

PENN STATE

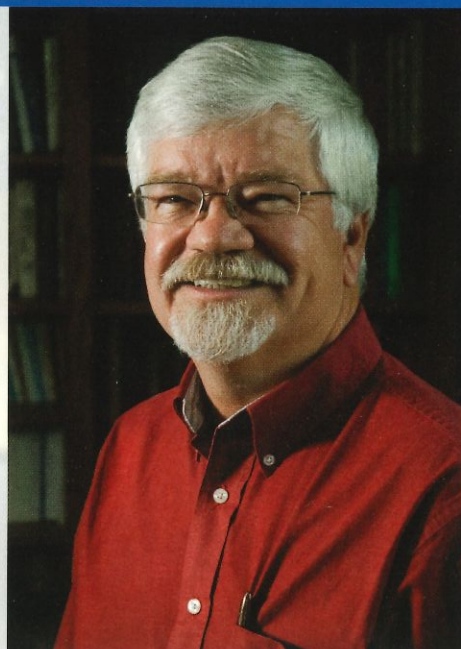


imagine

The Newsletter of Materials Science and Engineering • Winter 2011

RESEARCH FEATURES:

Two MatSE Professors are winning the battle against environmental oil recovery.



Dr. Gary L. Messing
Distinguished Professor of
Ceramic Science and Engineering
Head, Department of
Materials Science and Engineering

Welcome to the winter newsletter. The department welcomed 30 freshmen and 23 graduate students this fall bringing enrollments to 172 undergraduates and 170 graduate students. I'd like to report the status of two initiatives affecting the future of your department. After two years of seemingly endless meetings MatSE faculty have transformed our undergraduate curriculum for the first time in my thirty plus years at Penn State. The current program was reviewed with three objectives in mind; (1) increase scientific rigor and comprehension across the entire spectrum of materials, (2) increase outcome flexibility by increasing the number of possible areas of specialization, and (3) improve curriculum delivery efficiency. To increase materials rigor, students will now be required to take both inorganic and organic chemistry courses as prerequisites for *Introduction to Inorganic Materials* and *Introduction to Organic Materials* courses taught in the sophomore year in addition to our *Solid State Materials* course. To better inform students about the power of Computational Materials Science and Engineering, we have created a new required course of that name. Flexibility will be increased as students can design study specializations on topics such as energy materials, electronic materials, biomedical materials,

materials science, and business and materials, in addition to traditional material specializations such as ceramics, metals and polymers. A new materials selection course is designed to increase materials problem solving skills including a rigorous assessment of sustainability. To increase team-building skills, seniors will have the option of working on a senior semester project with other engineering students in the Learning Factory as an alternative to the traditional senior research thesis. Finally, an emphasis is being placed on interweaving sustainability into the department's course and laboratory offerings, including the introduction of a new elective course titled *Materials Sustainability and the Environment*. The new curriculum promises to educate students who are better equipped to handle the changing materials world.

About four years ago we started a program to promote and enhance safety consciousness and practice in MatSE. We worked with the External Advisory Board and the University's Office of Environment, Health and Safety (EHS) to review all of our safety practices. We created the Materials Safety Awareness Organization in MatSE to guide us through a transformation. See the whole story (<http://live.psu.edu/story/56194>) and the Safety Dance video (www.youtube.com/user/PennStateMatSE) that we created to show that safety can be fun. I particularly like the following quote from Kate Lumley-Sapanski, assistant director of EHS, "In some ways, the MSAO is unique to Penn State; with the variety of people on the team, it's like having a bunch of safety champions throughout the department. They genuinely care about safety and take the challenges on, and that makes a huge difference". MatSE is a leader at Penn State in ensuring a safe learning environment for all its members. I would like to single out Professor Mike Hickner and Scott Henninger for going the extra yard(s) to help create a safety culture that we proudly practice each and every day, and EAB member James Loftus (Owens Corning) for bringing his safety staff to MatSE to assess, and enhance, our safety practices. We wish you a pleasant and safe holiday season. Consider a donation to support our safety mission (see page 11).

BULLETIN BOARD

Would you rather receive updates and newsletters via email?

Please take a moment to update your Penn State information at:
www.matse.psu.edu/update

Newsletter Archive

To view all MatSE newsletters since 2005, visit <http://www.matse.psu.edu/newsletter>

On the cover:

MVC 2011, BEST OF SHOW:
Image submitted by Payam Khodaparast, Graduate Student, Materials Science and Engineering

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This is a great way for current students, alumni and MatSE friends to communicate!

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Imagine

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Yurek Elected to NAE

Dr. Gregory Yurek, '69 & '70, Founder, Chairman of the Board and former President & CEO of American Superconductor Corporation has been elected to the National Academy of Engineering. His citation reads "for engineering and leadership in development of high-temperature superconductor products".

Watari Receives Ceramics Award

Dr. Koji Watari '97, (Visiting scientist in the Messing Group, 1998-1999) Senior Research Scientist in the Advanced Manufacturing Research Institute in Nagoya, Japan and Professor Akira Nakajima (PhD, MatSE 1997, Messing advisor), Department of Metallurgy and Ceramics Science, Tokyo Institute of Technology received the Academic Award of Ceramic Society of Japan in Tokyo on June 3, 2011.

Alumni Receive TMS Awards

Dr. Samrat Choudhury '08 PhD is a recipient of the 2011 Young Leader Professional Development Award. Dr. Choudhury is currently serving as a Director's Postdoctoral Fellow in the Materials Science and Technology Division of Los Alamos National Laboratory.

Dr. Dongwon Shin '07 PhD is a recipient of the 2011 Young Leader Professional Development Award. Dr. Shin is an Alvin M. Weinberg Fellow at Oak Ridge National Laboratory.

McCauley Named Hosler Alumni Scholar

Penn State's College of Earth and Mineral Sciences is pleased to announce the recipient of the 2011 Charles L. Hosler Alumni Scholar Medal, James W. McCauley. Dr. McCauley is a chief scientist and ARL Fellow at the Army Research Laboratory in Aberdeen, Maryland, the highest ranking scientific position at ARL.

Dr. McCauley earned his M.S. in mineralogy and Ph.D. in solid state science from Penn State in 1965 and 1968, respectively. From 1968 to 1990, Jim served as a scientist, Branch and Division Chief in the Army Materials and Mechanics Research Center and Materials Technology Laboratory. He then served for five years as Professor of Ceramic Engineering and Dean of the New York State College of Ceramics at Alfred University before rejoining the Army as Senior Ceramic Materials Research Engineer in 1996.



James W. and Mary Ann McCauley

Dr. McCauley is particularly well-known for his invention of AION, aluminum oxynitride, a new transparent ceramic. He was also instrumental in pioneering research for synthesizing non-oxide ceramics, in which he united international research efforts, especially with Russia and Japan.

In addition to his leadership in academia and the military, Dr. McCauley has served the American Ceramic Society in many roles, including President in 1988. He

received the highest awards bestowed upon a member of the Society including Distinguished Life Member. Dr. McCauley's outstanding scientific contributions have been recognized with the Norton, Mueller, Friedberg and the McLaren awards. In 1990 he received the Prometheus Award from the National Institute for Materials Science in Tsukuba, Japan and a Jubilee medal from the Russian Academy of Sciences, Chernogolovka, Russia, October 2007. In 2007 he received the Senior Scientific-Professional (ST) Employee Presidential Rank Award.

The Charles L. Hosler Alumni Scholar Medal was established in 1992 to recognize the very highest levels of intellectual achievement attained by those educated in the College of Earth and Mineral Sciences at Penn State. Dr. McCauley's extensive scientific contributions, administrative leadership at Alfred University and the Army Research Laboratory, and service to his profession are recognized with the 2011 Hosler Medal.

Opportunities for Giving



If you would like to make a gift to either of these funds, please complete and return this form, including a check made payable to:

The Pennsylvania State University
Department of Materials Science and Engineering
121 Steidle Building
University Park, PA 16802

Yes, I want to support MatSE with my gift to:

- Materials Science and Engineering Enrichment Fund (student travel, awards, etc)
- Undergraduate Scholarships
- Safety Awareness Fund

Name: _____

Address: _____

Phone: _____

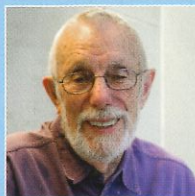
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Department Announces Inaugural Richard E. Tressler Distinguished Lecture Series



Dr. Richard Tressler had a huge impact on Materials Science and Engineering at Penn State and the profession. He transformed the Department of Materials Science and Engineering to a modern materials department through reorganization and key faculty hires. To commemorate his legacy, Professor Tressler's friends, alumni and faculty endowed the R. E. Tressler Distinguished Lectures in Materials to recognize outstanding leaders in materials. Professor Tressler was a Penn State alumnus and an individual who excelled in the commercialization of materials discoveries.

2011 RICHARD E. TRESSLER DISTINGUISHED LECTURERS



Donald W. Hamer
Chairman, State of the Art, Inc.

*Looking Back at 50+ years in Electronic Components Manufacturing-
Lessons Learned-Looking Forward*



L. Eric Cross
Evan Pugh Professor Emeritus of Electrical Engineering, Penn State

*Flexoelectric Composites: An Attractive Alternative Approach to High
Activity Lead-free Piezoelectrics*



Mildred S. Dresselhaus
Professor of Physics and Electrical Engineering, Emeritus Institute
Professor, Massachusetts Institute of Technology

The Promise of Nanomaterials for Thermoelectric Applications

Read more at http://www.matse.psu.edu/ret/2011_lecture_series

MatSE Donates Over 600 Books to Books4Cause

As the slow hand of Father Time sees faculty into retirement, so too does it see a coating of dust on hundreds of books in Steidle Building.

Faculty Emeritus Michael Coleman recently cleaned out his office in Steidle Building, soon to be followed in retirement by his long-time colleague, MatSE Professor Paul Howell. Simultaneously, a small handful of faculty are relocating their offices to the newly opened Millennium Science Complex. During these transitions, faculty and staff are dusting off still-useful textbooks to donate to the international organization called Books4Cause.

Books4Cause runs book drives and book donation campaigns which help fund and support various initiatives locally, nationally, and around the world. Spurred

by Coleman's donation to Books4Cause, MatSE Facilities Coordinator, Frank Driscoll, and Department Head, Gary Messing, contacted the MatSE faculty body and gathered over 600 books that will be re-purposed to educate even more future scientists.

If you have unused books you would like to donate to Books4Cause, you can learn more at www.books4cause.com, or call 800-570-3698.

A Books4Cause representative packs over 600 science books that have been donated by MatSE faculty.



Photo: Mike Fleck



Photo: Mike Fleck

- 275,600 gross sq. ft.
- 60,000 sq. ft. of green roof on five terraces
- 40,000 sq. ft. quiet lab
- 9,500 sq. ft. nano-clean room
- 66 fume hoods
- 30 bio-safety cabinets
- Total cost of \$225M

MSC QUICK FACTS

THE MILLENNIUM SCIENCE COMPLEX

The convergence of engineering, physical sciences, and life sciences, augmented by high-speed computation and data search, is opening new frontiers in human health, energy, and materials science. At Penn State, this convergence has a new home in the Millennium Science Complex, a 275,600 square-foot science building housing two of the University's premier research organizations - the Materials Research Institute and The Huck Institutes for the Life Sciences. More than just a collection of laboratories and instruments, the MSC embodies a new style of research, in which experts from many disciplines coordinate their technologies and knowledge in ways that produce exponential advances. By providing the research space and the opportunity for intellectual exchanges, both formal and informal, the MSC is expected to generate large returns on the University's investment in infrastructure.

Designed by internationally renowned architect Rafael Vinoly, the MSC is one of the nation's first buildings specifically constructed to support the integration of the physical and life sciences. Instruments for the characterization of organic and inorganic materials will be co-located in a vibration-free quiet space, part of 50,000 net square feet of user facilities dedicated to current and future generations of characterization and fabrication tools. Shared meeting and common areas are designed to encourage the free exchange of ideas that existed in the great corporate labs that defined physical science and engineering in the 20th century.

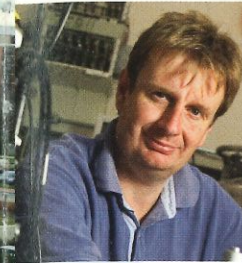
Learn more about the Millennium Science Complex at <http://www.mri.psu.edu/msc/>

By Walt Mills

www.matse.psu.edu

Randall Receives International Award

Clive Randall, Professor of Materials Science and Engineering and Director of the Center for Dielectric Studies, received the "International Award of Ferroelectric Materials and Their Applications" at the 28th Meeting of the Ferroelectric Materials and Their Applications Conference on May 26, 2011 held in Kyoto, Japan. This award, previously known as the Ikeda Award, is given annually for outstanding contributions in the research of ferroelectric materials. Professor Randall's citation reads "for contribution to the progress in Defect Chemistry and Thermodynamics of Perovskite Ferroelectrics". Professor Randall gave a plenary lecture titled "The Science and Engineering of Defects and their Importance in Ferroelectric Materials" and received a monetary award of 200,000 yen (approx \$2,000). Upon receiving the monetary award, Professor Randall asked that his award be donated to help families affected by the earthquake and tsunami.



Randall Gives Arthur L. Friedberg Memorial Lecture

Dr. Clive Randall is the recipient of the ACerS/NICE Arthur L. Friedberg Memorial Lecture. This ACerS/NICE lecture honors the memory of Arthur L. Friedberg for his teaching, research and numerous contributions to the ceramic engineering profession. The lecture is intended to provide a tutorial that reviews and instructs in some area of ceramics with a distinct engineering flavor. The lecture is presented at a level that is accessible to all ceramists. The award for this prestigious lecture is a certificate commemorating the engineering and professional contributions made to the ceramics professions by Dr. Friedberg. This lecture was delivered at the Materials Science & Technology (MS&T) Conference held in Columbus, Ohio in October 2011.

READ MORE!
Please visit our website to read about these additional stories:
Professor Roman Engel-Herbert Inspires Students, written by Andrew Paul, current undergraduate student in MatSE.
Professor Michael Hickner Aims for Pure Water, written by the Penn State Industrial Research Office.

www.matse.psu.edu

Trolier-McKinstry Receives Outstanding Educator Award

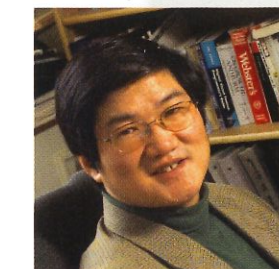
The Ceramic Educational Council Outstanding Educator Award of the American Ceramic Society recognizes truly outstanding work and creativity in teaching, directing student research or the general educational process of ceramic educators. Susan Trolier-McKinstry is professor of ceramic science and engineering and director of the W.M. Keck Smart Materials Integration Laboratory at Pennsylvania State University. Her main research interests include dielectric and piezoelectric thin films, the development of texture in bulk ceramic piezoelectrics and spectroscopic ellipsometry. She is particularly proud that 18 people she advised or co-advised have gone on to take faculty positions around the world.

Messing Gives Edward Orton Jr. Memorial Lecture

Dr. Gary Messing is the recipient of the Edward Orton Jr. Memorial Award. The invited lecturer is awarded for scholarly attainments in ceramics. This lecture was delivered at the Materials Science & Technology (MS&T) Conference held in Columbus, Ohio in October 2011.

Chen Receives TMS Award

Dr. Long-Qing Chen received the 2011 TMS Electronic, Magnetic & Photonic Materials



Distinguished Scientist/Engineer Award. This award recognizes an individual for research excellence in one or more areas related

to electronic, magnetic, and photonic materials science. Professor Chen's citation reads "for his broad, sustained impact on computational materials science in general and the modeling of phase transitions, domain structures, and electrical/mechanical/magnetic coupling in nanoferroelectrics and multiferroics"

Manias Named Editor of Materials Letters

Elsevier has named Evangelos Manias as Editor of *Materials Letters*. *Materials Letters* is Elsevier's leading rapid communications interdisciplinary journal in the field of materials science.

Manias has been an active member of the *Materials Letters* editorial board for many years; in his new role as a Principal Editor, he will spend the majority of his energy on developing and managing a featured letter thematic section, highlighting specific topics of high current interest through invited Featured Articles. In addition, as an editor he will handle incoming submissions that fit with areas of his expertise, i.e., broader field of polymers, composites, and nanocomposites.

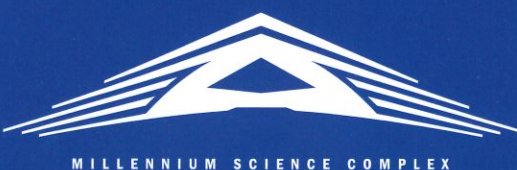
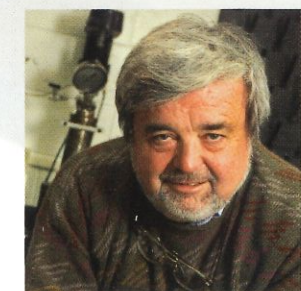


Materials Letters is an interdisciplinary rapid publication journal devoted to rapid communications of cutting edge research on the science, applications and processing of materials.

Materials Letters has an impact factor of 2.12. The *Materials Letters* editorial team is comprised of an editor-in-chief and five editors, including Manias, covering the broad spectrum of materials science and research published in the journal.

Macdonald Receives Honorary Doctorate

The department would like to congratulate Professor Digby D. Macdonald on being inducted as an Honorary Doctorate (Doctor Honoris Causa) from INSA Lyon (Institut National des Sciences Applique'es de Lyon) of France.



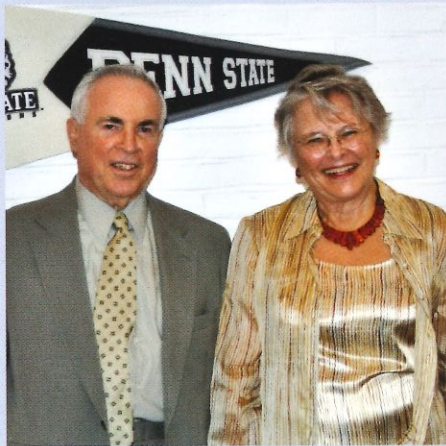
MILLENNIUM SCIENCE COMPLEX

Two MatSE Alumni Inducted into Obelisk Society

This past year MatSE was grateful to have two alumni families inducted into the College of Earth and Mineral Sciences Obelisk Society. The Obelisk Society was established in 1981 to provide special recognition and honor to individuals for extraordinary contributions to, and support of, the College of Earth and Mineral Sciences. Membership is open to all alumni and friends of the college.

David and Julianne Vaughn

Both Julianne and David are graduates of Penn State. Julianne is originally from the Wilkes-Barre area and is a 1963 graduate of the College of Education with a bachelor's degree in secondary education specializing in Russian. In London she obtained a Diploma in Montessori Education from St. Nicholas' College and has an M.A. from Montclair State Univ., New Jersey.



David is originally from England and graduated in 1961 with a B.Sc. in Chemistry and Geology from King's College, University of Durham, followed by an M.S. from the College of Earth and Mineral Sciences in Geochemistry in 1963. He then returned to England (with Julianne) and earned D.I.C. and PH.D. degrees in Physical Chemistry from the Imperial College of Science and Technology in the University of London. They returned to the USA in 1967. David retired from Exxon in 1999 and joined the Materials Research Laboratory as a visiting professor. His main interests are zeolites and other microporous materials as catalysts and sorbents, and has issued over 100 patents and published 95 scientific papers.

Julianne has long been retired as a teacher. Julianne notes that she was only able to come to Penn State because she is of Russian descent; she wanted to study Russian and Penn State was the only school to have the program. Otherwise, her parents would have required her to remain close to home and attend a college in the Wilkes-Barre area. She says that she had a great experience at Penn State, where she and David met.

Peter and Carol Thrower

Peter Thrower received B.A., M.A. and Ph.D. degrees in physics from Cambridge University in the UK. He worked as a research scientist for the United Kingdom Atomic Energy Authority at their Harwell research facility for nine years before moving to Penn State in 1969 to work with Dr. Phil Walker in the new Materials Science and Engineering Department.



During the early years at Penn State he took charge of the electron microscopy facility in the then Mineral Constitution Laboratory while continuing research on carbon materials and becoming heavily involved in undergraduate teaching. During his final ten years at the university he initiated and taught a general education course entitled "Materials in Today's World" that regularly had an enrollment of 1000 students per semester. In 1982 he was appointed Editor in Chief of the research journal CARBON, a position that he continues to hold. He retired from the university in 1998.

Carol Thrower graduated with a B.S. in metallurgy from Penn State in 1974 and worked in industry for the following eleven years, mainly specializing in metal heat-treating and gas atmospheres. She worked at Aircro, B.O.C., Proceadyne and Ironbound Heat Treating in New Jersey before moving to California to work for Multi-Industry Machines in the Los Angeles area.

Coppola Receives Alumni Achievement Award

Jack Coppola, retired senior vice president, science and technology for Johns Manville, was awarded the 2011 Graduates of Earth and Mineral Sciences (GEMS) Alumni Achievement Award on November 4, 2011. Jack received his BS in ceramic engineering from Alfred University in 1966 and his MS and PhD degrees in Materials Science & Engineering from Pennsylvania State University in 1969 and 1971, respectively. In addition to his industrial leadership Jack served many years on the Industry and Professional Activities Committee (IPAC) of the department and was an



Photo: Mike Fleck

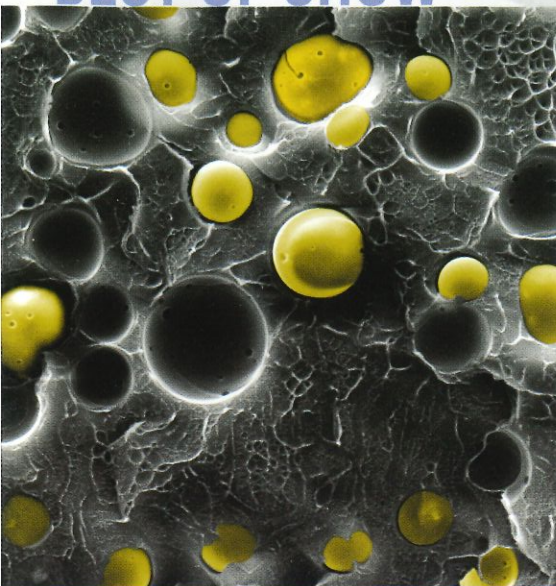
Jack and Jane Coppola at the Alumni Achievement Award Ceremony

important member in overseeing the transformation of the MatSE IPAC to the External Advisory Board (EAB). Jack served as Chairman of the EAB from 2008 to 2010 and has been responsible for its transformation to active engagement with our students, recruiting and development activities.

ALUMNI NOMINATION

If you would like to nominate a fellow alumni for a Departmental, College or University Alumni Award, please contact Katina at iyb7@psu.edu for more information on the various awards.

BEST OF SHOW



Payam Khodaparast, Graduate Student,
Materials Science and Engineering

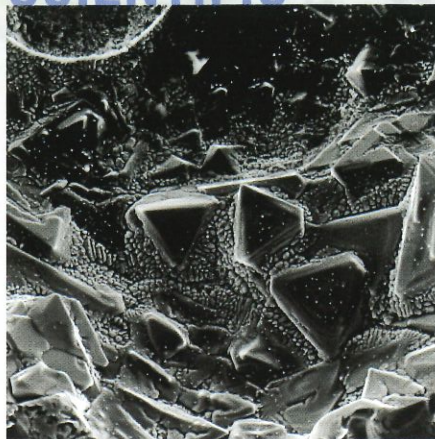
Materials Visualization Competition 2011

The Materials Visualization Competition (MVC) is a scientific visual and artistic competition co-sponsored by the Department of Materials Science and Engineering and the Materials Research Institute. Created to celebrate the quality of research in Materials at Penn State, this competition seeks to increase awareness of materials science through the creativity and visualization of our researchers.

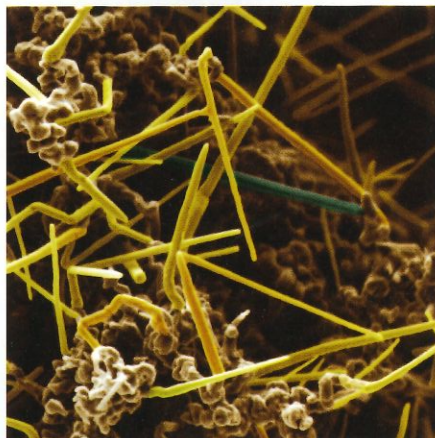
MVC11 was the third competition to be held. After careful consideration, MVC judges Michael Hickner, Jim Lukens-Gable, Craig Mellott, Jennifer Whittaker and Michael Fleck found these images to be particularly striking! Congratulations to our MVC11 winners!

A gallery of winning entries from MVC09 and MVC10 and image descriptions can be found at <http://www.matse.psu.edu/mvc>.

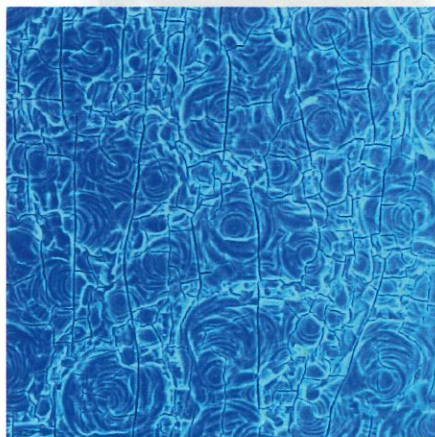
SCIENTIFIC



1ST PLACE SCIENTIFIC:
Eric Fitterling, Undergraduate Student,
Materials Science and Engineering

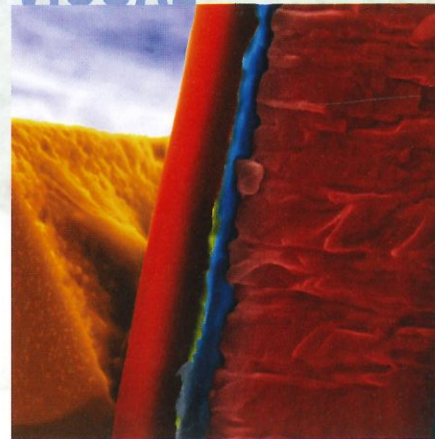


2ND PLACE SCIENTIFIC:
Melisa Steighner, Graduate Student,
Materials Science and Engineering



3RD PLACE SCIENTIFIC:
Timothy Tighe, Post Doc,
Materials Science and Engineering

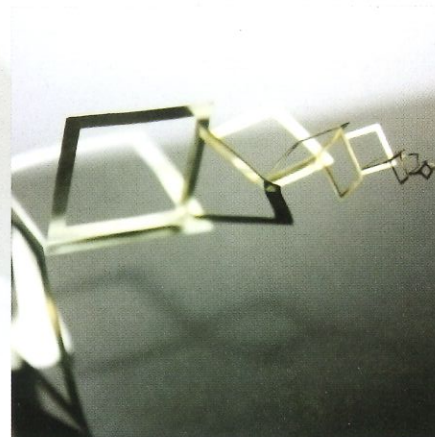
VISUAL



1ST PLACE VISUAL:
Flavio Griggio, Graduate Student,
Materials Science and Engineering

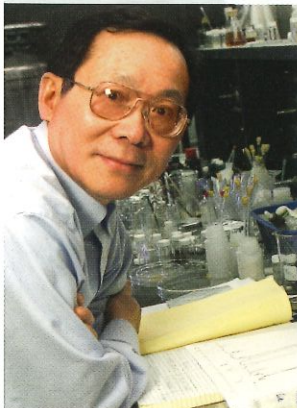


2ND PLACE VISUAL:
Stephen Poterala, Graduate Student,
Materials Science and Engineering



3RD PLACE VISUAL:
Benjamin Hall, Undergraduate Student,
Energy Engineering/Laser-Materials Interaction

Petro-SAP for Oil Spill Recovery



Dr. T.C. "Mike" Chung

In light of recent oil spills in the Gulf of Mexico and Yellowstone river—more than 20 years after the Exxon Valdez disaster in Alaska—we still have no effective technology for removing and cleaning up oil spills or oil slicks from sea water and shorelines. Despite the government's "all hands on deck" approach to combating the oil spill, currently-used methods (booms and skimmers, dispersants, and *in situ* burning) are decades-old, low-tech, and manpower-intensive, some with unknown environmental consequences. Oil spill accidents around the world are actually more frequent than the few highly publicized cases in the United States. Every few years there has been a major oil spill, due to storage tanks and pipes cracking, oil tanker collisions or wrecks, and even from the war with delivery destroying oil facilities. The Exxon Valdez spilled 11 million gallons of oil into the Prince William Sound, but even that did not make the top ten list. Indeed, 33 oil spills were measured as larger and more devastating in the past 40 years.

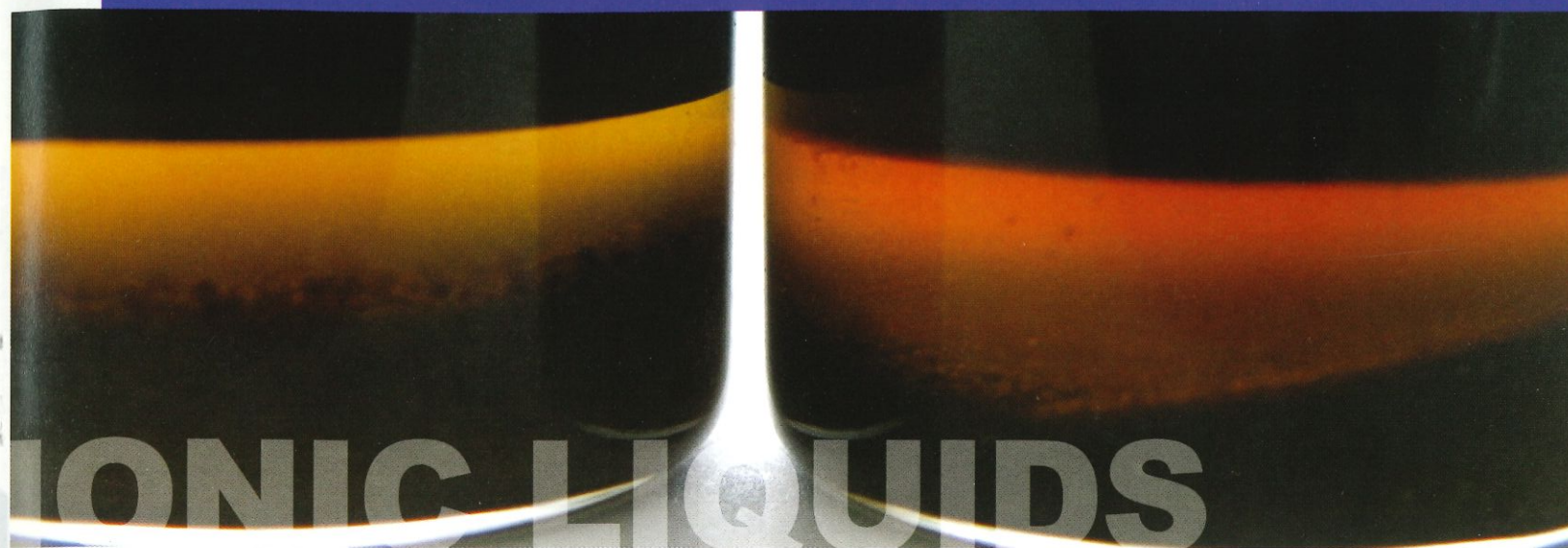
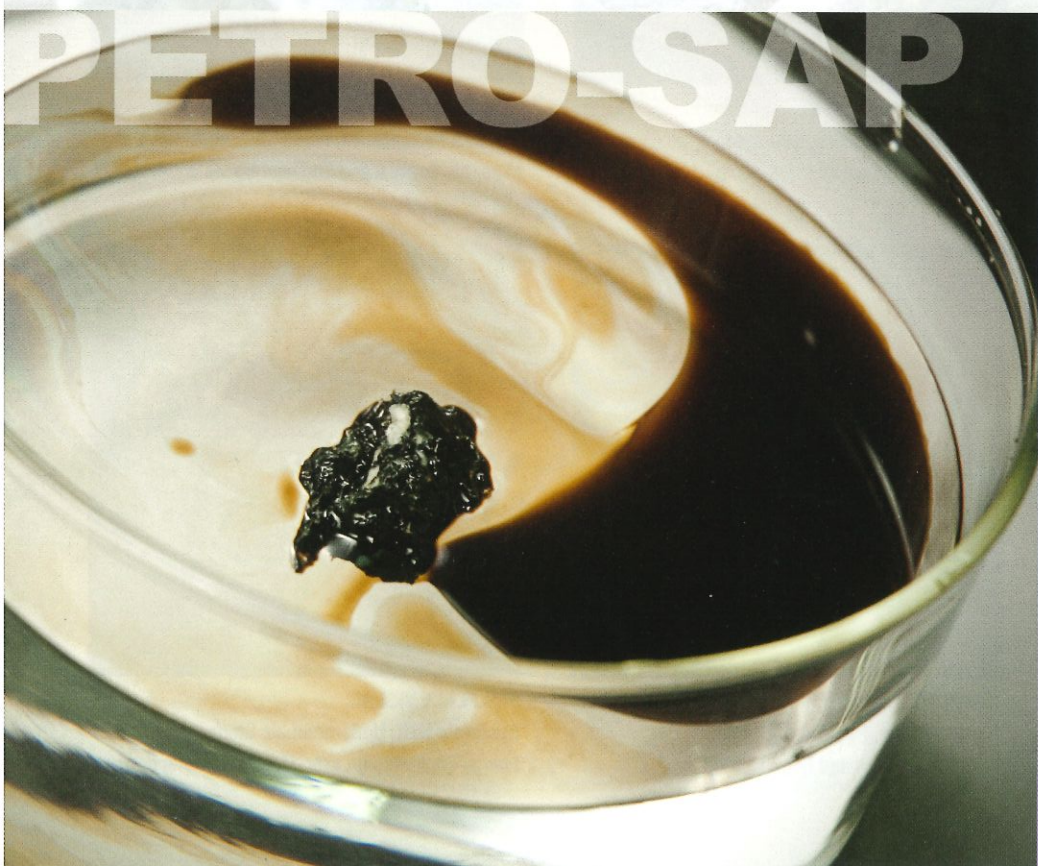
There have been reports discussing the sorption of crude oils. The economic and environmental concerns surrounding oil spills encouraged many researchers to investigate natural sorption materials, such as multifarious inorganic porous products (i.e. clay, talc, zeolites, silica aerogel, calcium fly ash, etc.), and organic biodegradable products (straw, hull, corncob, peat moss, sugarcane bagasse, wood/cotton fibers, wool-based materials, silkworm cocoon waste, etc.). Most of them show limited oil sorption capacity and also absorb water. There are also some papers discussing the usage of synthetic resins, including alkyl acrylates and rubbers. However, they are expensive and require a cross-linking reaction (preventing dissolution in oil) that is hardly complete and uniform; they usually require extensive solvent extraction to remove the soluble fraction. Meltblown polypropylene pads and booms are the most commonly used oil sorbent materials, adsorbing oil in their interstices via capillary action. Due to the weak oil-substrate interaction (absorption mechanism), the fiber-based absorbers exhibit many disadvantages, including failure to maintain oil of low viscosity and easy re-bleeding of absorbed oil under a slight external force. Furthermore,

the treatment of the recovered solid materials is always a major concern, including waste disposal, recyclability, and biodegradability.

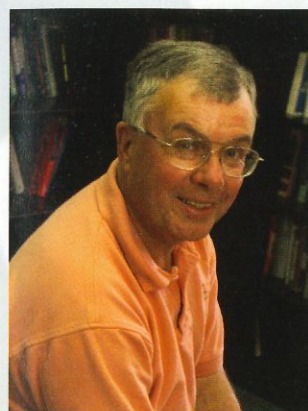
Mike Chung's group has developed and patented a new polyolefin-based oil super-absorbent polymer (Oil-SAP) that may provide a complete solution to combating oil spills. They are petroleum downstream products with aliphatic and aromatic side chains that have similar solubility parameters (oleophilic and hydrophobic properties) with the hydrocarbons in crude oil. They can effectively transform a maritime oil spill into a floating gel, ready for collection. Figure 1 shows a ½" sized Oil-SAP sample increase its weight by more than 40-50 times after coming into contact with crude oil. Its speed and capacity of oil absorption are superior, compared to that of currently-available oil absorbers.

Despite the government's 'all hands on deck' approach to combating the oil spill, currently-used methods are decades-old...

The resulting oil swelled Oil-SAP solid is floating on the water surface and can be picked up with a tweezer, without leaking oil. The combination of good mechanical strength and strong oil affinity assure its structure integrity and stability in ocean environments (waves, wind, sunlight, etc.). The recovered oil-swelled Oil-SAP, containing more than 98% oil and 2% of Oil-SAP, is suitable for regular oil refining processes (an economic, no waste, and no pollutant approach). The bulk side chains reduce the ceiling temperature for depolymerization and result in zero heating residue at 450° C, well below the first distillation step (>600° C) in oil refining. Furthermore, polyolefins are the most inexpensive polymeric material, with a large production capability around the world. Overall, this cost-effective new polyolefin oil-SAP technology shall dramatically reduce the environmental impacts from oil spills and help recover one of our most precious natural resources.



Ionic Liquids for Petroleum Recovery



Dr. Paul Painter

The separation and recovery of oil or tar from sand is a critical problem in a number of industries and crucial to the mitigation of environmental disasters, such as those associated with oil spills. For example, oil or tar sands compose a significant proportion of the world's known oil reserves. The largest deposits are found in Canada and Venezuela, which have combined oil sand reserves estimated to be equal to the world's total reserves of conventional crude oil. Canada's tar sands now provide the U.S. with about two million barrels of oil a day. Significant quantities of tar sands (estimated to contain 32 billion barrels of oil) can also be found in Eastern Utah in the US. These deposits are complex mixtures of sand, clays, water and bitumen, a "heavy" or highly viscous oil. Extraction and separation of bitumen from surface-mined oil sands for the purpose of processing to fuels is much more expensive than extracting conventional oil by drilling and involves the use of significant amounts of energy and water. The water used in the process is ultimately stored in vast tailing ponds. It is a complex mixture of water, dissolved salts, minerals, residual bitumen, surfactants released from the bitumen and other materials used in processing and is acutely toxic to aquatic life.

The environmental problems associated with extracting oil from tar sands are now a source of considerable concern. Some of these problems and the need for large quantities of water have prevented the exploitation of the Utah deposits (along with the higher viscosity of the bitumen and consolidated nature of the tar sands).

Oil contaminated sand and soil is also a major problem after oil spills, either accidental as in the Exxon Valdez or Deepwater Horizon incidents, or as a result of a deliberate act of war or terrorism, as in Kuwait, where large areas of the desert remain contaminated with residual oil that has now aged and become difficult to remove.

The environmental problems associated with extracting oil from tar sands are now a source of considerable concern.

There is also a problem with separating oil from drill cuttings – the sand, shale or other minerals brought to the surface during drilling operations for oil and gas. Drill cuttings are usually contaminated with oil, mostly from the drilling muds used to cool the drill bits and carry the cuttings to the surface.

Drill cuttings from the Marcellus shale also have naturally occurring low level radioactivity (NORM's) and are presently sent to engineered landfills.

In recent work in the department it has been shown that oil, bitumen or tar can be removed from sand and other minerals using ionic liquids, ILs. These are liquids whose constituents are ions, like common table salt (melting point 801°C), except that they are liquids below 100°C. As a result of their ionic nature, they have unusual solvent properties. The separation is usually conducted in conjunction with a non-polar solvent to lower the viscosity of the tar or bitumen and facilitate separation. The separation occurs at room temperature and does not result in the generation of waste process water. Essentially all of the bitumen or oil is recovered in a very clean form, with no detectable mineral fines, which interact preferentially with the IL, and no contamination from the IL. The minerals (sand) are also recovered in an uncontaminated form after removing residual IL with small amounts of (cold) water. Because of the unique properties of ILs, the water and IL used in this process can be readily separated, recovered and recycled through the system.



Congratulations all 2011 MatSE Graduates!

CONGRATULATIONS GRADUATES

GRADUATING B.S.

Cory Bomberger	Brian Poole
Michael Callahan	Zachary Royer
Jedidiah Chubb	Laura Schell
Kevin Dicker	Michael Schmitt
Michael Eckenrode	Jeremy Schreiber
Christopher Elwell	Daniel Seong
Eric Fitterling	Craig Shaner
Nathan Friedman	Joshua Sheldon
Thomas Gonze	Brittany Smith
Zachary Gray	Mikhail Zapata-Rotz
Erik Haussmann	Bruce Stevenson
Helyne Joseph	Nicholas Virbitsky
Jacob Lucas	Jin Wu
Elyssa Okkelberg	Wenting Xing
Michael Policelli	

MatSE Integrated B.S./M.S.

Yan Ling

GRADUATING M.S.

Alma Catano Barerra
Prateek Dasgupta
Erkan A. Gurdal
David Hartwich
Brittany Hedrick
Angela J. Kramer
Hunter D. Moore
Adem Ozelik
Nuexida Pulati
George Scopelianos
Brandy Soublet
Krystaufeux Williams

GRADUATING Ph. D.

Amit Arora	Wenjaun Liu
Kun-Ok Chang	Ian C. Manning
James Collins	Roi A. Meirom
Nicholas S. Dellas	Andrea Muller
Robert Dormaier	Romesh Patel
Brian Downey	Brandon Ribic
Swetha Ganeshan	Arkapol Saengdeejing
Bryan D. Gauntt	Malay Samantaray
Flavio Griggio	Guang Sheng
Gregory R. Hayes	Nicholas Smith
Raegan Johnson	Eftihia Vlahos
Paidan Khanchaitit	Ryan White
Donggeung Kim	Dong Jin Won
Gregory Larsen	Chao Xie
June Hyuk Lee	Kui Xu
Sung Hoon Lee	
Jun-Hong Lin	

IIM Update

The Department of Materials Science and Engineering have had seven exchanges as part of the International Internship in Materials Program (IIM) in 2010-11, two during summer semester, two during fall semester, and three during the spring semester. The participating institutions were the University of Padua, ENSCI, Simón Bolívar University, Leeds University, and Institut Quimic de Sarria (IQS). The following faculty actively supported and hosted the participants in their labs: Evangelos Manias, James Adair, Coray Colina, and Gary Messing. The IIM supports each participant with visa, housing, and programming information, to make their transition as smooth as possible.

For the upcoming year, the program has one completed and four pending Penn State undergraduate participants. Daniel Magagnosc did research at Leeds University, while Cody Seaman worked with Dr. Paolo Colombo at the University of Padua and Stephen Weitzner worked with Dr. Albe, Darmstadt University of Technology. For spring 2012, the International Internship in Materials (IIM) will host its first Japanese exchange with Tokyo Institute of Technology. Ryan Mannino, undergraduate in Materials will be working with Dr. Akira Nakajima on processing of visible light active TiO_2 photocatalyst from $BaTiO_3$. During this exchange, visiting us from Japan will be Ms. Shiomi Saito, working with Dr. Gary L. Messing. In addition, the IIM program will host Etienne Portuguez from Ecole Nationale Supérieure de Céramique Industrielle, working with Dr. Susan Trolier-McKinstry.

Soublet Promoted to First Lieutenant

Wednesday, May 11, 2011 was a busy, yet momentous day for MatSE graduate student and U.S. Marine, Brandy Soublet.

After two years as a student in Materials Science and Engineering, Soublet successfully defended her master's degree thesis at nine o'clock in the morning. Her thesis, *Microstructure, Connectivity and Mechanical Behavior in Alumina Microstructure Composites*, was well received by a panel of MatSE faculty. Soublet received her undergraduate degree in ocean engineering in the Spring of 2009 from the US Naval Academy. Her thesis advisor, Professor Gary L. Messing remarked that "Brandy was a joy to have in the class and lab. In both cases, she was organized and displayed a high drive to succeed. We'll miss her but look forward to following her career as an officer in the Marines".



Marine First Lieutenant,
Brandy Soublet

At four o'clock that afternoon on the steps of Old Main, Soublet, a Second Lieutenant in the United States Marine Corps, received a promotion to First Lieutenant. Soublet was promoted by Colonel Lewis Watt, who retired from the United States Marine Corps after a twenty-six year career, and who is a close friend of Soublet. "The promotion from Second Lieutenant to First Lieutenant is far more significant than some folks may think," said Watt. "Brandy will, while wearing these new silver bars, face challenges and take on responsibilities that are hard to imagine in this beautiful setting. Brandy is ready for this big change."

The promotion of Soublet was attended by proud family, friends, and fellow students. The department of Materials Science and Engineering would like to congratulate Brandy on her accomplishments and wish her a safe and successful future with the United States Marine Corps.

Skrabski Receives Elwood Group Scholarship

The department is proud to announce that Lauren Skrabski is the recipient of the fourth annual Ellwood Group, Inc. \$25,000 Metallurgy Scholarship. This scholarship is awarded on an annual basis to talented and dedicated metallurgical students to encourage pursuit of a career within the steel/heavy metals industry.

Lauren is scheduled to complete an internship within an Ellwood business unit in. Her academic achievement, extracurricular activities, and strong interest in a career in the steel industry make her a worthy recipient of the scholarship. Congratulations, Lauren!



Lauren Skrabski

PENNSTATE



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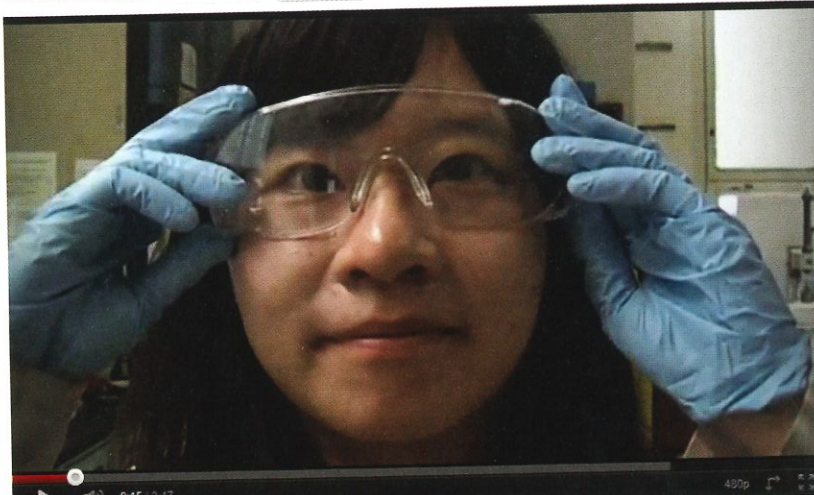
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MatSE Safety Video

Produced by the Department of Materials Science and Engineering (MatSE) and its Materials Safety Awareness Organization (MSAO), the MatSE Safety Dance Video was created to promote laboratory safety in an educational and memorable manner! This video is only a small part of the safety culture that's been created in MatSE since 2008. The MSAO oversees the culture of safety in MatSE, promoting safety in all aspects of materials research at Penn State.

You can find the MatSE Safety Dance Video on YouTube! Simply search for "PennStateMatSE" and enjoy the safety video as well as information about our faculty and research!

MatSE News is a publication of the Department of Materials Science and Engineering. For a free subscription, send your name and address to: MatSE, 121 Steidle Building, The Pennsylvania State University, University Park, PA 16802

This publication is available in alternative media on request.

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