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MSE news

MATERIALS SCIENCE AND ENGINEERING

www.materials.cmu.edu

Organic Electronics: Overcoming Design Challenges

Learn more on page 3

INSIDE

A Note From the Department Head

Gregory S. Rohrer, W.W. Mullins Professor

Dear MSE Graduates:

In this issue of *MSE News*, it is my pleasure to announce a new degree program: the Masters in Energy Science, Technology, and Policy (see story on page 4). The program—referred to as ESTP—represents an interdisciplinary degree in the College of Engineering that was designed and organized by the Department of Materials Science and Engineering.

The motivation for this program is the growing global concern—for both engineers and policy makers—represented by the production of energy, its transportation and storage, the efficiency with which it is used, and its economic and environmental impacts. The goal of the new ESTP program is to prepare graduates to take leadership roles in the deployment of emerging and future energy technologies.

While the connection between energy and materials is probably obvious to most of you, it is worth noting a few examples of the impacts that materials science can have on energy usage and efficiency.

For instance, it is interesting to take a look at the processing of aluminum, which consumes 3 percent of the total global electricity supply today. Over the last several decades, advances in materials processing have decreased the amount of energy used to make aluminum by about one-third, significantly reducing both greenhouse gas outputs and costs. Efficient recycling processes are also an important focus for this energy-intensive material, as recycled aluminum requires only 5 to 10 percent of the energy needed to make virgin aluminum from ore.

Similarly, while the global average for the efficiency of coal-fired power plants today is 30 to 35 percent, new plants have been designed with 46 percent efficiency—and it is thought that 50 percent is achievable. The increase in efficiency comes from operating the plants with higher-temperature steam—and the key enabling features needed to achieve these higher temperatures are new materials, including alloys for turbines that can remain stable at higher temperatures for longer times, as well as ceramic coatings that protect the materials in the turbine.

> "It is my pleasure to announce a new degree program: the Masters in Energy Science, Technology, and Policy—an interdisciplinary degree that was designed and organized by MSE."

These are just a few examples of the critical role that materials play in the efficient use of resources with reduced environmental impact. Beyond established technologies, materials scientists and engineers are poised to transform the way energy is produced, stored, and utilized through the development of materials that will enable new fuel cells, new batteries, the conversion of solar to chemical energy, and highly efficient solid-state lighting.

As with many of the ventures at Carnegie Mellon, the new ESTP degree program capitalizes on the interdisciplinary nature of the University. This program could not exist without the contributions of the other departments within the College of Engineering.

The ESTP program is directed by **Professor Sridhar Seetharaman** of MSE, and I encourage you to contact him for additional information about this exciting new addition to our curriculum. We look forward to enrolling the first class in ESTP this Fall and growing the program in the years to come.

Gregory S. Rohrer
W.W. Mullins Professor and Department Head

COVER STORY

Organic Electronics: Overcoming Design Challenges

Organic semiconductors are poised as never before to transform the electronics industry, creating unprecedented versatility in a range of applications. The novel combination of electrical and mechanical properties found in organic semiconductors, and the ability to process these materials at low temperatures, make them particularly well-suited for large-area, flexible electronic devices. Currently, organic electronic devices serve as key components in several commercialized products, such as OLED (organic light-emitting diode) televisions, but many materials scientists believe that organic electronics such as solar cells and LEDs can have far broader applications, in diverse platforms ranging from fabrics and portable electronics to commercial buildings.

Carnegie Mellon University has been one of the early contributors to the development of organic electronics. In the early 1990s, Professor Richard McCullough of the Department of Chemistry—who is currently the Vice President of Research at Carnegie Mellon—developed controlled reactions for the synthesis of regioregular polythiophenes that initiated worldwide research to realize the enormous potential of these materials. More recently, an interdisciplinary Carnegie Mellon research team focusing on organic polymer electronics has included MSE **Professors Lisa M. Porter** and **Michael R. Bockstaller**.

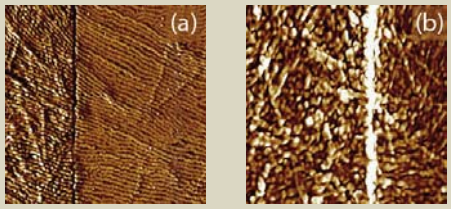


Figure 1: Morphology of P3HT nanofibrils in the vicinity of the (a) planar and (b) conventional contacts.

In collaboration with McCullough and Professor Tomek Kowalewski from the Chemistry Department, Professor Porter's research group is investigating charge injection and transport in organic polymer-based field-effect transistors. A critical limitation of organic electronic device development is the inability to control the morphology of the materials. In a recent study, soon to be featured in *Advanced Functional Materials*, this collaborative team has shown that contacts not only play an important role as charge injection barriers, but their geometry can also significantly affect devices' polymer morphology (see Figure 1) and, in turn, their electrical performance in terms of both carrier mobility and contact resistance. As shown in Figure 1(a), for recessed electrodes the morphology is substantially improved at the interface between the electrode and the channel, when compared with the conventional device shown in Figure 1(b).

Figure 2: Individual regioregular polythiophene nanofibrils spanning a 10 µm channel of an organic field-effect transistor with planarized contacts.

The cover of this edition of *MSE News* shows a large-area atomic-force micrograph of individual regioregular polythiophene nanofibrils spanning the length of a 10 µm channel of an organic field-effect transistor having planarized contacts. The image was taken by **K. Abhishek Singh**, an MSE Ph.D. student in Professor Porter's group, and Tomasz Young, a former Chemistry Ph.D. student in Professor Kowalewski's group. Their work also involved the design of a novel polymer deposition system that allows the formation of extremely thin polymer films.

The results from this collaborative team's study should have wide-ranging implications for the verification and refinement of theoretical models that explain charge injection and transport in organic electronic devices. In addition, the team's experimental approach to studying nanomorphology in transistors via the fabrication of ultra-thin-film devices may prove useful in other studies which could benefit from the direct visualization of active layers affected by substrate modifications, processing conditions, and other factors.

DEPARTMENT NEWS

MSE Launches New Masters Degree

Focused on Energy, Interdisciplinary Program Will Attract Diverse Students

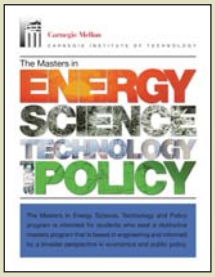
This fall, the Department of Materials Science and Engineering will administer a new, College-wide Masters degree program with a unique focus on energy. The interdisciplinary Masters in Energy Science, Technology, and Policy program will be based in engineering—but informed by a broader perspective on the energy implications of economics and public policy.

Students enroll in the program independent of a department, but select a concentration within one of six different departments in the College of Engineering: Materials Science and Engineering, Chemical Engineering, Civil and Environmental Engineering, Electrical and Computer Engineering, Engineering and Public Policy, and Mechanical Engineering. The curriculum consists of 96 units and is designed to be completed in one academic year. Students in the program are self-funded and involved principally in coursework. While project-based classes are permitted, they are not required.

The program, which draws instructors from across Carnegie Institute of Technology (CIT), covers a wide range of issues—from the harvesting and conversion of energy to its distribution, demand, and usage. Diverse subjects will include:

- The fundamental underlying scientific principles governing, and limiting, energy conversion and transport
- The technological, regulatory, and other barriers that exist today—and engineering challenges for enabling future power systems and infrastructure
- Sustainability and environmental issues
- The national and global socio-economic questions that govern energy policy and legislation

Graduates will have a unique education that is focused on energy, incorporating the different strengths offered by various CIT departments. They may pursue careers in the utility sector, power plant design and manufacture, primary metals and other energy-intensive manufacturing segments, consulting, government labs, and academic institutions.



MSE: Taking a Leadership Role

The Department of Materials Science and Engineering will not only administer the new Masters in Energy Science, Technology, and Policy program, but will also play a strong role in teaching one of the required core classes, "Energy Conversion and Supply." This class is the first step in a four-course sequence in which students learn the basic workings of the systems that supply, distribute, and utilize energy—as well as how economic forces and policy decisions drive the development of these systems.

In this course, fossil energy sources, nuclear energy, and renewable sources will all be considered, with a focus on both conventional and emerging systems. Students will also examine energy utilization in construction, transportation, and manufacturing. The class will include guest lecturers to provide expertise in specific systems, along with case studies highlighting energy-intensive technologies and industries.

Students choosing a concentration in MSE can take a variety of courses that focus on the mechanical and chemical stability of materials in extreme environments, solid state devices for energy conversion, materials in nuclear systems, materials for energy storage, and energy consumption and minimization in metals production. In addition, a special topics class on energy and society will be offered.

The curriculum will take advantage of the energy-related research of a number of MSE faculty, including **Professors Jay Whitacre** (new materials for batteries, primarily oxide intercalation compounds), **Richard Fruehan** (energy reduction in metals processing), and **Warren Garrison** (materials at extreme conditions). **Professors Anthony Rollett**, **Gregory Rohrer**, and **Paul Salvador** will lend their expertise in the micro-structural evolution of components in energy conversion devices.

For further information about the new Masters in Energy Science, Technology, and Policy program, contact **Professor Sridhar Seetharaman** at sridhars@andrew.cmu.edu, or visit the program Web site at http://neon.materials.cmu.edu/energy/.

Connecting With Young Engineers

By Making Science Fun, MSE Outreach Programs Spark Interest in Engineering Careers

The Department of Materials Science and Engineering is not only dedicated to maintaining its leadership in education at the University level—but is also increasingly focused on connecting with younger scientists and engineers. Through a number of outreach programs aimed at local elementary, middle, and high school students, MSE faculty and staff are both entertaining and encouraging these young people—with the ultimate goal of sparking their interest in a materials science or engineering career.

An Explosive, Educational Road Show

On January 16, **Professor Paul Salvador** and MSE X-Ray Laboratory Supervisor **Jason Wolf** brought a "whiz bang" interactive show to the Westinghouse Science Honors Institute (WSHI) in Churchill as part of the Institute's ongoing series of Saturday science lectures.

Sponsored by Westinghouse Electric Company, WSHI is a free program for approximately 300 high school juniors from Western Pennsylvania who demonstrate a strong interest in science and who maintain a high scholastic standing. WSHI consists of 10 Saturday-morning lectures, held from October through February, on selected topics in science and engineering. By enabling these talented students to network with science professionals, as well as students from different schools with the same abilities and interests, WSHI encourages them to pursue scientific careers.

During an outreach event, Jason Wolf of MSE (left) demonstrates the explosive results of dropping Mentos candies into a two-liter soda bottle.

The presentation by Salvador and Wolf combined practical information on materials science and engineering careers with exciting interactive demonstrations designed to grab students' attention. Topics such as materials structure and processing were first discussed, then demonstrated in fun, interactive ways. For example, students helped to freeze marshmallows in liquid nitrogen, then ate them. Using a special apparatus created by Salvador and Wolf, Mentos candies were dropped into two-liter soda bottles, and students witnessed the explosive results firsthand.

Following the presentation, about 100 students had the chance to try these experiments on their own, as well as use a portable scanning electron microscope (SEM) that the MSE team brought with them.

On February 19 and 20, Salvador and Wolf brought a larger team of MSE volunteers to the Engineers Week event held at Pittsburgh's Carnegie Science Center. This annual program, designed to inspire young people to explore engineering, includes more than 50 exhibits and event tables featuring presentations, demonstrations, and hands-on activities. Thousands of elementary, middle, and high school students attended the 2010 event, along with teachers and parents.

The MSE exhibit, which was very popular with attendees, featured many of the interactive learning activities from the WSHI presentation, allowing young scientists to experience engineering principles firsthand.

In October, the Department will continue to sponsor educational activities in conjunction with the Carnegie Mellon chapter of the Society for Women Engineers, as part of the Society's annual "High School Day" event. This one-day interactive workshop introduces female high school students to educational opportunities and careers in engineering and the applied sciences. Salvador and Wolf are already planning their involvement in this upcoming outreach event.

Inspiring a New Generation of Scientists

According to Professor Salvador, these outreach activities represent a critical effort to mentor the next generation of materials scientists and engineers.

"While I interact daily with undergraduate and graduate students at MSE, I don't have to convince them that materials science represents a great career opportunity—because they already have an established interest in our field," says Salvador. "It is much more challenging to connect with younger students who may not have a clear picture of materials science yet. Our outreach efforts give us a chance to not only introduce young people to our field, but to create interest and excitement about the profession."

Salvador notes that one key to success is making materials science fun. "It's always rewarding to watch young scientists do hands-on experiments, whether they are hesitantly tasting a frozen marshmallow or watching as the Mentos candies explode with energy," says Salvador. "We are taking a concept out of the textbook, and bringing it into real life. That's a great moment."

Remembering Richard Heckel

First CIT Alum to Serve as Department Head

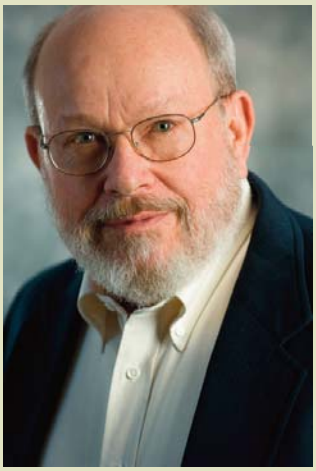


Photo courtesy MTU

Richard Heckel

It was with great sadness that the Department of Materials Science and Engineering learned of the passing of **Richard Heckel** *(B.S. 1955, M.S. 1958, Ph.D. 1959)* on May 25. Not only did Heckel earn three degrees at MSE, but he had the distinct honor of being the first MSE and CIT alumnus to serve as Department Head.

Upon receiving his doctorate in 1959, Heckel worked as a Senior Research Metallurgist at E.I. du Pont de Nemours' Experimental Station in Wilmington, Delaware. He began his long and successful career in academia in 1963, when he became a Professor of Materials Engineering at Drexel University in Philadelphia. He returned to Carnegie Mellon in 1971 as Professor and Department Head of MSE, a position he held from 1971 to 1976.

While heading MSE, Heckel led a number of important curriculum changes that were required when Carnegie Mellon separated the CIT and MIS organizations. He also played a critical role in MSE's involvement in developing the NSF-sponsored Processing Research Institute, as well as the NSF-sponsored Center for Joining Materials. During Heckel's tenure, MSE enrollment grew significantly, in part due to a new co-op program which enabled undergraduates to help finance their educations while also gaining experience through industrial internships.

From 1976 to 1996, Heckel held the position of Professor of Materials Science and Engineering at Michigan Technological University (MTU) in Houghton, Michigan. He retired from MTU in 1996, but held the title of Professor Emeritus until the time of his death.

During his retirement, Heckel founded and has acted as Technical Director of Engineering Trends, a globally recognized e-commerce consulting firm specializing in engineering education.

Heckel was a member of the American Society for Engineering Education; a Commission-at-Large of the Engineering Workforce Commission; a life member of the Minerals, Metals & Materials Society (TMS); and a Fellow, life member, and recipient of the *Bradley Stoughton Young Teacher of Metallurgy Award* at ASM International.

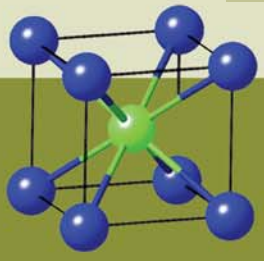
From 1973 to 1978, Heckel was a member of the U.S.-USSR Special Electrometallurgy Committee established by the Nixon-Brezhnev Detente Agreement in 1972. In 1984, he was a Visiting Professor at South China Institute of Technology in Guangzhou, China. In 1987, Heckel took a sabbatical from teaching and worked for the U.S. Department of Energy's Division of Material Science in Germantown, Maryland.

Heckel was preceded in death by his wife Peggy. He is survived by son Scott, daughter Laura, and four grandchildren—Josh, Kourtney, Kiersten, and Brandon.

Richard Heckel is remembered fondly by many MSE faculty and alumni, including his close friend **George Dieter** *(D.Sc., 1953)*. "I was Dick's boss when he started out at DuPont, and when I went to Drexel he was the first person I added to the faculty," remembers Dieter. "He was a terrific teacher and researcher who never received the recognition he deserved. His enthusiasm for anything he did was infectious, and students by the hundreds admired him as a leader and person. I would like his family to know how much Dick was admired by his fellow alumni, as well as the faculty and students he worked with. He made a lasting impression on everyone who knew him, and he will be greatly missed."

A Life of Remarkable Results

Since learning of the passing of Dick Heckel, MSE has been overwhelmed with stories about his impact on fellow alumni, colleagues, and students. **Professor Emeritus Henry Piehler** and **Mel Bernstein** (former MSE faculty member, MSE Department Head, and Associate Dean of CIT) remember Heckel's remarkable patience, exhibited on a Canadian fishing trip they took with him. Heckel was an accomplished fisherman; Bernstein and Piehler were not. Whenever the opportunity arose to cast into a prime area, Bernstein would inevitably wind up in a tree; Piehler preferred the land. The latter two would also have nothing to do with fish with teeth, refusing to use a steel leader whenever these fish were encountered. On the last night of the trip, Piehler and Bernstein were so tired of fishing that they volunteered to put up tents and cook dinner, freeing Heckel to patiently go on fishing. His patience was rewarded with a remarkable catch, typical of his accomplishments throughout his life.



FACULTY NEWS


Sridhar Seetharaman

Professor Sridhar Seetharaman, POSCO Professor of Materials Science and Engineering, has been elected as a foreign board member for the journal *Steel Research International*. The leading steel journal in Europe, *Steel Research International* provides a forum for the publication of high-quality manuscripts in areas ranging from process metallurgy and metal forming to materials engineering, as well as process control and testing. The emphasis is on steel and related metals, and on materials involved in steel processing, such as refractories and slags.

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Richard Fruehan

Professor Richard J. Fruehan, U.S. Steel Professor of Materials Science and Engineering, has received the *2010 AIST of AIME Hunt-Kelly Outstanding Paper Award* for his paper "Decarburization and Slag Formation Model for Electric Arc Furnace." Fruehan's co-authors are Raimundo A.F.O. Fortes and Hiroyuki Matsuura. The paper was selected based on its excellence, originality, relevance to the technology (applied or fundamental) of the iron and steel industry, and for its advancement of engineering and operating practice in the steel industry.

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Jay Whitacre

Assistant Professor Jay Whitacre is the recipient of the *2010 George Tallman Ladd Research Award*. This annual CIT award recognizes Carnegie Mellon faculty members who demonstrate outstanding research, professional accomplishments, and potential. In addition, Whitacre received national publicity recently when the January issue of *NATURE* magazine highlighted his recent $5 million stimulus grant to fund renewable energy storage technologies (see *MSE News*, Winter 2009). An article titled "From Steel to Science" focused on Pittsburgh's transformation into a knowledge base for life sciences, energy, robotics, and other growing technology areas. Whitacre's effort to develop renewable "smart grid" technologies was hailed as one example of the changing face of Pittsburgh.

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John Kitchin

Assistant Professor John Kitchin, who holds a courtesy appointment in MSE, was awarded a five-year, $750,000 grant from the U.S. Department of Energy to develop new materials for producing hydrogen and oxygen from water using electrochemistry. Kitchin is one of 69 researchers nationwide to receive stimulus funding as part of the Energy Department's Early Career Research Program. The new effort is designed to bolster the nation's scientific workforce by supporting exceptional researchers during their crucial early years. Kitchin's research, which is designed to make hydrogen production from water more efficient, will support the development of future energy systems that store intermittent renewable energy in chemical form. Kitchin is an Assistant Professor of Chemical Engineering at Carnegie Mellon.

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Kris Dahl

Another MSE courtesy faculty member, **Assistant Professor Kris Dahl**, has received the *NSF CAREER Award* for her research on "Genome Regulation and Nuclear Rheology." This prestigious five-year grant was created by the National Science Foundation to accelerate the progress of young faculty members in their professions. The subject of Dahl's research is the origin of gene expression. While the sequencing of the human genome was a major achievement, poor understanding of the mechanisms controlling gene expression currently limits the usefulness of this information. Dahl's hypothesis is that exposure to mechanical force causes reorganization of the nucleus that helps regulate gene expression. Dahl is an Assistant Professor of Chemical Engineering and BioMedical Engineering at Carnegie Mellon.

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Michael Bockstaller

Assistant Professor Michael R. Bockstaller was featured in a recent issue of *National Geographic Kids* for his efforts to develop new nanomaterial technologies that combine strength and durability with optical transparency. By changing the way objects interact and deflect light, Bockstaller's innovations can improve military camoflage and a range of consumer products.

ALUMNI NEWS

Alumni Profile: M. Elise Hyland

Since earning her B.S. degree in the Department of Materials Science and Engineering in 1981, **M. Elise ("Lisa") Hyland** has gone on to an extremely successful career—if a somewhat unconventional one for an engineer. Her professional path began typically enough, when she joined Alcoa Laboratories as a Research Engineer upon graduation, rising to become the Manager for the Alloy Development Division—while also earning her M.S. at MSE, which she completed in 1988. But Hyland, who had a dual major in Business as an undergrad, was increasingly drawn to the corporate world. "I always wanted to study business and work as a corporate executive, so in 1997 I decided to pursue a graduate degree at the Tepper School," says Hyland. After completing her M.B.A. in 2000, Hyland joined EQT Corp and held positions in finance and strategic planning, before moving to its subsidiary, Equitable Gas Company. There, she held positions in customer service and operations, rising to become President of Equitable Gas in 2007. In April 2010, she assumed her current position as President of Commercial Operations for EQT. In this position, she is focused on a number of strategic challenges, including increasing the utilization of the natural gas resources that are found throughout Pennsylvania in the form of Marcellus shale—both to increase U.S. energy independence and to strengthen the region's economy. While her high-level corporate position might seem an unusual path for a materials engineer, Hyland emphasizes the many connections between her studies at MSE and her current position. "The problem-solving skills I learned in the Department can be applied to any challenge that needs to be broken down and solved," she says. "And my technical background has certainly proven to be a strength at both Alcoa and EQT, which are resource- and technology-intensive businesses." Hyland's professional success has been matched by personal happiness. She is married to fellow MSE alum **Robert Hyland** *(B.S. 1981, M.S. 1984, Ph.D. 1989)* and the couple has four children: Logan, Ellen, Natalie, and Kelly. Daughter Ellen is following in her parents' Carnegie Mellon footsteps, having earned a B.S. in Mechanical Engineering in 2009.

M. Elise Hyland

Two Alums Named TMS Executives

The Minerals, Metals & Materials Society (TMS) recently named two MSE alumni as executives. **George T. "Rusty" Gray III** *(Ph.D., 1982)* recently became the 54th President of TMS, while **George Spanos** *(B.S. 1982, M.E. 1985, Ph.D. 1989)* is the organization's new Technical Director.

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Photo courtesy TMS

Rusty Gray

Rusty Gray was named President of TMS during the 139th TMS Annual Meeting & Exhibition, held in Seattle in February. Gray, who served as TMS Vice President in 2009, has been a member of the Society since 1986. He has served two terms on the TMS Board of Directors, first as Chair of the Structural Materials Division, then as Director of Publications. In his first address as President, Gray promised to focus special attention on the areas of international liaisons, leadership development, and meeting members' changing needs.

Gray has been an employee of Los Alamos National Laboratory (LANL) since 1985, pursuing both fundamental and applied research primarily in the elucidation of the structure/property behavior of materials subjected to dynamic and shock-wave deformation. At LANL, Gray has risen from staff member to team leader, achieving Laboratory Fellow status in 2002.

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Photo courtesy TMS

George Spanos

George Spanos joined the TMS staff at its headquarters near Pittsburgh in March, becoming the Society's Technical Director. Spanos has technical strengths that are well aligned with key growth areas targeted by TMS, including micro/nanostructure processing and property relationships, as well as integrated computational materials science and engineering. Spanos has been an active TMS member since 1982, working in many volunteer capacities.

Before joining TMS as Technical Director, Spanos served as Section Head in the Materials Science Division of the Naval Research Laboratory (NRL). He received the NRL Commanding Officer's *Award for Achievement in the Field of Equal Employment Opportunity,* in addition to two *Technology Transfer Awards*. Spanos was inducted as an ASM International Fellow in 2004, and has authored or co-authored 89 technical publications which have received 1,490 citations.

STUDENT NEWS


Marianna Sofman


Ellen Tworkoski

Congratulations to MSE juniors **Marianna Sofman** and **Ellen Tworkoski,** who have both been named recipients of the prestigious *Barry M. Goldwater Scholarship*. The Barry M. Goldwater Scholarship and Excellence in Education Program was established by Congress in 1986 to honor Senator Barry M. Goldwater, who served his country for 56 years as a soldier and statesman, including 30 years of service in the U.S. Senate. The purpose of the Foundation is to provide a continuing source of highly qualified scientists, mathematicians, and engineers by awarding scholarships to college students who intend to pursue careers in these fields. Available to juniors and seniors, each scholarship covers eligible expenses for undergraduate tuition, fees, books, and room and board, up to a maximum of $7,500 annually.

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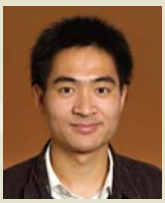
Katie McNerny


Li Huang

MSE doctoral students **Katie McNerny** and **Li Huang** are recipients of the *CIT Bertucci Graduate Fellowship*, created through the generosity of John and Claire Bertucci. This highly competitive award provides merit fellowships to graduate students pursuing doctoral degrees in the College of Engineering at Carnegie Mellon. This award, which reflects McNerny's and Huang's outstanding work in Materials Science and Engineering, includes financial support to help with tuition expenses.

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Benjamin Anglin

MSE doctoral student **Benjamin Anglin** has received the *National Defense Science and Engineering Graduate (NDSEG) Fellowship*. The Department of Defense created these awards in order to increase the number of U.S. citizens and nationals trained in science and engineering disciplines of military importance. Through the NDSEG program, 200 three-year fellowships were awarded in April to graduate students who demonstrated ability and special aptitude for advanced training in science and engineering. NDSEG fellowships include full tuition, all required fees, up to $1000 toward health insurance costs, and a stipend for a period of three years. The Office of Naval Research is the sponsoring agency for Anglin's fellowship.

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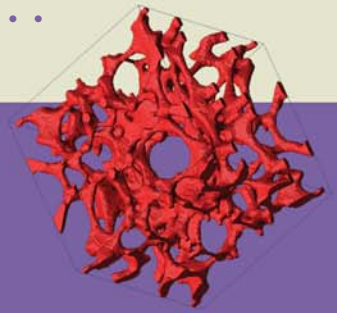


Fatma Uyar


Emine Gulsoy

A poster created by Ph.D. students **Fatma Uyar** and **Emine Gulsoy** recently won third place in the graduate division of the Biological Materials Science Poster Contest sponsored by the Minerals, Metals & Materials Society (TMS). The contest was held at the TMS Annual Meeting and Exhibition. Uyar's and Gulsoy's award-winning poster was titled "Tissue Development in Arabidopsis: 3D Shape Analysis for Detection of Cell Type."

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Joseph Tucker

The Edgar B. Speer Scholarship was awarded to MSE doctoral student **Joseph Tucker.** Created in 2006, this scholarship offers support to Carnegie Mellon engineering and business students who display financial need, leadership qualities, and academic excellence. Tucker will receive a grant of $25,000 toward his tuition costs.

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MSE junior **Ellen Tworkoski** has received a *WorldQuant Foundation Scholarship*, which provides educational grants to students who are studying quantitative analysis. Created to advance the cause of freedom of education, WorldQuant Foundation encourages and supports individuals of various cultural, economic, and religious backgrounds in their pursuit of higher education. The Foundation's World Quantitative and Science Scholarship Program gives financial awards to outstanding students who are highly motivated, committed to pursuing higher education in the fields of science and quantitative studies, and have a demonstrated financial need.

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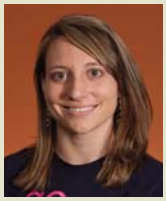
Anna Colletti

Junior **Anna Colletti** is among the 2009-10 recipients of the prestigious *Boeing Scholarship*. These scholarships are awarded annually to students from across the U.S. who are interested in a career in the aerospace industry, and include a grant of $2500 to support winners' studies in a related field, such as engineering. This grant program was created to help the aerospace leader build relationships with the nation's top engineering programs, as well as with especially promising students who may seek internships or entry-level positions with Boeing in the future. Eligible sophomores or juniors with a G.P.A. of 3.0 or higher, the ability to work successfully as team members, and a strong interest in the aerospace industry were encouraged to apply for the scholarships.

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STUDENT NEWS continued on page 10>

STUDENT NEWS CONTINUED

MSE doctoral student **Lauren Jackson** has been named a *National Science Foundation (NSF) Graduate Research Fellow*. The NSF Graduate Research Fellowship Program helps ensure the vitality of the human resource base of science and engineering in the United States, while also reinforcing its diversity. The program recognizes and supports outstanding students in NSF-supported science, technology, engineering, and mathematics disciplines who are pursuing research-based masters and doctoral degrees in the U.S. and abroad. Fellows benefit from a three-year annual stipend of $30,000, along with a $10,500 cost of education allowance for tuition and fees, a one-time $1000 international travel allowance, and the freedom to conduct their own research at any accredited U.S. or foreign institution of graduate education. NSF Fellows are anticipated to become knowledge experts who can contribute significantly to research, teaching, and innovations in science and engineering.

Recent Ph.D. Dissertations

Nina Burbure
"Influence of Ferroelectric Substrates on the Photochemical Reactivity of TiO_2 Thin Films"
ADVISOR: GREGORY ROHRER

Lisa Chan
"Synthetic Three-Dimensional Voxel-Based Microstructures That Contain Annealing Twins"
ADVISORS: GREGORY ROHRER AND ANTHONY ROLLETT

Pranay Choudhary
"Effects of Fine Scale Microstructure and Inclusions on the Toughness of Ultra High Strength Low Alloy Medium Carbon Steels"
ADVISOR: WARREN GARRISON

Hui Du
"Processing, Microstructure, and Microwave Dielectric Properties of Tunable $(Ba,Sr)TiO_3$ Thin Films"
ADVISORS: PAUL SALVADOR AND MAREK SKOWRONSKI

Emine Gulsoy
"Computational Tools for Automated Analysis of Three-Dimensional Microstructural Characterization Data"
ADVISOR: MARC DE GRAEF

Sarthak Havelia
"Epitaxial Stabilization of Kinetically Frustrated Metastable Materials"
ADVISOR: PAUL SALVADOR

Jessica Lisak
"Studies on the Effect of Topological and Compositional Heterogeneity on the Structure Formation in Block Copolymer and Block Copolymer-Blend Systems"
ADVISOR: MICHAEL BOCKSTALLER

Charudatta Phatak
"On the Use of Phase Reconstructed Vector Field Electron Tomography for the 3D Study of Magnetic Materials"
ADVISOR: MARC DE GRAEF

Stephen Sintay
"Statistical Microstructure Generation and 3D Microstructure Geometry Extraction"
ADVISOR: ANTHONY ROLLETT

Cong Wang
"A Study of Transient Ladle Reactions Involving Aluminum, Titanium, and Oxygen in Molten Iron"
ADVISOR: SRIDHAR SEETHARAMAN

Shengyu Wang
"Simulation of Abnormal Growth in Subgrain Structures in Deformed Materials"
ADVISOR: ANTHONY ROLLETT

Wei Wang
"Silicon-Based Nanocomposites as Lithium-Ion Battery Anodes"
ADVISOR: PRASHANT KUMTA

Hua Yuan
"Study of Composite Thin Films for Applications in High-Density Data Storage"
ADVISOR: DAVID LAUGHLIN

MSE Students Shine at "Meeting of the Minds"

Students from the Department of Materials Science and Engineering won a number of awards at the annual Carnegie Mellon Undergraduate Research Symposium, or "Meeting of the Minds."

This University-wide celebration of the diverse, creative, and exciting undergraduate research taking place on campus every day, and in every discipline, was held in the University Center on May 5. More than 450 students exhibited their research projects through poster sessions, oral presentations, demonstrations, and art installations.

Ankur Gupta

MSE senior **Ankur Gupta** won the *Undergraduate Environmental Research Award* for his research presentation entitled "A Study on the Feasibility of Lithium-Ion Battery Rejuvenation." Gupta's research also won second place in the CIT Honors Research Poster Competition, and second place in the Sigma Xi Competition, which was open to all students presenting posters in the quantitative sciences. Gupta is advised in his research by **Assistant Professor Jay Whitacre**.

Marianna Sofman

Junior **Marianna Sofman** won the *Thought* Competition for her article, "Self-Limited Heating and Biocompatability of Ferrofluids Synthesized From Fe-Ni-Based SPEX-Milled Nanoparticles." This award recognized Sofman as the author of the best article published in the 2010 issue of *Thought*, Carnegie Mellon's undergraduate research journal. **Professor Michael McHenry** is Sofman's advisor.

Youngeun Kim

Itai Stein

MSE students also dominated the Intel IFYRE and SRC-URO Poster Competition, open to students who participated in the Intel First Year Research Experience (IFYRE) program during Summer 2009 and/or the Semi-Conductor Research Corporation - Undergraduate Research Opportunities (SRC-URO) program in Spring 2010. Junior **Youngeun Kim** was awarded first place for "Self-Regulated Heating in Hyperthermic Cancer Therapy," while junior **Itai Stein** was one of two runners up. Stein's poster was titled "Thermal and Electrical Properties of Carbon Nanotube Aerogel." Kim's advisor is Professor McHenry, and Stein's advisor is **Assistant Professor Mohammad Islam**.

MSE Wins at ASM International's Young Members Night

Once again this year, students from MSE won every major award at ASM International's Young Members Night, hosted in February by the ASM Pittsburgh Golden Triangle Chapter. In the undergraduate poster competition, junior **Youngeun Kim** received the first-place prize. In the graduate student poster competition, doctoral student **Neerav Verma** was awarded first place, while doctoral student **Kate McNerny** received the second-place prize. Doctoral students **Ayesha Maria Hashambhoy** (third place), **Andy Schultz** (fourth place), and **Dhishan Kande** (fifth place) completed the MSE sweep of this category. Two MSE sophomores, **Alcoser Turi** and **Helen Ye**, received *ASM Past Chairpersons' Educational Assistance Scholarships*. Finally, senior **Brittany Selman** was honored with *ASM's Outstanding Senior Award*. Congratulations to all of our award winners at this event!

Shown here are poster contest winners (left to right) Kate McNerny, Youngeun Kim, Neerav Verma, Ayesha Hashambhoy, Andy Schultz, and Dhishan Kande.

MSE news

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