MS NEWS

MATERIALS SCIENCE AND ENGINEERING

Carnegie Mellon University

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Surface Tilts Due to Martensitic Transformation

SEE STORY ON PAGE 3

A NOTE FROM THE DEPARTMENT HEAD

GREGORY S. ROHRER,
W.W. Mullins Professor

IN THIS ISSUE:

As Department Head for Materials Science and Engineering, one of my most important responsibilities is to carry on the Department's long tradition of academic excellence. This issue of *MSE News* features two of our alumni that represent this tradition, and we are proud to showcase them on pages 7 and 8.

John Perepezko *(Ph.D. 1973)* has been a Professor of Materials Science and Engineering at the University of Wisconsin in Madison since 1975. Throughout his career, he has mentored the masters and doctoral research of more than 60 students, six of whom have gone on to become professors themselves. As one measure of John's success, he is a member of the National Academy of Engineering.

W. Joseph Schlitt *(B.S. 1964)* took a career path that focused on the mining and extractive metallurgy industry. He is President of the metallurgical consulting company he founded, Hydrometal, as well as the author of more than 60 technical papers.

As we look ahead, the future of the Department's educational programs is as bright as ever. For example, about 10 years ago, we decided to create a research and education program in polymer materials science. Today, we have three faculty in this area. The most senior, **Michael Bockstaller**, is a full Professor studying block co-polymers for a wide range of applications. **Adam Feinberg** focuses on new approaches to tissue engineering for the treatment of disease and trauma (see story on page 5). **Chris Bettinger** focuses on the design of new polymeric biomaterials and medical devices that seamlessly integrate with the human body. This core group has been extremely successful in bringing recognition to CMU MSE as a place where research on polymeric materials is being conducted at the state of the art.

> "THE ENTIRE CMU MSE COMMUNITY SHOULD TAKE PRIDE IN OUR HIGH NATIONAL AND INTERNATIONAL RANKINGS."

This newsletter highlights another new area of research, spintronics, led by one of our newest faculty, MSE alum **Vincent Sokalski** *(M.S. 2008, Ph.D. 2011)*. Vincent is collaborating closely with researchers in the Electrical and Computer Engineering Department to develop materials for use in spintronic devices. The magnetoresistive random access memory (MRAM) they are working on is part of a future in which less energy is used—and dissipated—in computation.

This issue of *MSE News* also includes notes about our Department's recent national and global rankings. In the newly released *U.S. News and World Report* ranking, our undergraduate program is ranked 9th. The Quacquarelli Symonds (QS) World Education Rankings place MSE 14th internationally and 6th in the US. These rankings are based largely on the external reputation of our faculty, students, and alumni. The entire CMU MSE community should take pride in these rankings, as they reflect the strength of our past—as well as the promise of our future.

Gregory S. Rohrer

ON THE COVER:

SURFACE TILTS DUE TO MARTENSITIC TRANSFORMATION

The cover image for this edition of *MSE News* was produced by **Michael Chapman**, a doctoral student in the group of **Professor Marc De Graef**.

The image represents a martensitic microstructure in a Au-Cu-Zn alloy, observed at low temperature in the group's Quanta 600 environmental scanning electron microscope. The sample was cooled down in a dedicated cooling stage, and a series of electron back-scatter diffraction patterns (EBSPs) was obtained, scanning across the entire field of view (which is about 150 microns wide).

Since the sample was polished in the austenitic (cubic) state at room temperature, the sample surface became "corrugated" due to the martensitic transformation, and each martensite variant gave rise to a different tilt of the local surface normal. This tilt, in turn, caused the back-ground intensity of the EBSPs to shift slightly as the electron beam was scanned across the sample.

When these shifts were analyzed, it was found that they clustered around six different shift values. By assigning a color to each of these six shifts, the research team was able to construct the cover image, which depicts the local surface tilts due to the martensitic transformation.

This research was funded by the United States Air Force Office of Scientific Research, under MURI contract FA9550-12-1-0458.

MSE RANKED HIGHLY BY TWO ORGANIZATIONS

Recently, *U.S. News & World Report* released its 2015 ranking of American engineering programs. The College of Engineering at Carnegie Mellon was ranked #5 among all engineering schools in the US. The undergraduate program in Materials Science and Engineering was ranked #9 among similar degree programs nationwide.

In addition, British education company Quacquarelli Symonds (QS) has also released its 2014 World Education Rankings. The QS rankings are among the top three most influential and widely observed international university rankings. In the QS assessment, the MSE program at Carnegie Mellon was ranked 6th nationally and 14th internationally.

"These rankings reflect the strength of our academic reputation and scholarship," says MSE **Department Head and Professor Gregory S. Rohrer**. "In other words, the research carried out by our faculty and students is highly respected not only here in the United States, but across the world."

"We have excellent young faculty whose reputations in the academic world are growing and will continue to grow for the foreseeable future," Rohrer adds. "It is the work and accomplishments of these faculty who will advance our reputation."

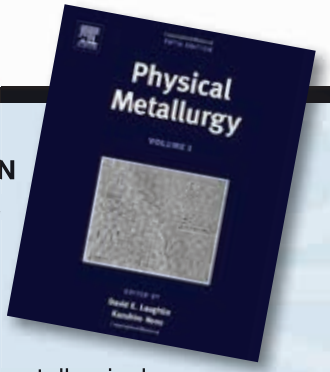
TAKING PRIDE IN ENGINEERING

CIT Pride Day is an annual, family-friendly event that celebrates being a part of the College of Engineering at Carnegie Mellon. Open to alumni, students, faculty, and staff, this celebration offers presentations from various engineering departments. At this year's event—held on Friday, September 19—undergraduate students from Materials Science and Engineering used liquid nitrogen and mini marshmallows to show how temperature affects the state of different materials.

Ryan Oh courtesy of The Tartan

FACULTY NEWS

MSE FACULTY CONTINUE TO DISTINGUISH THEMSELVES WITH A WIDE RANGE OF AWARDS, HONORS, AND PUBLICATIONS. THEIR IMPRESSIVE ACHIEVEMENTS SUPPORT THE DEPARTMENT'S REPUTATION AS A GLOBAL LEADER AND INNOVATOR.

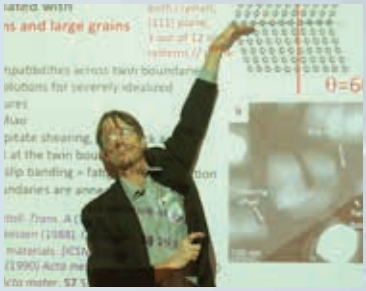


PROFESSOR DAVID LAUGHLIN was presented with the *Edgar C. Bain Award* by the Pittsburgh chapter of ASM International last May. This award is given to "an outstanding member for valuable contributions to the metallurgical and materials community." On being presented with the award, Laughlin pointed out the many accomplishments of Edgar C. Bain, a metallurgist and member of the National Academy of Sciences who worked for U.S. Steel Corporation. Laughlin noted that Bain is not only known for "Bainite" and the "Bain Strain," but was also the first American scientist to report on the existence of superlattice reflections in X-ray spectrograms of atomic ordering alloys. In addition, Laughlin is serving as Co-Editor of the *Physical Metallurgy* series, an authoritative reference tool that provides a complete knowledge set in physical metallurgy, which is the largest discipline in the field of materials science and engineering. The fifth edition has just been published by Elsevier. These books have been in the planning and execution stage for nearly four years, and their publication has been eagerly awaited by the metallurgical and materials community. Laughlin has co-authored several chapters; other MSE faculty contributors include **Michael McHenry**, **Anthony Rollett**, and **Katayun Barmak**.

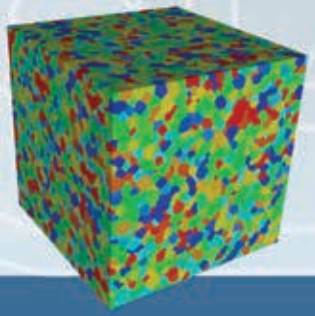
PROFESSOR GREGORY S. ROHRER has been selected to receive the American Ceramic Society's *W. David Kingery Award*. This award recognizes distinguished lifelong achievements involving multidisciplinary and global contributions to ceramic technology, science, education, and art. Upon announcing the award, the American Ceramic Society (ACerS) Board of Directors—which unanimously approved Rohrer's selection—called it "an important and well-deserved honor." Rohrer was recognized at the ACerS Honors and Awards Banquet, held during the Society's 116th Annual Meeting in October, which took place in Pittsburgh. The award includes a piece of commemorative glassware, a certificate containing a citation of the achievement on which the award is based, and a $5,000 prize.

ASSISTANT PROFESSOR ADAM FEINBERG was chosen as a "Young Innovator" by the journal *Cellular and Molecular Bioengineering* as part of a special issue created to highlight "the best and brightest" young faculty working in the field. In an editorial, the magazine said, "This Young Innovators issue was designed to profile the best research being carried out by the most talented assistant professors working in the area of cellular and molecular bioengineering." Honorees were selected based on their track record of accomplishments, the quality and importance of a submitted abstract, and a full-length manuscript that underwent a rigorous peer review process. Feinberg was cited for his new "shrink wrapping" methodology, described in his published manuscript, that can be used to envelope cells in a defined extracellular matrix. His approach represents a novel means of recreating the complexities of the extracellular matrix *in vivo*. Along with the other "Young Innovators," Feinberg presented his findings at the 2014 Annual Biomedical Engineering Society Meeting in San Antonio, Texas, in October.

PROFESSOR JAY WHITACRE has received three recent honors. First, he was awarded a new patent—US Patent 8,741,455—for his "sodium ion based aqueous electrolyte electrochemical secondary energy storage device." This technology is aimed at replacing conventional lithium-ion batteries with a more cost- and energy-efficient alternative. Second, in May Whitacre received a *2014 Resonate Award* from the Resnick Sustainability Institute at Caltech. The award recognizes his achievements as founder of Aquion Energy, spun out of Carnegie Mellon in late 2009. Since then this organization has raised over $100 million, has hired over 130 employees, and is currently shipping products. Third, Whitacre has been named one of "The World's Top 25 Eco-Innovators" by *Fortune* magazine, joining a prestigious list that also includes film director James Cameron, former New York City mayor Michael Bloomberg, and Tesla Motors CEO Elon Musk.



PROFESSOR ANTHONY ROLLETT has had a busy travel schedule. In August, he gave a plenary talk at the XXIII International Materials Research Congress 2014, held in Cancun, Mexico. That same month, Rollett presented at the 17th International Conference on the Textures of Materials in Dresden, Germany. In September, Rollett traveled to Cape Cod, Massachusetts, to speak at the 10th Biennial International Conference on Fatigue Damage of Structural Materials, organized by world-leading scientific publisher Elsevier. Finally, in early October Rollett served as a plenary speaker at the 7th Multiscale Materials Modeling International Conference, held in Berkeley, California.

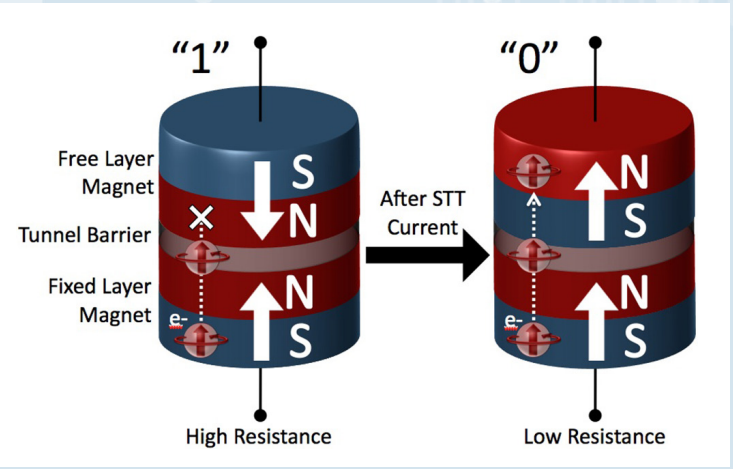


SOKALSKI WORKS TO IMPROVE ELECTRONICS PERFORMANCE

In Partnership With Samsung, Vincent Sokalski Targets Improvements in Device Storage, Speed, and Power

It's no secret that today's increasingly demanding consumers want their electronic gadgets to perform better. They want to store more data, access it faster, and charge the battery less often. It turns out that the solution to each of these challenges may lie in tiny nanoscale magnets.

"Most electronic devices take advantage of the fact that electrons have negative charge, something that's been known for centuries. However, electrons also have spin—and fascinating breakthroughs in modern physics have taught us that we can use that spin to both probe and manipulate a material's magnetic state at very small dimensions," explains **Assistant Research Professor Vincent M. Sokalski** of MSE. "Leveraging that spin is the basis for an emerging technology known as magnetoresistive random access memory, or MRAM, as well as a broader field of study known as spintronics." (See sidebar, "How Does MRAM Work?")



To fast-track new breakthroughs in the area of spintronics, in 2013 Samsung Electronics launched Samsung Global MRAM Innovation, a new program intended to support leading-edge research. This initiative was designed to create opportunities—at colleges, universities, and research labs around the world—for exploring breakthrough and innovative MRAM technologies. In response, Samsung received research proposals from teams around the world.

Earlier this year, Sokalski—who is a recognized expert in MRAM and spintronics—received one of six awards from Samsung through this highly competitive funding program. The Sokalski team includes MSE Ph.D. candidate **Price Pellegren**, as well as Professor Jian-Gang (Jimmy) Zhu of the Department of Electrical and Computer Engineering at Carnegie Mellon.

"Our team is focused on developing materials for MRAM that will enable scaling to smaller dimensions for high storage capacity, creating a new technology that should prove successful in today's memory market," says Sokalski.

"There remain a number of obstacles to MRAM's success and, more and more, it's become clear that these challenges are materials-related—where the device properties are ultimately dictated by fine details of the atomic structure and nanoscale interfaces," Sokalski continues. "Being able to engineer these interfaces through processing and material selection is critical to MRAM performance and is the focus of our collaborative effort with Samsung. If this can be done, then MRAM may have a bright future in next-generation smartphones and tablets."

HOW DOES MRAM WORK?

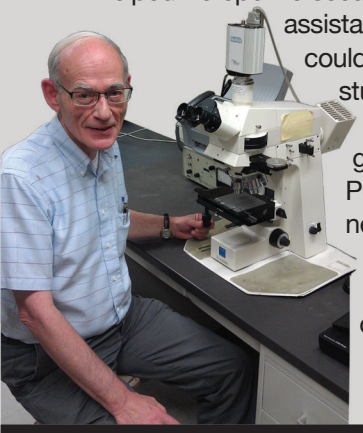
Quantum devices known as magnetic tunnel junctions (MTJs) are the individual storage units in magnetoresistive random access memory, or MRAM. These devices have an electrical resistance that changes when they become magnetized in a certain direction through a phenomenon known as spin-transfer torque (STT). "Because magnetic states don't tend to spontaneously change—for the same reason magnets don't randomly fall off the refrigerator—an MTJ's resistance doesn't change until we tell it to," notes Professor Sokalski. "This gives rise to a property known as non-volatility, where information will be retained even if power is lost or turned off—allowing us to give energy sources, like the battery, a break." Combined with its scalability, low energy consumption, and fast read/write operations, MRAM is the leading candidate for the next generation of computer memory.

A LOYAL SUPPORTER | *John Perepezko*

John Perepezko *(Ph.D. 1973)* began his relationship with MSE as a part-time doctoral student, while working as an Assistant Scientist at U.S. Steel's Bain Laboratory in Monroeville.

A Brooklyn native, Perepezko had earned his B.S. and M.S. from the Polytechnic Institute of New York—but was aware of Carnegie Mellon's outstanding reputation in metallurgy. "It made sense to pursue my doctoral research at MSE, since this worldclass program was in my backyard when I took a position at the U.S. Steel Research Center," notes Perepezko.

When his position at U.S. Steel was eliminated, **Professor Harold Paxton** helped Perepezko secure a teaching assistantship so he could pursue his studies full-time. It was an act of generosity that Perepezko has never forgotten. "I've always felt a strong sense of loyalty to the Department because of the close relationships I built," he says. "I feel like I had mentors who were important to me, while gaining skills that allowed me to have a successful career."



That impressive career includes a faculty position since 1975 at the University of Wisconsin in Madison, where today Perepezko is the IBM-Bascom Professor. He has personally mentored more than 60 masters and doctoral students, six of whom have become professors themselves.

Perepezko is also well known for his research, which focuses on the mechanisms, kinetics, and thermodynamics of phase transformations, especially the nucleation of crystals in amorphous materials and high temperature materials. He has published nearly 400 research papers, is a TMS Fellow, and was elected to the National Academy of Engineering in 2004.

Throughout his career, Perepezko has maintained close ties to MSE, providing critical financial support for facility upgrades and other strategic initiatives. When he visited MSE during the 2013 Saltminers Dinner, Perepezko was gratified to see the dramatic renovations on the A and C levels of Doherty Hall.

"The Department has done a great job of improving its student facilities, so the next generation of graduates is very well prepared," Perepezko says. "I'm very impressed with what has been accomplished—and I'm happy to contribute to these and other initiatives that keep MSE at the forefront of materials science education."

ALUMNI NEWS BRIEFS

Debdutta Roy *(M.S. 2010, Ph.D. 2012)* has won the 2014 *AIST Hunt-Kelly Outstanding Paper Award* for a paper she co-authored as part of her doctoral work at MSE. The paper, titled "Effect of Silicon on the Desulfurization of Al-Killed Steels," was chosen by the Association for Iron & Steel Technology (AIST) as its best published paper in the previous year. Co-authors of the winning paper are **Professors Chris Pistorius** and **Richard Fruehan**.

Jihoon Choi *(Ph.D. 2012)* has joined the Materials Science and Engineering faculty at Chungnam National University as an Assistant Professor. The University is located in Daejeon, South Korea.

Kelly Collier *(B.S. 2011)* has been named the *Western Pennsylvania Young Entrepreneur of the Year* by the US Small Business Administration. Collier is the founder and CEO of ActivAided Orthotics, a Pittsburgh-based company that makes custom back braces. The company's products are based on a senior-year project Collier worked on at Carnegie Mellon.

Andrzej Wojcieszynski *(M.E. 1990, Ph.D. 1993)* has been recognized as a member of ASM's 2014 Class of Fellows, an honor created to recognize members' distinguished contributions to materials science and engineering. Wojcieszynski was cited for "advances in powder metallurgy that resulted in the development of corrosion and wear resistant alloys for high performance applications." He is currently Technical Director for ATI Powder Metals, based in Pittsburgh.

Piyamanee "Nee" Komolwit *(M.S. 2005, Ph.D. 2009)* has been named a 2015 Board Member by the Heat Treating Society (HTS). She is a Senior Engineer, Surface Technology, for Kennametal in Latrobe, Pennsylvania. In this role, Komolwit is the technical lead for the heat treatment competency team, responsible for global heat treatment capability, quality control on heat treatment processes, and related equipment and consumables at all Kennametal plants.

LOOKING BACK AFTER 50 YEARS

After graduating from MSE, **W. Joseph Schlitt** *(B.S. 1964)* earned a Ph.D. in metallurgy from Penn State University in 1968. He then worked in the R&D group of mining company Kennecott Corporation for 14 years. He spent the next 20 years at a large engineering and construction company that catered to the minerals industry. Since 2004, Schlitt has been a consulting metallurgist and president of his own company, Hydrometal, Inc. He has written over 60 technical papers and edited six books, including the last two editions of the *SME Mining Handbook*. At our request, Schlitt submitted the following article, which looks back on the time he spent at MSE in the early 1960s.

It has been almost exactly 50 years since I graduated with a B.S. degree that says Metallurgical Engineering from a university called Carnegie Institute of Technology. I'm still proud of both names, as they help define who I am.

During my undergraduate days, the mark of an engineer was a slide rule on the belt, or possibly in the purse. If you

wanted to try your hand at those early computers, it meant dealing with a massive deck of punch cards. Backpacks and water bottles were virtually unknown, but beer bottles had already been invented.

Our day-student class was small, compared to the 39 who graduated last May. However, even then our class was coed. There was also a significant night school program catering to people from Alcoa, Westinghouse and the steel companies. I took some advanced classes at night, as they weren't always offered during the day.

Overall, there was a much greater emphasis on extractive metallurgy, both ferrous and nonferrous, than there is today. Courses covered a variety of mineral dressing techniques. Laboratory exercises included jigging, tabling, flotation, and leaching. Our lab reports first went to the teaching assistant, who graded them for technical content. Then they went to the English Department, where they were corrected for grammatical errors, spelling mistakes, and the like. Our final grade was an average of the two.

There was also a special quantitative analysis course for metallurgists. Assays included ash in coal, iron in iron ore, manganese in steel, and lead in galena concentrate. All were run using classical wet methods, without the benefit of instrumental methods, such as ICP or even AA spectroscopy. I have fond memories of The Metals Club, an informal gathering of faculty and students held periodically at one of the frat houses. Beer was provided and the conversations were often wide-ranging, occasionally even touching on metallurgy.

At the end of my sophomore year, I was selected to participate in a summer program sponsored by the National Science Foundation. I worked for **Professor Paul Shewmon**, the guru of diffusion. We grew high-purity copper bi-crystals in a modified zone refining furnace. After I polished one of the faces, I inscribed a deep gouge across the grain boundary, which created a bimodal profile. Then I used an interference microscope to monitor the relaxation of this profile due to progressive annealing. The experience was fascinating and left me with the thought that physical metallurgy was the place to be.

Then during my junior year, my perspective started to shift as I took more advanced extractive and chemical metallurgy courses. In the end, I did my senior thesis on the dissolution of lime in BOF slags—a subject that **Professor Chris Pistorius** tells me is still relevant today. I found the thesis to be a very worthwhile undertaking, so I hope it is still part of the curriculum.

GAINING A GLOBAL PERSPECTIVE

Senior Kimberly Justl Looks Back at Her Summer in Japan

When **Kimberly Justl** learned of Tokyo Institute of Technology's new exchange program with Carnegie Mellon, she was eager to explore Japanese culture during her summer break—while also collaborating with fellow researchers from the other side of the world.

"I've always loved traveling on vacations," says Justl, now a senior. "I thought actually living in Tokyo would allow me to immerse myself fully in the Japanese way of life. I was thrilled when the Institute provided me with housing, travel expenses, and a monthly stipend to support my summer abroad."

Kimberly Justl (second from right) visited the city of Kamakura, a popular tourist destination, with fellow exchange students.

Justl's laboratory work in Tokyo centered on processing and applications for carbon nanofibers, which are cylindric nanostructures composed of graphene layers. Justl explored whether functionalized carbon nanofibers would make effective catalysts.

"When materials exist on a very small scale, they often exhibit very different properties—and I have always found this fascinating," explains Justl. She was gratified to find that the ongoing research on carbon nanofibers at Tokyo Institute of Technology dovetailed perfectly with her previous work with nanomaterials at CMU.

However, while her work in the laboratory was easily translated to a new environment, Justl did encounter some translation difficulties outside the campus. "At the Institute, everyone spoke perfect English and I was very comfortable," says Justl, who does not speak or read Japanese. "But when I traveled on the weekends to places like the island of Hokkaido, I was surprised by how few people spoke English. Ordering a meal, arranging transportation, shopping…these were all huge challenges because of the language barrier."

Looking back now, Justl is proud of the way she adapted to this sometimes challenging environment—and feels she has grown as a result. "It was a valuable experience to immerse myself in a new culture and a new language for three months," she notes. "I actually navigated very well in spite of the obstacles. I tested myself and was able to learn quite a bit!"

MSE STUDENTS EXCEL AT ASM YOUNG MEMBERS NIGHT

On February 20, the ASM Pittsburgh Golden Triangle Chapter hosted its 2014 Young Members' Night at the University Club. Once again, MSE dominated this annual celebration of promising young engineers.

This year's student speaker was second-year Ph.D. candidate **Brian DeCost** of MSE, whose presentation was titled "Towards Stable Nanocrystalline Metals: A Computational Approach."

Students from the Department swept the Graduate Student Poster Competition. **Rachel Ferebee** won first place, **Tugce Ozturk** claimed second place, and **Sudipto Mandal** was awarded third place.

In the Undergraduate Student Poster Competition, **Elise Hall**, **Holly Fitzgibbon**, and **Tejank Shah** tied for second place. **Natasha Gorski** won the third-place prize.

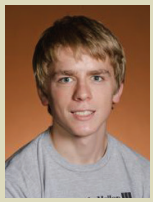
Stephen Chen won the *Outstanding College Senior* award. Junior **Dylan Quintana** was honored with the *Past Chairpersons Educational Assistance Scholarship (PCEAS) Junior* award, while sophomore **Joshua Kubiak** received the *PCEAS Sophomore* award.

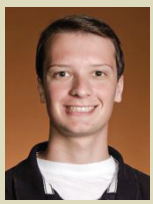
Congratulations to all the winners from our Department!

STUDENT NEWS

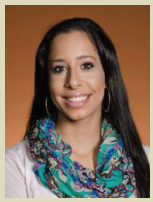
STUDENT NEWS BRIEFS

Graduate student **Brian Lin** will be honored with the *Best Paper* award at The Minerals, Metals & Materials Society (TMS) 2015 Annual Meeting & Exhibition next March in Orlando, Florida. Lin's paper, entitled "Reducing the Dependency on Government Funding" is being recognized by TMS for showing original thought and creativity on global or national issues relating to the field of metallurgy or materials science.





Three MSE undergraduates have been recognized as *Boeing Scholars* for the 2014-15 academic year: senior **Blair M. Graham**, junior **Joshua Kubiak**, and junior **Benjamin Paren**. Boeing created this scholarship program in order to identify and build relationships with the nation's top engineering students—who may seek internships or entry-level positions with Boeing in the future. Boeing scholarships, which include a $5000 grant, are awarded to promising students who are interested in the field of aerospace.



Junior **Dominique MacCalla** is part of a seven-member undergraduate team from Carnegie Mellon that participated in the 2014 International Genetically Engineered Machine (iGEM) competition in October. The multidisciplinary CMU team focused on studying the level of estrogen in wastewater. MacCalla, a dual major in MSE and Biomedical Engineering, was chosen for this prestigious team in a competitive application process that included students from across Carnegie Mellon.

Ph.D. candidate **Clare Mahoney** recently enlisted fellow MSE students to create a unique dance video that attempts to simplistically explain her complex doctoral research—which focuses on making polymers more useful in electronic packaging applications. The video has been entered in the seventh annual "Dance Your Ph.D." contest, sponsored by *Science* and the American Association for the Advancement of Science (AAAS). You can watch Mahoney's entertaining video at http://vimeo.com/107372477.

Senior **Dylan Quintana** has been named a 2015 *Andrew Carnegie Society Scholar.* This honor is given annually to seniors who best represent their class in service and leadership; recipients are selected by their deans and department heads. Since its inception in 1975, the program has recognized nearly 1,000 students. Each ACS Scholar receives a monetary award—made possible by the generosity of ACS members—that supports their academic and personal growth.

Senior **Kate Groschner** spent her summer purposefully creating a product that engineers usually try to avoid generating: carbon monoxide. Groschner participated in a nine-week Summer Scholars program sponsored by the Center for Materials Science and Engineering, in collaboration with the Materials Processing Center, at the Massachusetts Institute of Technology (MIT). Groschner's project with Professor Fikile Brushett of MIT researched nanoparticle catalyst monolayers created via galvanic replacement for the conversion of CO_2 to CO. This conversion is of particular interest because carbon monoxide can then be easily turned into hydrocarbon fuels or the monomers for plastics. If this conversion can be made efficiently, this process can provide an economic incentive for further adoption of carbon capture technologies.

For the second year in a row, five MSE graduate students participated in Pedal PGH, the region's leading bicycle event, held this year on August 24. According to event sponsor BikePGH, Pedal PGH is a "casual, fun ride that exposes people of all ages and fitness levels to the neighborhoods, parks, bridges, and geography that make our region so unique." The event offers a variety of courses, with varying distances, to accommodate riders of all ability levels. The MSE bike riders are **Evan Wilson-Drolet**, **Miaolei Yan**, **Brian DeCost**, **Bongjoon Lee**, and **Rachel Ferebee**.

< **Left to right: Bongjoon Lee, Evan Wilson-Drolet, Brian DeCost, Rachel Ferebee, and Miaolei Yan**

COMMENCEMENT 2014: *A Time to Shine*

The Department of Materials Science and Engineering celebrated its annual Commencement ceremony on Sunday, May 18, at Winchester Thurston School. The Department awarded 39 B.S. degrees, 54 M.S. degrees, and 15 Ph.D. degrees.

Whether these graduates are continuing their educations, accepting industry positions, or joining the world of academia, the entire MSE family wishes them all the best!

At the May 18 event, the following students were recognized with special awards:

- *The William W. Mullins Undergraduate Award*
  Recipient: **Madeline Cramer**
- *The Hubert I. Aaronson Undergraduate Award*
  Recipient: **Tejank Shah**
- *The James W. Kirkpatrick & Jean Kirkpatrick Keelan Award*
  Recipient: **Bryce Pardoe**
- *The William T. Lankford Memorial Scholarship Award*
  Recipient: **Holly Fitzgibbon**
- *The ASM Golden Triangle Chapter Outstanding College Senior Award*
  Recipient: **Stephen Chen**
- *The Paxton Award for Best Doctoral Dissertation*
  Recipient: **Dr. Siyang Xu**

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING
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Commencement
Class of 2014

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