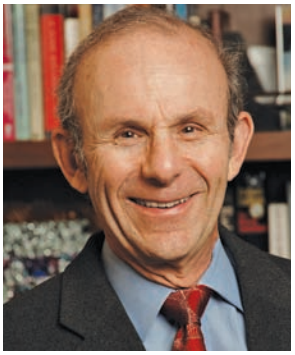
McCormick
Northwestern Engineering

Materials Science and Engineering

Robert R. McCormick School of
Engineering and Applied Science
Northwestern University

SPRING 2011

Two MSE Professors Elected to American Academy of Arts and Sciences




New AAAS inductees David Seidman and Monica Olvera de la Cruz.

Two McCormick materials science and engineering professors — Monica Olvera de la Cruz and David Seidman — were elected to the prestigious American Academy of Arts and Sciences, one of the nation's oldest honorary societies and independent policy research centers.

Olvera de la Cruz is the Lawyer Taylor Professor of Material Science and Engineering, chemical and biological engineering, and chemistry. Seidman is Walter P. Murphy Professor of Materials Science and Engineering. They are two of the 229 leaders in the sciences, social sciences, the humanities, the arts, business, and public affairs who were elected this year; five faculty members from Northwestern were elected to AAAS, including President Morton Schapiro.

"Monica and David have had tremendously successful careers as researchers and educators at McCormick, and it brings me great pleasure to see them recognized at this level," says Julio Ottino, dean of McCormick School of Engineering. "Membership in the Academy is a high honor, and it is especially gratifying to be recognized by the oldest academy in the United States."

Olvera de la Cruz has developed theoretical models to determine the thermodynamics, statistics, and dynamics of macromolecules in complex environments, including multicomponent solutions of heterogeneous synthetic and biological molecules.

Seidman's research aims to understand physical phenomena in a wide range of material systems on an atomic scale. Currently he and his research group are studying aluminum-, nickel- and iron-based alloys for possible high-temperature and structural applications, and metal silicide/silicon reactions pertinent to solid-state devices.

Chad Mirkin Now Elected to All Three Branches of the National Academies

Northwestern University scientist Chad A. Mirkin, a world-renowned leader in nanotechnology research and its application, has been elected a member of the prestigious Institute of Medicine (IOM).

He is the first at Northwestern and in the Midwest and the 10th in the world to be elected to all three branches of the National Academies. Mirkin was elected a member of the National Academy of Sciences earlier this year and a member of the National Academy of Engineering in 2009.

Chad Mirkin

Mirkin is the George B. Rathmann Professor of Chemistry in the Weinberg College of Arts and Sciences and professor of medicine, chemical and biological engineering, biomedical engineering and materials science and engineering and director of Northwestern's International Institute for Nanotechnology.

Membership in the IOM is one of the highest honors in the fields of health and medicine in the United States. Mirkin is among 65 new members and five foreign associates recognized for their major contributions to the advancement of the medical sciences, health care and public health.

Mirkin will be inducted into the Institute next October during its annual meeting in Washington, D.C. At least one-quarter of the institute's membership is selected from outside the health professions. The newly elected members raise IOM's total membership to 1,817.

Mirkin, a member of President Obama's Council of Advisors on Science and Technology, is the recipient of more than 60 national and international prizes. He is known for the invention and development of biological and medical diagnostic systems based upon nanomaterials and new approaches to cancer therapeutics based upon gene regulation. Mirkin is the inventor and chief developer of three groundbreaking nanoscale fabrication and analytical tools: Dip-Pen Nanolithography, Polymer Pen Lithography and Beam-Pen Lithography. He is the founder of three Chicago-based companies: Aurasense, Nanosphere and NanoInk.

Established in 1970 by the National Academy of Sciences, IOM is a national resource for independent, scientifically informed analysis and recommendations on health issues.

3-D Map of Atoms Sheds Light on Nanoscale Interfaces in Teeth

Teeth and bone are important and complex structures in humans and other animals, but little is actually known about their chemical structure at the atomic scale. What exactly gives them their renowned toughness, hardness and strength? How do organisms control the synthesis of these advanced functional composites?

Now, using a highly sophisticated atomic-scale imaging tool on a sea creature's tooth, two Northwestern University researchers have peeled away some of the mystery of organic/inorganic interfaces that are at the heart of tooth and bone structure. They are the first to produce a three-dimensional map of the location and identity of millions of individual atoms in the complex hybrid material that allows the animal to literally chew rock.

Demonstrating that atom-probe tomography (APT) can be used to interrogate such materials opens up the possibility of tracking fluoride in teeth and cancer and osteoporosis drugs in bone (at previously inaccessible length scales). The detailed knowledge of organic/inorganic interfaces also will help scientists rationally design useful new materials that combine the best properties of organic and inorganic materials.

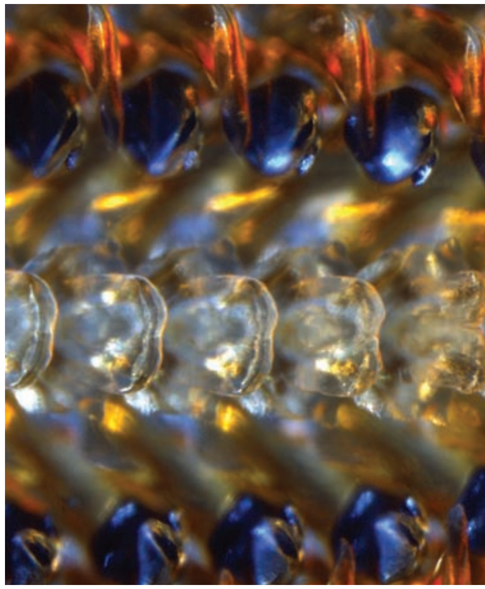
The results were published Jan. 13 by the journal Nature.

"The interface between the organic and inorganic materials plays a large role in controlling properties and structure," said Derk Joester, senior author of the paper. "How do organisms make and control these materials? We need to understand this architecture on the nanoscale level to design new materials intelligently. "

Joester is the Morris E. Fine Junior Professor in Materials and Manufacturing. Lyle Gordon, a doctoral student in Joester's lab, is the other author of the paper.

The two set out to find the organic fibers they knew to be an important part of the tooth's structure, buried in the tough outer layer of the tooth, made of magnetite. Their quantitative mapping of the tooth shows that the carbon-based fibers, each 5 to 10 nanometers in diameter, also contained either sodium or magnesium ions. Joester and Gordon are the first to have direct proof of the location, dimension and chemical composition of organic fibers inside the mineral.

They were surprised by the chemical heterogeneity of the fibers, which hints at how organisms modulate chemistry at the nanoscale. Joester and Gordon are anxious to learn more about how the organic fibers interface with the inorganic minerals, which is key to understanding hybrid materials.



The radula (an anatomical structure used for eating by mollusks) of a Chaetopleura Apiculata (Eastern Beaded Chiton), showing the numerous rows of black teeth mineralized with iron oxide (magnetite).

Derk Joester

"The tooth's toughness comes from this mix of organic and inorganic materials and the interfaces between them," Joester said. "While this is in principle well known, it is intriguing to think we may have overlooked how subtle changes in the chemical makeup of nanoscale interfaces may play a role in, for instance, bone formation or the diffusion of fluoride into tooth enamel."

Atom-probe tomography (APT) produces an atom-by-atom, 3-D reconstruction of a sample with sub-nanometer resolution. But many in the field didn't think APT would work to analyze a material made up of organic and inorganic parts.

Fortunately for Joester and Gordon, Northwestern has both David Seidman, a leader in the field who uses APT to study metals, and two of the few APT instruments in the country. (There are less than a dozen.) Seidman, Walter P. Murphy Professor of Materials Science and Engineering, encouraged Joester to take the risk and use APT to study biological architectures. The scientists also were able to exchange ideas with the engineers developing 3-D atom-probe instruments at CAMECA, a scientific instrumentation company in nearby Madison, Wis.

Joester and Gordon imaged teeth of the chiton, a tiny marine mollusk, because much is known about the biomineralization process. The chiton lives in the sea and feeds on algae found on rocks. It continually makes new rows of teeth — one a day — to replace mature but worn teeth; in conveyor-belt fashion, the older teeth move down the creature's tongue-like radula toward the mouth where it feeds.

Chiton teeth resemble human teeth in that they have a hard and tough outer layer — equivalent to our enamel — and a softer core. Instead of enamel, the rock-chewing chitons use magnetite, a very hard iron oxide, which gives their teeth a black luster.

The researchers extracted micron-sized samples from the leading edge of the tooth. Using a focused ion beam tool at the Northwestern University Atomic and Nanoscale Characterization Experimental Center core facility, these samples were fashioned into very sharp tips (less than 20 nanometers across). The process is reminiscent of sharpening a pencil, albeit with a supercharged stream of gallium ions.

The APT technique applies an extremely high electric field to the sample; atoms on the surface ionize, fly off and hit an imaging detector (similar to those found in night-vision equipment). The atoms are stripped off atom-by-atom and layer-by-layer, like peeling an onion. Computer methods then are used to calculate the original location of the atoms, producing a 3-D map or tomogram of millions of atoms within the sample.

Joester and Gordon now are studying the tooth enamel of a vertebrate and plan to apply APT to bone, which is also made of organic and inorganic parts, to learn more about its nanoscale structure.

Wessels Group Creates First Bipolar Magnetic Junction Transistor

Bruce Wessels

> *Now that the group has created a transistor that uses the magnetization to control the amplification, they've created a semiconductor that is multifunctional: It can potentially process and store digital information.*

Over the past 50 years, computers have gotten faster and smaller due to miniaturization of integrated circuits. According to Moore's Law, which states that the number of transistors that can be placed on an integrated circuit will double about every two years, these improvements should continue.

But soon, transistor size will reach atomic dimensions — a major barrier for scientists and engineers in the miniaturization of transistors.

One possible solution are magnetic semiconductor devices, which use electron spin to control conduction. Researchers in materials science and engineering have created for the first time a bipolar magnetic junction transistor and that shows amplification and operation at room temperature.

Graduate student Nikhil Rangaraju, postdoctoral fellow John A. Peters, and Bruce W. Wessels, Walter P. Murphy Professor of Materials Science and Engineering, designed and created the device. Their results are published online in the journal *Physical Review Letters*.

Over the past 10 years, Wessels and his group have been working to create semiconductor alloys that are magnetic. He found it in thin films of the alloy indium-manganese-arsenic, which Wessels previously used to create semiconductor diodes. Now that the group has created a transistor that uses the magnetization to control the amplification, they've created a semiconductor that is multifunctional: It can potentially process and store digital information. In a computer, information is stored on a magnetic hard drive and processed by semiconducting memory. A semiconductor magnetic junction transistor could potentially do both jobs.

Researchers have previously created magnetic semiconductor devices, but Wessels and his group are the first to create one that can control spin and amplify signals at room temperature — two operations essential to computer processing.

Creating this device has taken two years of microfabrication, characterization, and measurement, which they performed at McCormick and at Argonne National Laboratory's Center for Nanoscale Materials.

Potential immediate applications for the device include magnetic sensors (like the kind used in magnetic resonance imaging MRIs), and in the future, this device could be used as a basic building block for a new kind of computer logic.

Next researchers hope to improve the device performance and integrate it with other devices onto one chip.

"It's almost like the holy grail of computer logic to get devices that show magnetism and semiconduction at the same time," Wessels said. "Could this be an answer to the limits of Moore's Law? We have hope."

The complete citation is "Magnetoamplification in a Bipolar Magnetic Junction Transistor." *Phys. Rev. Lett.* 105, 117202 (2010).

UPCOMING EVENTS

The following events are free and open to the public. Alumni and friends of the department are encouraged to attend and to register in advance. Please contact the department at 847-491-3537 or matsci@northwestern.edu.

May 19th: The John E. Hilliard Symposium. The 2011 keynote speaker is alumnus Dmitry Shashkov, PhD, president and CEO of Fabricated Products, H. C. Starck. This day-long capstone event highlights the original research of our senior graduate students and will take place at the Transportation Center, 600 Foster Street, Evanston, IL.

June 1-3: The Jerome B. Cohen Distinguished Lecture Series in Materials Science and Engineering. The 2011 lecture series will be presented by Emily Carter, Gerhard R. Andlinger Professor in Energy and the Environment, Professor of Mechanical and Aerospace Engineering & Applied and Computational Mathematics, Princeton University. The talks will take place at 4 p.m. in Tech L211, 2145 Sheridan Road, Evanston, IL.

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Universal Law For Material Evolution

Peter Voorhees

It's a problem that materials scientists have considered for years: how does a material composed of more than one phase evolve when heated to a temperature that will allow atoms to move? In many cases, a rod-like phase embedded in another will break up into smaller domains, very much like the droplets at the end of a stream of water, resulting in dramatic changes in the properties of the material.

Now, researchers at McCormick, together with collaborators from the Risø National Laboratory for Sustainable Energy in Denmark and the Swiss Light Source at the Paul Scherrer Institut in Switzerland have answered an important question about this break-up process: How does it happen, and how long does it take?

Researchers found the answer is universal among materials — a rare case in the materials world — and their results were published August 1 in the journal *Nature Physics*.

Peter Voorhees, Frank C. Engelhart Professor of Materials Science and Engineering at Northwestern, Erik Lauridsen from Risø, and two graduate students spent five, 24-hour days at the Swiss Light Source (SLS) at the Paul Scherrer Institut, using 4-D synchrotron-based X-ray tomographic microscopy (a relatively new approach that allows for very fast measurements of a material in three-dimensions and in time) to observe the evolution of the rod-shaped phases (a phase is a region of a material that has a unique composition or atomic structure) during the break-up process. They measured the details of what happened — the shape of the interfaces of the rods as they broke up — and five days later, they had over two terabytes of information to analyze.

They found that the shape of the interfaces during break-up becomes universal, no matter what material is used. This sort of universality allows them to predict the dynamics of the break-up process in a vast array of materials, like steel and even noncrystalline materials like polymers.

Voorhees then brought the experimental data to Michael Miksis, professor of engineering sciences and applied mathematics, and the two of them and a graduate student described the process theoretically. They developed equations to calculate the time required for the pinching process to happen, and they found that the kinetics of the process is fixed early on and is the same, no matter the material.

"If it's a rod that's pinching off by diffusion in the material this is it," Voorhees said.

The process has an impact on a wide range of materials, including steel and polymers. For example, many metal parts are made by casting, when a liquid metal is poured into a mold and solidifies into the shape of the part. As the liquid solidifies it forms tree-like structures called dendrites, and if one of the arms of the dendrites break off, it can lead to a change in the properties of the solidified material. The airplane industry, for instance, spent a long time developing solidification methods to avoid this problem when casting jet turbine blades. Another example is polymer solar cells, which use a complicated mixture of two types of polymers. When heated up, the mixture evolves by a process that involves pinching, which ultimately alters the properties of the mixture and the efficiency of the solar cell.

The shape of the interfaces during break-up becomes universal, no matter what material is used. This sort of universality allows them to predict the dynamics of the breakup process in a vast array of materials, like steel and even noncrystalline materials like polymers.

Improv Group Provides Creative Outlet for Graduate Students

During the day they toil in the lab, conducting state-of-the-art research in a years-long effort to earn their PhDs. But their nights belong to improv.

They are the members of SPG Improv, the University's only graduate improv group. Started by materials science graduate student Bryce Meredig in 2008, the group holds monthly performances (every third Thursday, 6 p.m. in Seabury 250) and provides a creative outlet for engineering graduate students.

"I did improv in college, starting my sophomore year (at Stanford University), and I assumed that when I came here I would have to be a real grown up and I wouldn't be able to do it anymore," Meredig says. But after talking with a few peers who were interested, Meredig decided an improv group might be just the thing McCormick graduate students needed.

"This is giving me something that problems sets and lectures and recitations are not giving me in terms of creativity and using both halves of my brain," Meredig said." I just found that I almost needed it… The students in the group have also become better public speakers because of it."

The group's faculty adviser is Elizabeth Gerber, assistant professor of mechanical engineering, who performed in Meredig's improv group at Stanford when she was a graduate student. Gerber also researches how to foster creativity and innovation. In one study, she taught improv to undergraduate students, then had them think of new ideas to see if there was a direct correlation between improv and idea generation.

"He's providing them not only with a venue to have a lot of fun — they are having a lot of fun, if you've seen them perform — but also to practice these skills that are necessary," she says.

New Nano-Engineered Aluminum Alloy

David Dunand and David Seidman

Lightweight and corrosion-resistant, aluminum alloys could provide an excellent alternative to steel or titanium — except for one problem. Most aluminum alloys are only good up to 200 degrees Celsius, which means they couldn't be used in high-temperature conditions, like in engines.

Now, two materials science professors have created a new kind of aluminum alloy by engineering it at the nano level to give it high-strength and corrosion resistance to high temperatures. Their results were published in the journal Small.

David N. Seidman, Walter P. Murphy Professor of Materials Science and Engineering, and David C. Dunand, James N. and Margie M. Krebs Professor of Materials Science and Engineering, combined aluminum with lithium (which has a lower density than aluminum and makes the material more lightweight) and scandium — an exotic element that dramatically strengthens aluminum. They also added a bit of ytterbium, which also acts as a strengthener but is much cheaper than scandium.

But creating an alloy isn't just a matter of mixing the elements together — the researchers have a scientifically designed process of timed heating that naturally arranges the atoms into nano-particles with a new kind of structure — a core surrounded by two shells. The core is ytterbium-rich, while the first shell is rich in scandium and the second shell contains mostly lithium. This core/shell/shell structure has been achieved by chemists in liquid solutions but this is the first time it has been achieved by processing solely in the solid-state.

The core/shell/shell nano-particles make the material much stronger because they act as strong obstacles for line defects (called dislocations) that can glide through the material, and their layered structure helps make the material much more resistant to high temperatures.

"We have shown that this process works in the solid state," Dunand said. "It shows we can make nano-particles that are complex and tuned to the properties we need. It could be applicable to a large number of alloys."

The researchers also found that some nano-particles had a structure they weren't expecting — a single particle with two cores and two inner shells, like a double-yolked egg. This is the first time this type of structure has been observed.

Next the researchers will undertake a systematic study to determine how different parameters affect their core/shell/shell structures and will continue testing the alloy for efficiency and tweaking the composition to make it optimal.

The first author of the paper is Christian Monachon, an undergraduate student who was a visiting researcher from École Polytechnique Fédérale de Lausanne in Switzerland. This research was sponsored by the Department of Energy (Basic Energy Science).

Jiaxing Huang Discovers New Properties of World's Thinnest Material

Graphene oxide, a single-atomic-layered material made by reacting graphite powders with strong oxidizing agents, has attracted a lot of interest from scientists because of its ability to easily convert to graphene — a hotly studied material that scientists believe could be used to produce low-cost carbon-based transparent and flexible electronics.

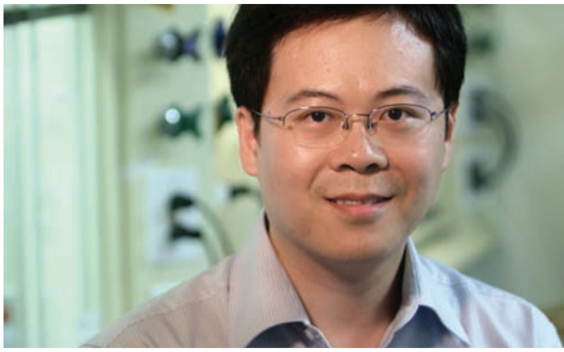
But to Jiaxing Huang, assistant professor of materials science and engineering, and his research group, graphene oxide itself is even more interesting. Huang and his group have studied the material for years and have discovered how to assemble these soft sheets like floating water lilies pads. They also used a camera flash to turn them into graphene, and invented a fluorescence quenching technique to make them visible under microscopes.

Now, working with Kenneth R. Shull, professor of materials science and engineering, they have discovered that graphene oxide sheets behave like surfactants, the chemicals in soap and shampoo that make stains disperse in water. The team's results are published online in the *Journal of the American Chemical Society*.

Graphene oxide has been known in the scientific world for more than a century and was largely described as hydrophilic, or attracted to water. But Huang and his research group thought that graphene oxide should be amphiphilic, a property of surfactants that can both attracts and repels water, because part of the graphene oxide structure is actually water repelling.

"We view graphene oxide as a soft material," Huang says. "For example, it is essentially two-dimensional polymers composed of carbon, hydrogen and oxygen. They are also colloidal particles with very exotic shapes."

To test their hypothesis, Huang and his group put graphene oxide in carbonated water. They found that the sheets can hitchhike onto



Jiaxing Huang

the rising bubbles to reach the water surface — just like a surfactant would do. Next they found that graphite oxide can disperse oil droplets in water — just like a surfactant would.

This new insight into a fundamental property of the material, according to Huang, is important for understanding how graphene oxide is processed and handled. It could lead to new applications for the material.

FACULTY NEWS

Vinayak Dravid and **Chris Wolverton** were elected fellows of the American Physical Society. Dravid was honored for seminal contributions to the materials physics of functional materials through the use of state of the art electron microscopy techniques. Wolverton was honored for innovative contributions to atomic- and multi-scale computational materials physics, particularly in the area of phase stability of materials.

Vinayak Dravid was elected fellow of the American Association for the Advancement of Science based on his pioneering research on nanotechnology, nanometrology, and the structure and response of materials.

Katherine Faber was named one of ten American Competitiveness and Innovation (ACI) fellows by the NSF Division of Materials Research for 2010, cited for her leadership in both the field of ceramics and in the advancement of women in science and engineering.

Mark Hersam and alum **Nathan Guisinger** of Argonne National Lab discussed the recent Physics Nobel Prize for work on graphene Chicago Public Radio (WBEZ 91.5) on October 11.

Jiaxing Huang has received a prestigious early-career Sloan Research Fellowship from the Alfred P. Sloan Foundation. Huang recently discussed production of graphene oxide as a featured speaker in the Materials Today Virtual Conference: The New Carbon Era.

Amanda Petford-Long has been named an Argonne Distinguished Fellow.

David Seidman has been selected to receive a highly-competitive 2010 IBM Faculty Award recognizing the quality and importance of his research to the semiconductor industry. He also received the Institute of Metals Robert Franklin Mehl Award at the TMS meeting in San Diego.

Peter Voorhees received the 2011 Bruce Chalmers Award for his established record of research and publications in the field of solidification processing. The award was presented at the TMS Annual meeting in San Diego.

Julia Weertman will receive ASM Honorary Membership in 2011, "...for her pioneering contributions in teaching and research accomplishments, and profound service to materials science and engineering, professional societies, and service to the materials community at large."

STUDENT NEWS

Kendra Erk (Shull) and **Mike Walsh** (Hersam) recently began post-doctoral fellowships at NIST.

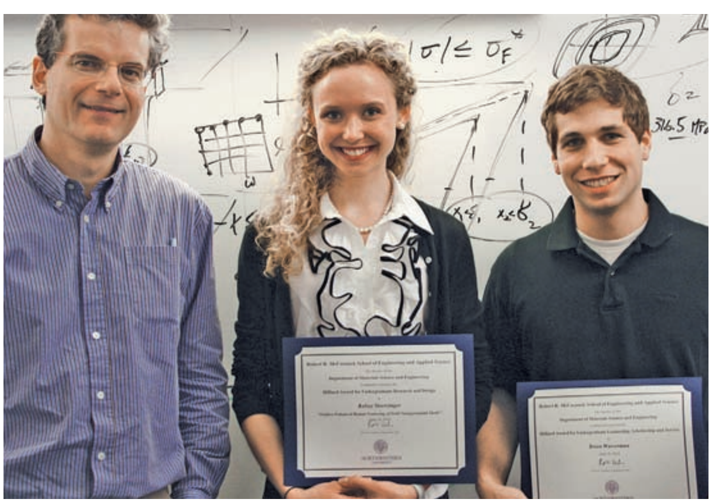
Senior **Ryan Ginder** won second place in the Materials Advantage student speaking contest held at the MS&T conference. Ryan's talk, "Improving Li-Ion Battery Capacity via PANI Composite Anodes" was based on his undergraduate research with the Hersam group.

Seniors **William Chang**, **Ryan Ginder**, **Boping Lui** and **Thomas Yu** won the second place award of the 2010 Undergraduate Design Competition, sponsored by ASM. The team was mentored by grad student Ryan Glamm and advised by Professor Greg Olson. The third place team, from U Florida, was advised by MSE alumna Michele Manuel.

MSE seniors honored at McCormick Convocation:
Eschbach Award: **Kelsey Stoerzinger**; Gotaas Award: **Matthew Draper**; Co-op of the Year Award: **Allison Weil**

MSE seniors place in Frey Design competition. Second prize: Applying Transformation-Induced Plasticity to Titanium Alloys: **Pitichon Klomjit**, **Kelsey Stoerzinger**, **Wenhao Sun**, **Frank Lin**, **Allison Weil**, **Tian Zhou**. Third prize: Design and Optimization of a Blast Resistant Steel Alloy: **Matthew Draper**. The faculty adviser for both projects was Greg Olson.

The 2010 Hilliard Undergraduate Awards were presented to two graduating seniors in June. The Hilliard Award for Undergraduate Research and Design was presented to **Kesley Stoerzinger** for her project, "Surface Enhanced Raman Scattering (SERS) of Gold Nanopyramidal Shells" completed with faculty adviser Teri Odom and graduate student mentors Warefta Hasan and Julia Lin. Kelsey is first author of "Screening Nanopyramid Assemblies to Optimize Surface Enhanced Raman Scattering" published in J. Phys. Chem. Lett. 1, 1046 (2010). The Hilliard Award for Leadership, Scholarship, Service was presented to **Brian Wasserman** for his participation on the Weinberg Student Advisory Board and his efforts to inform students about the materials science major in WCAS. Brian completed an honors thesis, "Biological Control of Strontium and Barium Uptake by Desmid Green Algae," with faculty adviser Derk Joester and graduate student mentor Minna Krejci.



Senior class advisor David Dunand with Hillard Undergraduate Award recipients Kelsey Stoerzinger and Brian Wasserman.

Gotaas Award 2010: Winner Matthew Draper with Associate Dean Stephen Carr.

ALUMNI NEWS

Gretchen Fougere (PhD, 1995) has become assistant dean for diversity and outreach at Boston University.

Amber Genau (PhD, 2008) has accepted a faculty position in the Department of Materials Science and Engineering at the University of Alabama, Birmingham.

Andrea Hodge (PhD, 2002) has been appointed to the Philip and Cayley MacDonald Early Career Chair at USC. Andrea is a member of the Department of Aerospace and Mechanical Engineering with a joint appointment in the Mork Family Department of Chemical Engineering and Materials Science.

Emmanuelle Marquis (PhD, 2003) will join the faculty of the University of Michigan in January. She has most recently held the prestigious Royal Society Dorothy Hodgkin Fellowship in the Department of Materials at the University of Oxford, UK.

John Romankiewicz (BS, 2006) joined the Department of State, Office of Climate Change.

Toshiari Saegusa (PhD, 1978) won the Aoki Award for Lifetime Achievement at the 16th International Symposium on the Packaging and Transport of Radioactive Materials (PATRAM).

Michelle Seitz (PhD Faber/ Shull) was awarded third place in the Quadrant Thesis Award competition at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland.

Dmitry Shashkov (PhD, 1997) joined H.C. Starck as the president of the Fabricated Products division after spending eight years at Honeywell.

K. Sujata (PhD, 1989), a leader in Chicago's philanthropy, business and nonprofit communities, has been named president of the Chicago Foundation for Women.

EVENTS

Professor Greg Olson and alumnus Ralph Daehn receive awards at the MS&T conference.

On October 7, **Yet-Ming Chiang**, Kyocera Professor in the Department of Materials Science and Engineering at MIT, gave the annual Fine Lecture. His talk was titled, "Materials Research to Improve Electrical Storage for Transportation and the Electric Grid."

At the annual MS&T Conference in Houston in October, Professor **Greg Olson** received the ASM Gold Medal, alumnus & board member **Anil Virkar** was inducted as an ASM fellow, **Ralph Daehn** (MS '75) received the Allan Ray Putnam Service Award , **Glenn Daehn** (BS '83) was inducted as an ASM fellow, and **Elizabeth Dickey** (PhD '97) was inducted as an American Ceramics Society fellow.

Also at the conference, seniors **William Chang**, **Ryan Ginder**, **Boping Lui** and **Thomas Yu** won the Second Place Award of the 2010 Undergraduate Design Competition, sponsored by ASM. The team, mentored by graduate student **Ryan Glamm** and advised by Professor **Greg Olson**, received $1,500 and travel assistance to attend the MS&T 10 in Houston, TX. The third place team, from the University of Florida, was advised by MSE alumna **Michele Manuel**. Senior **Ryan Ginder** won second place in the Materials Advantage student speaking contest held at the conference. Ryan's talk, "Improving Li-Ion Battery Capacity via PANI Composite Anodes," was based on his undergraduate research with the Hersam group.

The Dow lecture, "Nanogenerator for Self-Powering Nanosystems and Piezotronics for MEMS," was presented on February 15 by **Zhong Lin Wang** from Georgia Institute of Technology. Alumnus **Mike Radler** presented the Dow plaque.

Dorn Lecture: Peter Voorhees, speaker Edourd Artz (Saarland University) and David Dunand at the annual Dorn Lecture on Oct. 26. Arzt's lecture was titled, "Strength, Adhesion, Sound and Survival: A Tour of Size Effects."

IN MEMORIAM

Anne M. Mayes, 1964-2011

Alumna Anne M. Mayes passed away January 25, 2011 at her home in Mustang, Oklahoma. Anne completed her PhD at Northwestern as the first doctoral student of Monica Olvera de la Cruz. After a post-doctoral fellowship at IBM Almaden, she returned to MIT, her undergraduate alma mater, as a faculty member. She became the first woman tenured and promoted to full professor in the department. Anne's research interests focused on the role of polymers in environmental issues including recycling, energy storage, water filtration and biomaterials. Among the many accolades for her research and teaching, she received the MRS Outstanding Young Investigator Award in 1998. She retired from MIT for medical reasons in 2006 and returned to Oklahoma with her husband, Glenn Mailand.

Jim Hahn Honored With World War II Medal

Former McCormick staff member Jim Hahn received an early Veteran's Day surprise when he was presented with a World War II medal that he earned but never received.

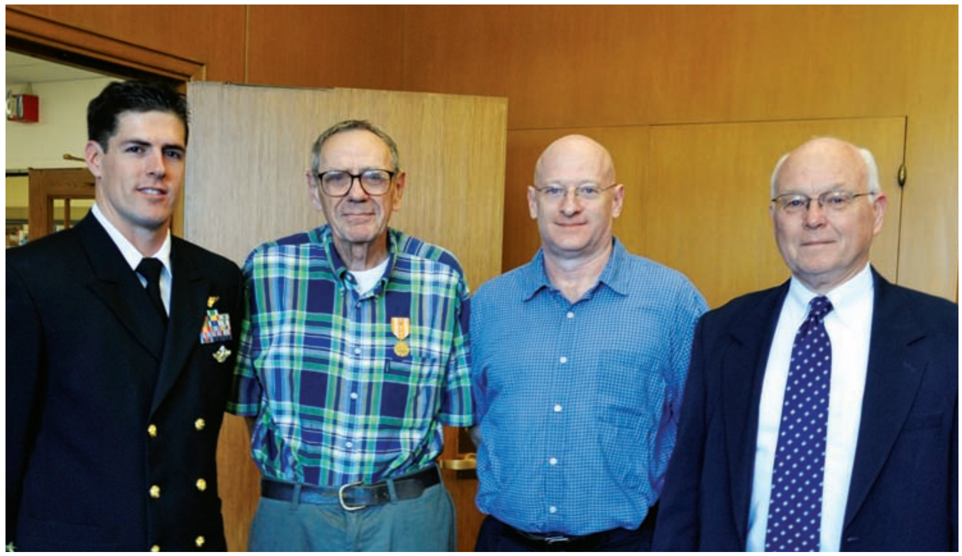
Hahn joined the Department of Materials Science and Engineering machine shop in the 1950s when the department was forming as the first of its kind in the nation. Hahn, now 85, still comes to the shop to work with students and over the years has spoken with Mark Seniw, manager of the Central Laboratory for Materials Mechanical Properties (CLAMMP), about his World War II experiences.

Seniw recently found out that Hahn never received his Asiatic-Pacific Campaign medal and arranged for the medal to be presented to Hahn by Lt. Anthony Arendt, an assistant professor of naval science at Northwestern's ROTC program. The ceremony took place in the office of Stephen Carr, associate dean of undergraduate engineering.

"On behalf of the late President Franklin D. Roosevelt and the people of a grateful nation, I present to you this Asiatic-Pacific Campaign Medal with campaign star in recognition of your service during the Okinawa Gunto operation March 17 – June 30, 1945 as a member of the 139th Naval Construction Battalion," Arendt said.

Hahn was humble about his service.

"Thank you," he said over and over. "That's all I can say."



Lt. Anthony Arendt, Jim Hahn, Mark Seniw, Associate Dean Stephen Carr

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