

PENNSTATE



# *imagine*

*The Newsletter of Materials Science and Engineering • Winter 2008/2009*

## **Research Spotlight:**

Fabrication Of Highly Efficient Biomimetic Devices



**Dr. Gary L. Messing**

**Distinguished Professor of  
Materials Science and Engineering  
Head, Department of  
Materials Science and Engineering**

Welcome to the winter issue of our newsletter. The most exciting news is that construction has begun on the new materials building (officially the Millennium Science Complex). We expect to move about 1/3 of the faculty to the new building when it is finished in 2011. We have also learned that the University has made a major financial commitment to renovate Steidle Building so that the materials research infrastructure is top notch in all materials-related research buildings. We are just beginning the plans for the renovation of the research space in Steidle but we plan to organize the renovation around research themes like polymers, energy materials and computational materials to complement those in the Millennium Science Complex. I am pleased to say that the teaching lab spaces have been completely transformed to mirror the cutting edge research in the department. A special thank you to Bob Kumpf '84, '86, '88 of Bayer MaterialScience and a member of the External Advisory Board (EAB) for facilitating the donation of a state of the art injection molding machine (Krauss Maffei model KM80).

We have recently raised SAFETY to a new level of awareness and practice. It became obvious over the last year that safety was not practiced to the same level of rigor by all faculty and students in the department. The EAB was tasked with reviewing a few labs during their fall meeting. I can only say they were astounded at the lax safety environment. Their recommendations for creating a safer research and teaching

environment will help to ensure that all graduates of MatSE experience and are trained in safety standards like those in industrial and government labs. Professor Michael Hickner and Scott Henninger will be leading our commitment to safety.

We have worked for the last year with the EAB on a video to recruit young people to our discipline. The video has now been completed and is available to all members of the MatSE family for student recruiting. The video is clearly focused on those who do not know materials and, of course, it is focused on Penn State MatSE. You can see the video at [www.matse.psu.edu/video](http://www.matse.psu.edu/video). If you would like to receive a cd of the video, please contact Katina ([katina@matse.psu.edu](mailto:katina@matse.psu.edu)).

Finally, please take time to read the feature about the outstanding women faculty in MatSE. We believe we've created an environment where women have the opportunity to excel despite having complex multidimensional lives. We will strive to increase the number of women in materials science and engineering. Our women faculty are excellent role models so that future female students can imagine the possibilities of a career in materials.

Have a safe and prosperous 2009!

***“We have also learned that the University has made a major financial commitment to renovate Steidle Building so that the materials research infrastructure is top notch in all materials-related research buildings.”***



DEPARTMENT OF  
**MATERIALS  
SCIENCE AND  
ENGINEERING**  
COLLEGE OF EARTH AND  
MINERAL SCIENCES

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# The Millennium Science Complex

## A Vision of 21st Century Science

Ground was broken this past fall for the construction of Penn State's showplace research building for 21st century science in the heart of the University Park campus. The Millennium Science Complex will provide a central location for faculty and students involved in materials research to collaborate across departmental boundaries in a state-of-the-art research facility.

Designed by the internationally renowned firm of Rafael Viñoly Architects, this 275,000 square foot building will bring together both materials researchers and life scientists from the Materials Research Institute and the Huck Institutes of the Life Sciences. Through this interface, the Millennium Science Complex will foster collaborations in the developing convergence of materials and biomedical engineering.



The materials research program will provide 10,000 square feet of cleanroom space, with another 6,000 square feet of cleanroom support space. Total user facilities will occupy 50,000 net square feet with several state-of-the-art characterization and fabrication tools housed in a specialized quiet space with low acoustic and electromagnetic noise suitable for future generations of image analysis instruments. Characterization tools will be placed in approximately 10,000 net square feet of high caliber space, much of which will have separate isolated slab flooring.



Another 10,000 square feet are set aside for other characterization tools.

Along with providing central user facilities and flexible desk and meeting space for faculty and students from around campus, the materials building will be home to a number of materials faculty groups, along with 30 full-time technical staff. Research areas will include electronic materials and devices, nano and microfabrication and thin films, optics and biophotonics, surface science, functional polymers, complex oxides, and NEMS and MEMS.

The Millennium Science Complex will build on Penn State's number one national ranking in materials research expenditures and its top three ranking in industrial research funding. According to Carlo Pantano, distinguished professor of materials science and engineering and director of the Materials Research Institute, "These facilities are intended to enable and catalyze cross-campus interdisciplinary research activities in the physical and engineering sciences, and especially at the interface with life science and biomedical engineering."

The Millennium Science Complex is scheduled for a summer 2011 opening.

*Wait Mills, Writer/Editor, Materials Research Institute*

## Renovation in Steidle Building

For the first time in more than twenty years, Steidle Building, the home of MatSE, will undergo a major renovation. The scope of these renovations will include major upgrades to the utilities infrastructure throughout the building, giving the offices a facelift, and extensive laboratory renovations.

Initial meetings with renovation planners have been very positive. A committee will be working with consultants to work out the details of the overall plan. This presents a great opportunity to reorganize the building and set up our research infrastructure. The project will progress in several phases and will begin in the summer of 2010. Completion is planned to coincide with the opening of the new Millennium Science complex.



*A renovation crew from Penn State's Office of Physical Plant installs new kitchen cabinets in the new student commons room.*

The proposed renovations and the reorganization of the building will center on research clusters including computational materials science, electrical energy conversion and storage, polymeric materials, and thermoelastic and mechanical properties to complement research areas in the Millennium Science Complex.

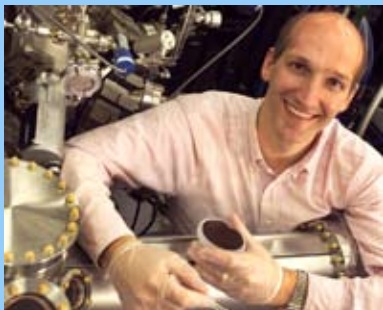
*By Frank Driscoll*

### Hickner selected as Office of Naval Research Young Scientist



Dr. Michael Hickner, Assistant Professor of Materials Science and Engineering has been selected as an Office of Naval Research Young Investigator, United States Department of Defense. This program is designed to attract young scientists and engineers who show exceptional promise for outstanding research and teaching careers. Dr. Hickner is one of 27 investigators selected for this award from a group of 208 applicants. Congratulations Mike!

### Darrell Schlom Moves to Cornell



The department would like to thank Dr. Darrell Schlom, Professor of Materials Science and Engineering, for sixteen years of excellence at Penn State. Darrell received the MRS Medal for his research on complex oxides at Penn State at the fall MRS meeting held in Boston. Darrell will be relocating his group to Cornell University where he will continue his oxide research. We look forward to working with Darrell on joint MRSEC (Materials Research Science and Engineering Center) projects.

### Center for Nanoscale Science Receives \$13.2 million NSF Grant

Penn State's Center for Nanoscale Science has received a six-year, \$13.2 million grant from the National Science Foundation to continue research and educational activities in its Materials Research Science and Engineering Center. "The goal of the Center is to design and create new materials with unprecedented properties and functions, starting with nanometer-scale building blocks," said Thomas Mallouk, the DuPont Professor of Materials Chemistry and Physics at Penn State and director of the MRSEC.

The Penn State MRSEC will continue its research in four areas — nanoscale motors, nanowires, optical metamaterials and multiferroics — and will support a range of seed projects in organic solar cells, fuel cells and novel electronic materials. "Our focus is on basic science and engineering research," said Mallouk. "In each project, there are interesting possibilities for practical applications, some in the near term and some longer term. Some of the long-term ideas are remotely powered micro-scalpels for minimally invasive surgery, nanowire transistors that compute using the spin of electrons instead of their charge, hybrid optical-electronic circuits, perfect lenses, plastic solar cells, and magnetic memories that are fully integrated into silicon chips."

Nationwide, there are 27 MRSEC centers, each with a different technical focus. Universities compete for MRSEC funding every three years. In the current competition, Penn State and 13 other universities were selected for funding from among 100 universities that had submitted proposals. "Penn State has a long history of excellence in materials research," Mallouk said. "With over 200 faculty who are active in the field, Penn State has the depth of expertise and the outstanding facilities that are needed to make headway on a range of important problems. In this center, we do not work on problems that could be solved by one or two of us. We go after the big ones that really require an interdisciplinary team with complementary skills." The Penn State MRSEC involves 42 faculty and more than 50 students from 11 academic departments and institutes at Penn State, as well as collaborators from six other universities. The research of the faculty and students is integrated with a broad educational outreach program that involves the Franklin Institute in Philadelphia. MRSEC researchers have collaborations with several national laboratories and also extensive international collaborations. The MRSEC is also affiliated with companies that are seeking to commercialize the results of the center's research. An essential component of MRSEC projects, especially those that translate to nanotechnology and energy technologies, has been ongoing support provided by the Commonwealth of Pennsylvania through the Ben Franklin Technology Development Authority of the Department of Community and Economic Development.

Story by Andrea Messer



Mallouk at the 2006 Taylor Lecture in Materials.

### ABET Review Successful

Our ABET review has come and gone and the review went well. Our Program Evaluator (PEV), Elliott Slavomovich, was very complimentary of the faculty and students of the department as well as the assessment process we have in place.

An outcome of the visit was the opportunity to create four new Program Educational Objectives (PEOs) for the department. Program Educational Objectives are broad statements about the predicted accomplishments of our recent graduates. The new PEOs are presented below.



I would like to thank Allison and Jenneth for their dedication to the ABET cause and for their help in making the ABET evaluation seamless. I would also like to thank all faculty and students for their contributions to our ABET continuous improvement process. In particular, the faculty (Randall, Trolier-McKinstry, Green, Gopalan, Mohny, Muhlstein, Howell, Manias, Hickner, Runt, Redwing, and Messing) that met with our PEV.

Finally, I want to thank John Hellmann. It was his foresight and organization that built the foundation upon which our successful review was established.

If you are a recent graduate, 3-5 years out from graduation, please look for a new alumni survey that was sent to you in early January. Your feedback on the new PEOs is extremely important to the department's continuous improvement and we would greatly appreciate hearing from you by February 15, 2009. Please see the PEO's on the web at [www.matse.psu.edu/alumni/Alumni\\_Survey.pdf](http://www.matse.psu.edu/alumni/Alumni_Survey.pdf). There is a place for you to fill out the alumni survey. Please take a moment we really need to hear from you.

Thanks.

By: R. Allen Kimel, Associate Head for Undergraduate Studies

## Fabrication of Highly Efficient Biomimetic Devices

Living organisms can provide inspiration for innovations, especially in the case of biological structures exhibiting multifunctional properties. For example, insect bodies contain photonic micro- and nanostructures to create external coloration changes with viewing angle (iridescence), and/or to appear metallic. In the broadest sense, biomimetics is aimed at exploiting structures and functionalities found in nature for technological applications. But the mechanisms of formation of biological structures are tremendously complex, which makes it extremely difficult, if not impossible, to exactly imitate those mechanisms. An alternative approach is to fabricate

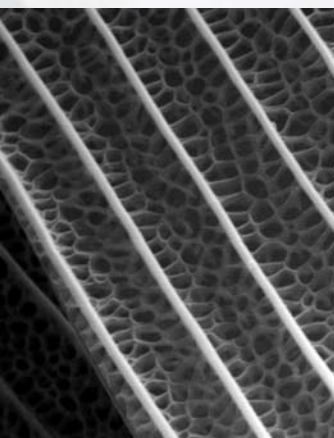
replicas of biological structures based on converting templates harvested from a particular species into synthetic materials. This bioreplication aims to take advantage of the spatial features of biological structures for the development of novel devices with tailored functionalities. In this way, biological structures can be made out of more stable, harder, and high-temperature-

tolerant artificial materials. This approach could result in reliable and inexpensive processes for the fabrication of complex nanostructures with unique functionalities for use in fields ranging from medicine to security.

Naturally, the exact replication of biotemplates by artificial methods is, in general, limited by the capabilities of currently available techniques. In this respect, two major problems can arise. First, there are few techniques available to grow high-fidelity replicas, particularly at the nanoscale or on curved biotemplates. Second, most physical or chemical processing methods will result in damage to or destruction of the original biotemplate, since these methods often require either elevated temperatures and exposure to chemical agents or mechanical stress. Within this context, we have developed a novel technique, namely the conformal-evaporated-film-by-rotation (CEFR) technique<sup>[i],[ii]</sup>, to fabricate high-fidelity replicas of biotemplates exhibiting micro- and nano-scale features distributed over either planar or curved surfaces.

The CEFR technique is particularly well-suited for bioreplication. The temperatures involved are sufficiently low and the replication process occurs in a non-corrosive environment, thereby avoiding damage of the organic skeleton, and thus preserving the integrity of the underlying biotemplate. Furthermore, the CEFR technique allows the production of replicas made of insulating materials, metals, semiconductors, semimetals, polymers and organic materials. By implementing the CEFR technique, we have successfully created replicas of the wing of a butterfly. The butterfly wing has a photonic band-gap structure which provides its particular color, together with additional functionalities including aerodynamics, light weight, mimicry and camouflage. The replicated wing is composed of thousands of scales, which are intricately shaped with stratification, voids and groves of complex shapes to display several optical effects, e.g., interference, scattering and diffraction. Since the morphology of the butterfly wing makes it a very efficient diffuser of light, the replica structure could be used as an antireflection coating for increased photon trapping over solar cells. Still other potential applications include optical filters for spectral imaging, optical sensors and decorative coatings.

R.J. Martín-Palma, A. Lakhtakia and C.G. Pantano



Getting closer to the surface, an enlarged (15,000x) view of the area between the ribs on a butterfly wing.



**Above:** Enlarged view of surface of butterfly wings after application of coating using CEFR.

**Below:** The head of a fly coated with chalcogenide glass is magnified at 150x.



## Research Safety Goes Under the Microscope

Safety has gained elevated attention in MatSE. Discussions with the External Advisory Board (EAB) and the recent OSHA requirements at Penn State (not OSHA regulated before January 1, 2008) have prompted a revamped approach to how safety is taught to our students, a new commitment to maintaining high-



Department Safety Officer, Scott Henninger, has placed new safety glass receptacles in each lab.

performance and safe labs, and the increased attention of the faculty, staff, and students within the department. The MatSE Safety Awareness Organization (MSAO) headed by Mike Hickner

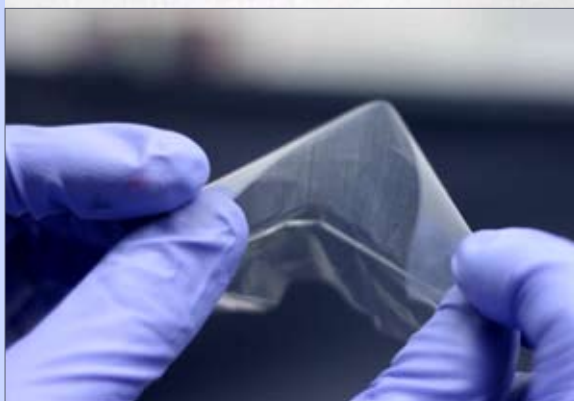
and Scott Henninger with representation from all corners of the department has provided a focal point for safety discussions and is charged with bolstering the safety culture throughout MatSE. Two new initiatives are now underway. An OSHA-mandatory safety glasses program has been put in place by Scott with funding from the department. Each student and postdoc who works in a laboratory is being issued a pair of safety glasses. There are a few styles of comfortable glasses from which people can choose and each pair will be labeled with the owner's name. This program is a positive step towards giving the students a stake in the safety culture of the department along with the additional responsibility and attention it deserves. Additionally, both informal and formal inspections have been stepped-up with notifications to PIs and lab members for follow-up action. These inspections have already had a huge effect on the appearance and compliance of our labs, and have set us up well for the annual University laboratory inspections in January. Also in January, the department will be organizing a safety week with displays, movies, and special reminders to kick off 2009 as the safest, most productive department at Penn State! EAB member Dr. James Loftus '84, '86, '88 will give a special seminar to highlight industries view of safety and the importance of safety to all.

By Mike Hickner

## Polymer Electric Storage, Flexible and Adaptable

The proliferation of solar, wind and even tidal electric generation and the rapid emergence of hybrid electric automobiles demands flexible and reliable methods of high-capacity electrical storage. Now a team of Penn State materials scientists is developing ferroelectric polymer-based capacitors that can deliver power more rapidly and are much lighter than conventional batteries.

The researchers, who include Qing Wang, associate professor of materials science and engineering, Yingying Lu, postdoctoral fellow, Jason Claude and Junjun Li, graduate students in materials science and engineering, developed poly(vinylidene fluoride) based polymers with very high dielectric permittivities at room temperature.



Permittivity is a measure of how much charge is stored in a material for a given electric field. They found that by altering the chemical composition of the polymer, they could tune the dielectric property and energy density.

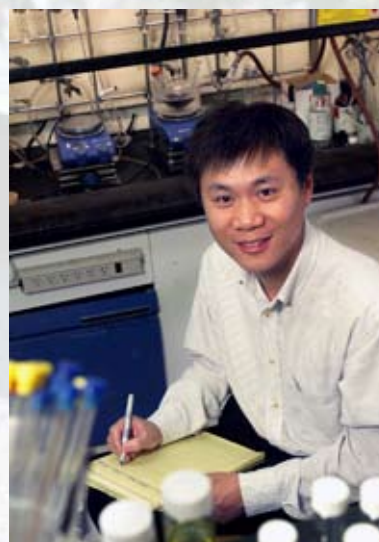
Electric cars are a good target for ferroelectric polymer capacitors because they convert mechanical energy generated when, for example coasting downhill, convert it to electricity and charge batteries for use at other times. Conventional batteries are often heavy, and may not be able to deliver the power amounts needed for quick acceleration.

The Penn State group further modified this ferroelectric polymer by adding nanoparticulate ceramics. They believed that combining polymers with high breakdown strength with ceramics of high permittivity would produce a composite material with a large energy storage capacity. Unfortunately mixing nano particles of ceramic with polymers is not a simple action. If the two materials are not matched for electrical properties, their interface will breakdown at high electric fields and the ability of the composite to store energy will decrease, rather than increase. "Matching the permittivity and uniformly dispersing the ceramic nanoparticles is challenging," says Wang. "Both problems have to be tackled and solved at the same time for the composites to have the desired characteristics." Wang and his group functionalized the surface of the dielectric particles to fine-tune the interface and particle mixing.

Dielectric polymers like the ones Wang creates cannot only be used as capacitors, but could also substitute for the dielectric silicon dioxide layer currently used in computers. Their use would open the way for flexible electronics applications, such as foldable screens and computers.

The National Science Foundation and the Office of Naval Research funded this research.

Story by Andrea Messer



Dr. Qing Wang is an Associate Professor of Materials Science and Engineering.



Gary Messing visited **Dorothy Pate Enright** in the spring of 2008 in Houston, Texas. Dorothy created the “Dorothy Pate Enright Endowed Scholarship in Materials Science and Engineering in 1999. The purpose of this scholarship is to provide recognition and financial assistance to outstanding undergraduate students enrolled or planning to enroll in Materials Science and Engineering. Since 1999, The Dorothy Pate Enright Scholarship has benefited 34 students.



**Oh-Hun Kwon, '86** PhD CerSE, received the 2008 F. H. Norton Award presented by The New England Section of The American Ceramic Society. Dr. Kwon is also a champion of green manufacturing methods for ceramic materials. He is a longtime member and supporter of the New England Section of ACerS.

Dr. Kwon is currently the Director of Ceramic Technology at Satin-Gobain's Northboro Ceramics and Plastics Research and Development Center.

### In Memory; Howard O. Beaver '48



Howard O. 'Mike' Beaver, Jr., 83, a retired specialty steel manufacturing company executive, died Nov. 24, 2008, in The Highlands at Wyomissing. Mr. Beaver was formerly of Muhlenberg Park.

He was a 1942 graduate of Mount Penn High School. He attended the United States Naval Academy in 1944 while serving in the Navy and graduated with a bachelor's degree in metallurgy from Pennsylvania State University in 1948. He received an honorary doctor of science degree from Albright College in 1982.

Mr. Beaver began his career at Carpenter Steel Company in 1944 as a mill employee. Upon graduation from college, he began as a metallurgist. He served as plant metallurgist, melting; manager, mill metallurgy; assistant

general superintendent; assistant vice president, steel manufacturing; vice president of production; group vice president, steel; president, chairman of the board and chief executive officer, 1971 to 1983; and on the board of directors. He retired in 1993.

He was a former member of the advisory panel of the Congressional Office of Technological Assessment, Washington. He served on the boards of directors of Girard Bank, Mellon Bank, Hershey Foods Company, and Hershey Entertainment and Resort Company.

He taught metallurgy at Wyomissing Polytechnic Institute after graduation from Penn State. The school became part of Penn State and later Berks Campus in 1958. The association began a lifelong connection for Mr. Beaver as a volunteer for Penn State and the Berks Campus.

Mr. Beaver was an executive board past president, Boy Scouts of America, Hawk Mountain Council; past president, advisory board, Berks Campus, Penn State University; trustee at Penn State University, University Park; general chairman, capital campaign at Berks Campus; board of trustees, Chit Chat Foundation; and past president of the Muhlenberg Lions Club. He was active with the United Way of Berks County, Pennsylvanians For Effective Government and the Keystone Games.

Mr. Beaver was the recipient of many awards, including: Certificate of Distinction, Financial World, 1979;

Silver Award, The Wall Street Transcript, 1980; Horatio Alger Award, 1981; Humanitarian Award, B'nai B'rith International, 1981; Distinguished Pennsylvanian, William Penn Comm., 1981; Benjamin Fairless Award from AIME, 1981; Businessman of the Year, Berks County Chamber of Commerce, 1982; Billy Wallis Founders Award, Electric Metal Makers Guild Inc., 1982; Wilbur Doran Award, United Way of Berks County, 1985; Hall of Fame, Junior Achievement of Berks County, 1985; Thun Award, 1990; Fellow, American Society of Metals; Distinguished Alumni Award, Pennsylvania State University, 1991; Caron Award from the Caron Foundation; Mount Penn High School Hall of Fame; and Fellow of the American Society of Metals (Bradley Stoughton Award, 1967; David Ford McFarland Award, 1972; Medal of Achievement for Research, 1980; and Distinguished Life Membership Award, 1988).

Two buildings have been named in honor of Mr. Beaver: The Beaver Community Center at Berks Campus of Penn State and the Beaver Family Center headquarters for Hawk Mountain Council, Boy Scouts of America.



Bill Easterling, Dean, College of Earth and Mineral Sciences pictured with John Kaniuk

**John A. Kaniuk, '69** B.S in Ceramic Science and Engineering, recently received the 2008 GEMS Alumni Achievement Award from the College of Earth and Mineral Sciences (EMS) at Penn State. The GEMS Alumni Achievement Award is given by the EMS Alumni Society to recognize outstanding achievement by EMS alumni. Mr. Kaniuk is President of Zircoa, Inc., a manufacturer of Zirconia products in Solon, Ohio. As President of Zircoa, he changed the culture and structure of their operations. Zircoa has been locally and nationally recognized for its employee training and empowerment in development utilizing Kaniuk's quality philosophy. His significant accomplishments include developing low moisture castable technology and implementing it into the steel industry that resulted in over \$30 million in new sales into such areas as blast furnace troughs and ladles. He was also recognized in 1996 as a Penn State Centennial Fellow and in 2007 he received the MatSE Distinguished Alumni Award.



**William Schneider, '70** Ph.D. in Solid State Sciences along with his wife Joanne visited Penn State on June 25, 2008. The Schneider's reside in California but traveled through Happy Valley on their way to visit family.

**If you are planning a visit to Penn State and would like a tour of Steidle Building, please contact Katina at [katina@matse.psu.edu](mailto:katina@matse.psu.edu).**

**MS&T 2008 Football Winner**



The Materials Science and Engineering Department sponsored a Penn State reception in conjunction with the Materials Science and Technology Exposition on October 7, 2008. Over eighty alumni, students, faculty and friends attended the event held in Pittsburgh, PA. We would like to congratulate **Robert Marchiando '90** who won the autographed Joe Paterno football. Coming Fall 2009, we will be back in Pittsburgh. Mark your calendars for Tuesday, October 27, 2009 at the David L. Lawrence Convention Center in Pittsburgh, PA.

**MRS 2008 Football Winner**



The Materials Science and Engineering Department sponsored a Penn State reception in conjunction with the Materials Research Society Meeting on December 2, 2008. Over thirty alumni, students, faculty and friends attended the event held in Boston, MA. We would like to congratulate **Jun Wang '04** who won the autographed Joe Paterno football.

[www.matse.psu.edu](http://www.matse.psu.edu)

**MatSE News from MS&T 2008**

**A number of alumni, faculty and students were recognized at the Materials Science and Technology Conference and Exhibition (MS&T) held October 5-9, 2008 in Pittsburgh.**

**John A. Kaniuk '69** was inducted as President of ACerS. John Kaniuk is the President of Solon, Ohio-based Zircoa, Inc. John received the 2007 Distinguished Alumni Award from the Department of Materials Science and Engineering in recognition of his contributions to the science and technology of advanced refractory materials.

**Katherine T. Faber '78** served as the Past President of ACerS. Kathy is the Walter P. Murphy Professor of Materials Science and Engineering at Northwestern University. Kathy is also a member of the MatSE department External Advisory Board (EAB).

Another EAB member receiving honor is **S. Jill Glass '87, '90**. Jill was named a 2008 Society Fellow of ACerS. Jill is the manager of the Materials Reliability Department at Sandia National Laboratories in Albuquerque, New Mexico.

**Della Roy**, Professor Emerita of Materials Science at Penn State was awarded Distinguished Life Membership of ACerS. Della was awarded Fellow of ACerS in 1971. In addition, she received the Jeppson (1982), Copeland (1987), and Bleining (2004) awards, and the annual Della Roy Lecture is named in her honor.

**Rustum Roy '48**, Evan Pugh Professor of the Solid State Emeritus gave the Frontiers of Science & Society – Rustum Roy Lecture this year. The annual lecture honors the contributions Rustum has made to science and technology and their interrelationship to society-at-large.

**Soonil Lee '06**, Postdoctoral Scholar at Penn State, **Clive A. Randall**, Professor of Materials Science and Engineering and Director of the Center for Dielectric Studies, and **Zi-Kui Liu**, Professor of Materials Science and Engineering and Director of the Center for Computational Design received the Richard and Patricia Spriggs Phase Equilibria Award for their paper *“Modified Phase Diagram for the Barium Oxide-Titanium Dioxide System for the Ferroelectric Barium Titanate.”*

**John R. Hellmann '77, '81**, received the Outstanding Educator Award from the Ceramic Educational Council. John is a Professor in Materials Science and Engineering and the Associate Dean for Education in the College of Earth and Mineral Sciences.

**Carlo Pantano**, Distinguished Professor of Materials Science and Engineering and Director of the Materials Research Institute gave a talk titled

*“Chemical Stability of Clean and Functionalized Glass Surfaces”* as part of the Alfred R. Cooper Distinguished Speaker Series.

**MatSE undergraduate and graduate students receiving recognition at MS&T this year.**

**Brad Hasek**, (senior-metals) was awarded a FeMET Scholarship from AISI for his active academic achievements and interest in the iron and steel industry.



*Kevin Fox, MatSE '03, '05, and Michael Wallace, MatSE '08 at MS&T 2008.*

**Laura Jean Lucca**, (junior-ceramics & metals) was awarded the John M. Haniak Scholarship. This award is given to an outstanding undergraduate member of ASM International who demonstrates exemplary academic and personal achievements.

**Jessica Serra**, (senior-ceramics) received the 2008 Nicholas J. Grant Scholarship. This scholarship is awarded to an outstanding undergraduate member of ASM who demonstrates exemplary academic and personal achievements, as well as interest and potential in metallurgy or materials science and engineering.

**Guang Sheng**, (graduate) received the Graduate Excellence in Materials Science (GEMS) Sapphire Award.

**Vivek Tomer**, (graduate) received the Best Student Presentation Award – Oral Category for his presentation titled *“Induced Anisotropy in Electrically Modified Polymer/Ceramic Nanocomposites.”*



## Celebrating the Leadership of the Women in MatSE

We are honored to showcase the outstanding achievements of the Women in MatSE. The remarkable talents of these women are revolutionizing the field of Materials Science and Engineering.

In 2006 The National Academies Press published *Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering*. The report states that “Career impediments for women deprive the nation of an important source of talented and accomplished scientists and engineers who could contribute to our nation’s competitiveness. Transforming institutional structures and procedures to eliminate gender bias is a major national task that will require strong leadership and continuous attention, evaluation, and accountability.” A workshop on Gender Equity in Materials Science and Engineering in May 2008 organized by the University Materials Council and supported by DOE-BES and the NSF, underscored the importance of change within academia to ensure that “Implicit biases, unconscious attitudes, invisible factors and schemas (do not) influence decision making and continue to adversely affect the progress of women in MSE.”

In January of 2007 the department took on the task of “evaluating the environment within the Department of Materials Science and Engineering as it pertains to women employees, students and faculty”.

The outcome of this group was the creation of an

Ombudsperson position. This position will assist in the mediation of gender related issues. We established and publicized through the web a departmental statement emphasizing our commitment to providing a professional, inclusive environment that embraces the gender, racial and cultural diversity of our students, staff and faculty. We have instituted an orientation program for all students that address gender-related climate issues and taken actions to address gender equity within the department. We have started a strong foundation to maintain an environment free of bias, inequities and discrimination.

By creating such an inclusive environment and through deliberate actions during with future women academicians. These women will have the honor to join the ranks of the outstanding women faculty of Materials Science and Engineering.

### THE WOMEN OF MATSE (left to right)

**Joan M. Redwing** – Professor of Materials Science and Engineering and Electrical Engineering, Chair of the Intercollege Graduate Degree Program in Materials Science and Engineering at Penn State, Secretary of the American Association for Crystal Growth since 2005, and Associate Editor for the *Journal of Crystal Growth*.

**Elizabeth C. Dickey** – Professor of Materials Science and Engineering, Associate Director of the Materials Research Institute, Director of the Materials Characterization Laboratory, and Chair of the Basic Sciences Division of The American Ceramic Society.

**Suzanne E. Mohney** – Professor of Materials Science and Engineering, Editor-in-Chief for the *Journal of Electronic Materials* and 2007 Chair Electronic Materials and Processing Division Executive Committee of the American Vacuum Society.

**Susan Trolier-McKinstry** – Professor of Ceramic Science and Engineering, President of IEEE Ultrasonics, Ferroelectrics and Frequency Control Society, Associate Editor for *Applied Physics Letters*, Director of the Center of Excellence in Piezoelectric Materials and Devices at Penn State, and inaugural National Security Science and Engineering Fellow.

**Coray M. Colina** – Associate Professor of Materials Science and Engineering, Director of the Center for the Study of Polymeric Systems, and Guest Editor for the *Journal of Physical Chemistry*.



**2008 Graduates**

**Summer 08 - B.S.**

Christopher Brink  
Eric Liu  
Michael Phipps  
James Shubilla  
Craig Thomas

**Summer 08 - M.S.**

Joshua Boyce  
James Collins  
Tanisha Diggs  
Roi Meiom  
Alfonso Mendoza  
Cheol Hong Min  
Hideki Ogihara  
Sunyoung Park  
Heidi Schulze

**Summer 08 - Ph.D.**

Majeera Mantina  
Robert Schaut  
Uthaiorn Suriyapraphadilok  
Qinglei Wang  
Jie Zhu

**Fall 08 - B.S.**

Garnia Juwondo  
David Rossberg  
Daniel Song

**Fall 08 - M.S.**

Defrain, Raymond  
Kolluru, Pavan  
Liang, Siwei  
Romasco, Amber  
Tweed-Kent, Sean

**Fall 08 - Ph.D.**

Burke, Robert  
Claude, Jason  
Koseski, Ryan  
Meyer, David  
Montgomery, Eliza  
Nandan, Rituraj  
Park, Pilyeon  
Rai, Rohit  
Unal, Burcu

**Materials Camp Expands Knowledge of Renewable Energy**

Twenty-two high school students from nine states arrived on campus during the week of July 6th – 11th to learn about renewable energy and the materials that make them work. The residential summer workshop is provided without charge for rising juniors and seniors with an interest in science through the ASM Materials Education Foundation.



Hosted by the Department of Materials Science and Engineering and the Department of Energy and Mineral Engineering, the hands-on workshop found students dissecting, examining, and creating their own batteries, photovoltaics, and fuel cells over the first three days. On Thursday, the students integrated their devices into systems to power toy cars, water pumps and electronics, or to generate hydrogen from water to power a fuel cell. On Friday, the students exhibited their research through poster presentations to patrons of the Central Pennsylvania Festival of the Arts.

The students worked with professors Allen Kimel and Michael Hickner, from materials science, and Jeffrey Brownson from energy and minerals, along with one graduate and three undergraduate student mentors, all of whom volunteered their time. The results were students whose enthusiasm for science and renewable energy was evident in their eagerness to share their knowledge, experiments, and posters with passersby at the festival.

Nathan, one of seven Pennsylvania students, explained his team's solar cells, which were dye sensitized with the juice of berries. Nathan's intention coming into camp was to study robotics

or electrical engineering in college. Now he has added materials and energy to his potential careers. Sean, an upcoming senior from Westfield, NJ, knew nothing about solar cells or fuel cells before he came to camp. The camp gave him a strong introduction to renewable energy, he said, and now he wants to learn more about materials. Erica, also from New Jersey, said she had only a limited idea about the variety of energy sources when she arrived, but it was fun learning from the instructors and from each other. "The sun is safest," she advised. "It worked best for us."

ASM offers the camps to introduce students to materials science at a time when they are making decisions about future careers. Since 2000, more than \$1,000,000 has been donated to support the camps and over 1,200 students a year attend the camps on various campuses around the country. The only charge for students is their transportation to and from camp. Interested students can apply for admission through the ASM Materials Education Foundation Web site.

*Walt Mills, Writer/Editor, Materials Research Institute*

## IIM Program Continues to Grow

The International Internship in Materials (IIM) supported by the Bayer USA Foundation and the Alcoa Campus Partnership Program celebrated its first internship in China. Yan (Anne) Ling, a junior with dual options in Ceramics and Metals worked with Dr. Long-Qing Chen and Dr. Zhang Tao at the Shanghai Institute of Ceramics in China. In a fall interview, Ling commented, "Research is going pretty well. I have been taken off the alumina fiber topic as that is an area of national security. I am now working on storage phosphors, mainly CsBr:Eu<sup>3+</sup> films for x-ray imaging plates used in computed radiography. I have started making different molar concentrations of CsBr:Eu<sup>3+</sup> and will starting testing soon." As Yan Ling spent the fall with SICCAS, Corina Oelgardt from TU Clausthal, Germany, returned to MatSE to continue research on Al<sub>2</sub>O<sub>3</sub>-Y<sub>2</sub>O<sub>3</sub>-ZrO<sub>2</sub> composites with the Messing Group.

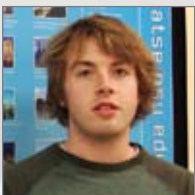


MatSE junior, Yan Ling (left), at Shanghai Institute of Ceramics in China

## IIM Students Abroad in Spring, 2009



Nathan Friedman, a Materials Science and Engineering student, specializing in polymer science will be conducting research spring 2009 with Professor Giovanna Brusatin of the University of Padua and Dr. James Runt of Penn State University on a polymer and hybrid organic/inorganic scratch resistant transparent coatings project.



Erik Haussmann, majoring in Materials Science and Engineering, with the ceramics science option, will be joining Dr. Lothar Wondraczek, of Friedrich-Alexander University, Erlangen-Nuremberg, Germany and Dr. Venkatraman Gopalan, of Penn State University, conducting research on long lifetime phosphorescent glass ceramics.



Edward Mily, Jr, a junior Materials Science and Engineering student concentrating in polymers science will be traveling to the University of Basque Country, in San Sebastian, Spain to work with Maria J. Fernandez-Berridi and Dr. Paul Painter of Penn State University on hydrophobic surfaces.



Fabrice Gouny will be conducting research with Dr. Susan Trolrier-McKinstry's Research Group in Spring 2009. Currently, Fabrice is a student at the National School of Industrial Ceramics in Limoges, France.





*imagine*

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