating Metastability". On October 1, 2014 Ryan O'Hayre's team (O'Hayre, Neal Sullivan, Robert Braun, Sandrine Ricote and Jianhua Tong) officially started a \$1M, 2-year ARPA-E project on the Protonic Ceramic "Flex Fuel Cell". They are in the process of filing several patents through Will Vaughn's office to protect the IP that led to the successful ARPA-E grant award.

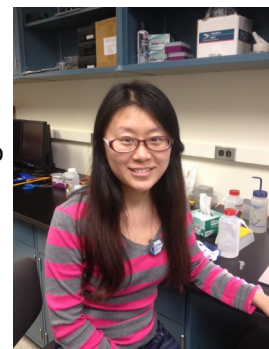
We are pleased to welcome Assistant Professor Geoff Brennecka to the Center. He joins us after nearly a decade working on dielectric and ferroelectric ceramics at Sandia National Laboratories in Albuquerque.

Svitlana Pylypenko, previously a research professor in the Center, began in September as an assistant professor in the Chemistry and Geochemistry Department at Mines.

Brian Gorman is the 2014 recipient of the W. F. J. Heinrich Award from the Microscopy and Microanalysis Society. This award, given to one individual per year, is for the best scientific accomplishment by an individual under the age of 40. The list of previous awardees (<http://www.microbeamanalysis.org/awards-1/k.-f.-j.-heinrich-award>) shows the esteem of this award.

Ivar Reimanis was elected as a Fellow of the American Ceramic Society and the award was presented in October in Pittsburgh at the MS&T14 meeting. In October, Geoff Brennecka began a three-year term as a Board of Director for the American Ceramic Society. More recently, Geoff was elected to the IEEE UFFC (Ultrasonics, Ferroelectrics, and Frequency Control Society) Administrative Committee.

Yi Ke, Rita Kirchhofer, Marc Rubat du Merac, Ann Deml, Kevin Wood, Jason Fish, and Archana Subrimaniyan earned their PhDs. Several of our graduate students received international awards this year. Yachao Chen was awarded the Graduate Excellence in Materials Science (GEMS) award for her presentation at the MS&T 2014 meeting in Pittsburgh. Adam Stokes received the best student presentation award at the IEEE-Photovoltaic Specialists Conference in Denver last summer.



Doctoral candidate, Yachao Chen, winner of the Graduate Excellence in Materials Science award, in her lab.

CCAC continues to have strong interactions with CoorsTek and is particularly grateful for the recent \$26.9M gift to CSM by CoorsTek and the Coors family. CCAC is the recipient of one of the first CoorsTek Fellowship awards which will go to Ms. Jaya Dorsey to fund her PhD in the area of grain boundary characterization of oxide ceramics for structural applications.

The Colorado Center for Advanced Ceramics Asst. Prof. Corinne Packard's collaborative work with NREL on next generation solar PV technologies has been awarded \$1.5 million by the US Department of Energy. The project aims to develop an InGaAsP/Si tandem photovoltaic technology that will yield

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Research Center Highlights

(Continued from page 5)

low-cost, high-efficiency devices. The research conducts controlled liftoff of III-V devices grown on Ge substrates with



Dr. Corinne Packard

attention toward device quality, substrate reuse, and manufacturability. Focus is also given to developing a low-cost, high-throughput growth of highly efficient III-V

solar cells with the optimal bandgap to achieve the maximum efficiency from a two-junction structure. The Mines-NREL joint project is funded through SunShot's "Next Generation Photovoltaics Program" - a collective national effort put forth by the Department of Energy with the goal of making solar energy fully cost-competitive with traditional energy sources before the end of the decade.

Big Changes for the Physical Metallurgy Lab

Beginning in August, 2014, the Physical Metallurgy Lab (PML) has made some rather sizeable improvements to make research and the use of the lab easier and more efficient.

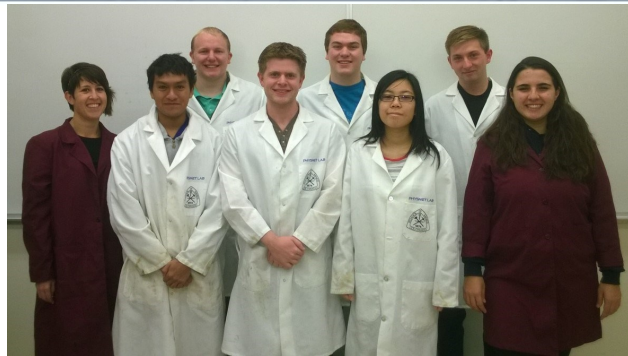
The newest and largest addition to the lab is the addition of our new work-study students. With ten new students staffing the lab, equipment is being kept operational and the lab itself is staying well stocked with everything that research in the lab requires. The amount of work studies this year allows for the lab to be staffed almost all the time. The

new students are being trained so that they are up to date on the purpose of the lab as well as the use of the equipment within it. In addition, all assistants in the lab are trained in EHS and are well suited to handle most situations in the lab

The Lab's new changes are best seen by the replacement and improvement of equipment which has been taken up a notch this year. Re-plumbing of the entire suite of polishing wheel will eliminate equipment down time due to clogged drains. The PML has also begun cycling out the older static grinding stations to get them repaired and powder coated. The refurbished grinders will be easier to reload with grinding paper, and they have been powder coated blue.

The lab has also begun the removal of older equipment and the removal or repair of equipment that is not functioning. The most notable piece of equipment that has been added recently is the new Mega T-400 saw. The MSX saw has also seen an overhaul with new bearings, belt, and a replacement pump. It is functioning almost like new. You may have noticed several plaques on various pieces of equipment noting, "supported by ArcelorMittal." Through their campus partnership, ArcelorMittal, has been instrumental in facilitating replacement and repair of several pieces of equipment in the PML.

In addition to the saw improvements, the PML is in the process of adding several other new pieces of equipment such as a new tool chest for the storage room as well as new quench buckets



Back row, from left to right is Tyrel Jacobsen, Will Major, and Garet Gavito. Front row, Zahra Ghanbari, Johnny Briones, Brendan Lyle, Jeanette Young and Ana Araujo.

and baskets for the furnaces. Another new addition to the lab is a table-mounted bolt cutter (40 HRC max) now located near the grinding wheels. The fume hoods have also been updated recently with new padding. This has replaced the older padding which has seen better days and is no longer viable for use in the lab.

Along with the new tools and equipment, several upgrades have also been implemented to help researchers using the lab. The newest of these upgrades are focused at the microscope room, and are to improve the equipment within it. Recently both PAX-it microscopes have been upgraded so that the computers attached to them now have 3 Terabyte hard drives so that new research can be stored there. One of the Vickers micro-hardness has also been fitted with new digital micrometers for the stage translation.

We plan to continue the improvement of the lab and upgrading the equipment within it. This will be accomplished while also keeping the lab well-staffed and stocked so as to allow the students and researchers of The Colorado School of Mines the best opportunity for research and study.

Research Center Highlights

Advanced Steel Processing and Products Research

Prof. John Speer, Director
aspprc.mines.edu

The Advanced Steel Processing and Products Research Center conducts research on bar, plate and sheet steels, with membership from 29 companies representing major steel producers and users from North America and around the world. The Center continues to be active, now in its 31st year. As always, several students defended theses over the past several months, and 8 new graduate students joined the Center in August. Two more students will begin



Lia Sissom, ASPPRC's new administrator.

in January, and the Center expects to have a busy period of recruiting a number of additional students who will be needed in the summer or fall of 2015. We also have several undergraduate students assisting with research projects in the center.

Some changes in the professional staff have also occurred, with Elaine Sutton retiring after serving ten years as the Center's Program Assistant

in August, and Lia Sissom taking over as ASPPRC Administrator. Prof. Kip Findley was granted tenure by the Colorado School of Mines in 2014, and Emmanuel De Moor, a Research Assistant Professor for the past several years, accepted a tenure track position, and will continue his involvement with ASPPRC in his new capacity. These recent appointments should help position the Center for continued success in the future. Visiting researchers Hidenori Nako, Jiyao Hong and Gabriela Martinez returned to Kobe Steel, Baosteel and UANL-Monterrey, respectively, over the summer, and Dr. Yulong Zhang and Dr. Yeon-Sang Ahn arrived from Baosteel and POSCO, respectively. Dr. Dean Pierce also joined the Center as a Post-Doctoral Research Associate. Prof. Van Tyne continues in his service as Associate Department Head.

The newest initiatives in the center include a project on rail metallurgy (with Evraz-Pueblo and the Colorado Office of Economic Development and International Trade), and involvement in the ALMMII (American Lightweight Materials Manufacturing Innovation Institute), a \$140M multi-

institution program that is part of the NNMI initiative (National Network of Manufacturing Institutes), for which David Matlock attended the President's announcement at the White House. Some other recent highlights include David's Brimacombe Award Lecture at AISTech, and John Speer's AIST Tadeusz Sendzimir Medal for contributions to the steelmaking process. John also gave the David R. Gaskell Memorial Lecture at Purdue University and received Mines' Excellence in Research Award. Kip Findley gave an invited lecture at the Steely Hydrogen conference in Ghent, Belgium and was named the Colorado School of Mines Student Activities Advisor of the Year (Colorado School of Mines Material Advantage Chapter). Emmanuel De Moor gave two keynote lectures at conferences in Europe. Chet Van Tyne gave a Keynote in India and was honored by the Forging Industry Education and Research Foundation for 25 years of service as the FIERF Professor at Mines. As these comments are being prepared, David Matlock is at Sheffield University delivering the prestigious Hatfield Memorial Lecture. Recent graduate Grant Thomas won an Institute Finalist Medal from the American Iron and Steel Institute for a recent publication with ASPPRC, and Amy Clarke was elected to the TMS Board of Trustees. We are so proud of the continued success of all of our students, past and present!

Best wishes to the "extended ASPPRC family" from all of the faculty, staff and students. For any further information, please contact Lia Sissom at lsissom@mines.edu.



Members and friends of ASPPRC honor Elaine Sutton (pictured, middle row, 5th from the left) at her retirement party at Table Mountain Inn on August 27th.

Research Center Highlights

Center for Welding, Joining and Coatings Research

Prof. Stephen Liu, Director
cwjcr.mines.edu

At the invitation of Petrobrás, the Brazilian State-Owned Oil Company, Prof. Stephen Liu was the guest lecturer during Rio Welding 2014, from August 27-29 in the “Cidade Maravilha” of Rio de Janeiro, Brazil. He presented “Pyrometallurgical Studies of Molten Metal Droplets for the Characterization of Gas Metal Arc Welding” to an audience of 380 participants.

Prof. Stephen Liu was an invited speaker at the Aviation Week - Brazing Symposium in Phoenix, Arizona. From September 23-24. He delivered a talk on the “Fundamentals of



Pictured L to R: Mr. Daniel de Almeida, Executive Director of the Brazilian Welding Association, and Dr. Cecille Mayer, Executive Director of the International Institute of Welding, with Prof. Stephen Liu, at IIV Pan American Welding Congress held in São Paulo, Brazil in October, 2014 .

Brazing: From Capillary to Wide Gap Joints” to an audience of 150.

Prof. Stephen Liu was honored with the Jaeger Lecture Award during the First International Institute of Welding (IIW) Pan American Welding Congress, October 20-23, in Sao Paulo, Brazil. He delivered the opening lecture on “Residual Stress

Management using LTTW Consumables”. The Lecture was established to honor Prof. Hans Jaeger, a great educator and industrialist in the field of shipbuilding.

Stephen Tate, PhD candidate, participated in the ICALEO (International Congress on Applications of Laser & Electro-Optics) 2014 Annual Meeting from October 19-23 in San Diego, California with a presentation titled “Fiber Laser Welding of High-N, High-Mn Austenitic Stainless Steel”.

Colorado School of Mines was represented with six student presentations in the American Welding Society FabTech National Annual Meeting on November 10-13 in Atlanta, Georgia. The names of the students and their titles of presenta-

tion are given in the following:

- Ali Alshawaf (PhD candidate): Weldability of Modern, Advanced High Strength Steels Using

Implant Testing with Hydrogen Charging.

- Kin-Ling Sham (Graduated PhD): The Effect of Nickel on Strength and Toughness in High Strength Low Alloy (HSLA) Submerged Arc Welding (SAW) Multi-Pass Welds.

- Erik Pfeif (PhD candidate): Comparison of Longitudinal Mechanical Properties of Nitronic 40 electron Beam Welded and Laser Beam Welds.

- Nathan Switzner (PhD candidate): GTA Welding of Cast Bronze with Stainless Steel.

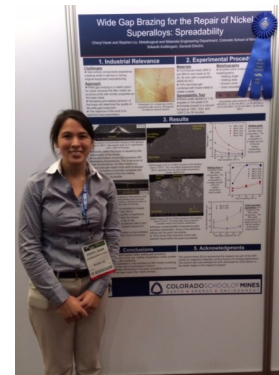
- Stephen Tate (PhD candidate): Development of a High-N, High-Mn Austenitic Stainless Steel Laser Weldability Diagram.

- Zhifen Wang (PhD candidate): Effect of Low Transformation Temperature Welding Consumables on Mechanical Properties of Lap Joints.

- Devon Gonzales (MS candidate): Development of Aluminum Matrix Composites for Solid Freeform Fabrication.

At the AWS FabTech Annual Meeting, Cheryl Hawk, MS Candidate, won the First Place Poster Award – Graduate Students Category. Her poster was titled “Wide Gap Brazing for the Repair of Nickel Superalloys: Spreadability”.

At the same AWS Annual Meeting in Atlanta, three students were recognized with Scholarship and Fellowship. Nathan Switzner received the American Welding Society National Graduate Fellowship 2014/2015, a 1-year award of \$25000. Minrui Gao, PhD candidate, won the American Welding Society International Scholarship for 2014/2015. The American Welding Society District awarded their \$2500 2014-15 Fellowship to Cheryl Hawk.



At the AWS-FabTech meeting in November, 2014: Left: Cheryl Hawk with her prize-winning poster.



Right: Ali Alshawaf after a successful presentation.

Research Center Highlights

Center for Non-Ferrous Structural Alloys

Prof. Michael Kaufman, Director
canfsa.unt.edu

The Center for Advanced Non-Ferrous Structural Alloys (CANFSA) is an NSF Industry/University Cooperative Research Center (I/UCRC) located jointly at the Colorado School of Mines and the University of North Texas. The Center Director is Prof. Mike Kaufman who is currently interim Dean of the CSM College of Applied Science and Engineering, and until recently was head of the Metallurgical and Materials Engineering Department at CSM.

“Some colleagues and I were concerned that many materials departments in the US have lost their expertise in physical metallurgy,” says Mike, “and so in 2011 we established CANFSA to become the premier research organization for non-ferrous structural alloys”.

Research at CANFSA utilizes computational modeling, metals processing and state-of-the-art characterization techniques to focus on three thrust areas; lightweight non-ferrous alloys (such as aluminum and magnesium), high performance non-ferrous alloys (including titanium and superalloys) and advanced alloys and processes (coatings, additive manufacturing, high entropy alloys). CANFSA has recently completed four research projects, currently has nine on-going projects, and the Industrial Advisory Board recently approved the seven new project topics listed below, which should be starting within the next year:

- Texture and grain size prediction of Ti-6Al-4V during forging and annealing and experimental validation
- Microstructural characterization of nanoparticulate reinforced ultra-high performance aluminum alloys
- Characterizing microstructural evolution in nickel-titanium intermetallics
- Effect of grain size and precipitate volume fraction on creep and fatigue of Ni-based alloys
- Understanding the physical metallurgy of new low CTE Ni-alloys
- Development of novel high temperature Ti-alloys
- Develop piezoelectric layers to predict end-of-life of

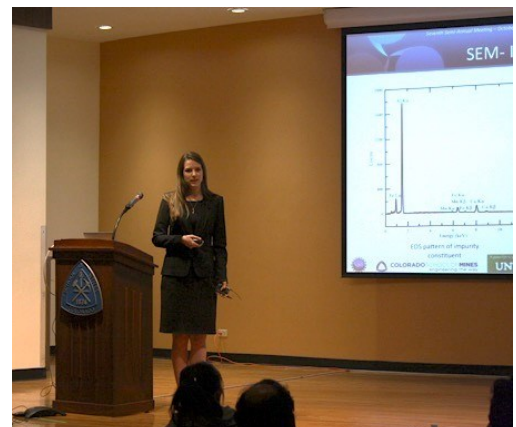


Participants at the October 2014 CANFSA meeting

coatings for dies and components

Over the past three-and-a-half years, membership in CANFSA has grown by nearly 50%, and CANFSA now has thirteen members which include large corporations (ATI, Boeing, GE Aviation, Honeywell, Plansee, United Technologies Research Center), small businesses (ALTiSS, Queen City Forging, Thermo-Calc Software, Weber Metals), government labs (Army Research Labs, Los Alamos National Labs) and a trade association (North American Die Casting Association). The center has face-to-face meetings twice a year, and 42 people attended the recent meeting held October 1-3 at CSM.

Mike Kaufman adds, “We are very proud of the progress that CANFSA has made over the past three years. The center budget has grown to nearly \$1.2 million, the first of the CANFSA students have started to graduate and our members are very actively involved in the research performed at the center”.



CSM PhD candidate Ellen Wright presents her research at the October CANFSA meeting



Colorado School of Mines
Department of Metallurgical and Materials Engineering
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SUPPORT MME

A gift to the 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 CSM Foundation.

<http://giving.mines.edu/>
303-273-3275

<http://metallurgy.mines.edu/>

Newsletter design by Ann Deml (Ph.D. Materials Science, 2014)

