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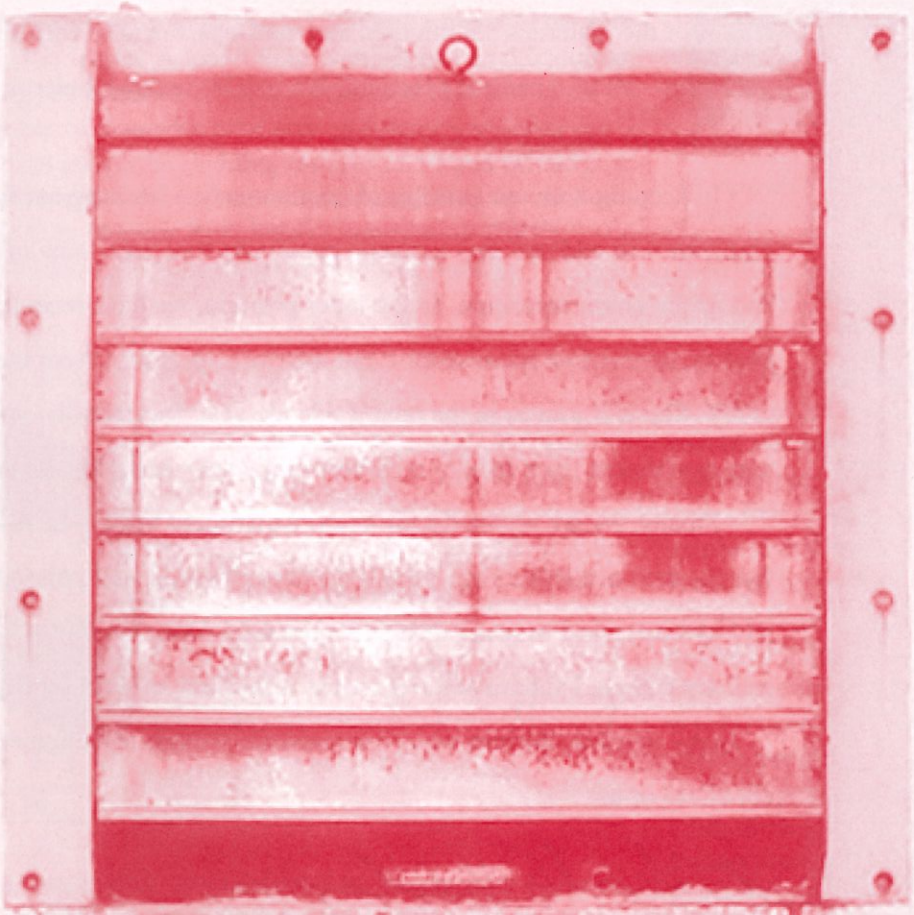
MATSE

PENN STATE



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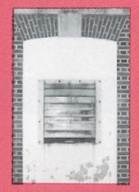
On The Cover

A ventilation grill on Hosler Building displays corrosion in progress. Researchers featured in this issue investigate some of the reasons different metals fail, and what can be done about it.



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Things to Come...

Dear Alumni and Friends,

In many ways, the Department of Materials Science and Engineering and the materials research community at Penn State are moving onward and upward.

• The Materials Research Institute (MRI), heretofore a coordinating unit for materials research, has become an operational unit of the University that includes the Materials Research Laboratory as an interdisciplinary facility. Materials Science and Engineering professors **Carlo Pantano** and **Gary Messing** are leading the new organization (see details on page 6).

• A new materials research building has made the list of future buildings to be funded and built at Penn State. Our concept is to develop a large building that can house the interdisciplinary materials research efforts across campus, the service facilities of the materials community, and the Department of Materials Science and Engineering—all of it centrally located! We will be seeking generous, grateful donors to assist us with funding the new facility.

• In keeping with our strategy of continuously refreshing our faculty with youthful vigor, we will add two new assistant professors this year—one in organic materials and one in characterization. In the latter position, we have recently recruited **Beth Dickey,** an electron microscopist and interface specialist, from the University of Kentucky. She will join us in the next academic year. Incidentally, we have added fourteen new tenure track faculty members in my ten-year tenure as department head.

• Finally, we are searching for a new department head to be my replacement effective the next academic year. I think the department is well poised to move onward and upward, and I'm ready to spend more time doing the things I want to do as I ease into my dotage. I'll have some personal reflections to share in a later newsletter.

In my opinion, the best years for materials science and engineering at Penn State are ahead of us.

Richard E. Tressler

Richard E. Tressler, Professor and Head
Department of Materials Science and Engineering

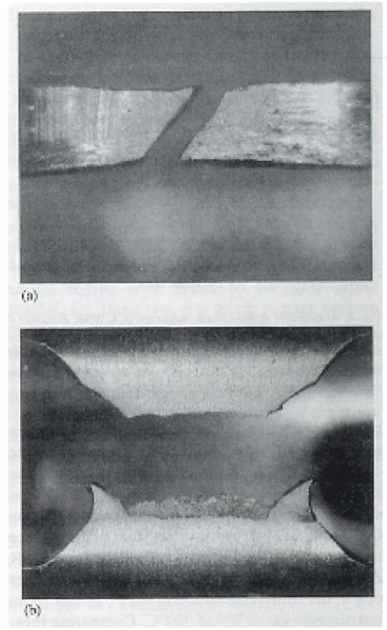
Research Roundup

Zeroing in on Zircaloy

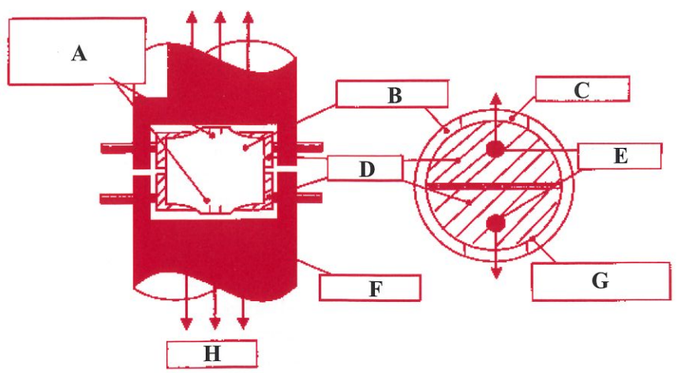
Experiments conducted by Penn State metallurgy and nuclear engineering experts could help the American and French nuclear power industry forecast the likely consequences of a low probability type of accident, and to design fuel rods that will be even less likely to fail should such an accident ever occur.

A so-called rod ejection accident (REA) is among the more serious, though unlikely, types of malfunctions that could happen in a light water nuclear reactor power plant. If an REA occurred, too much energy would be deposited into the reactor's uranium dioxide fuel, resulting in rapid heating and thermal expansion of the fuel and fission gas release. This could cause the cladding—the zirconium alloy (Zircaloy) metal casing that holds the fuel—to fail and release the fuel into the core, either through heat or pressure damage.

As noted in a 1996 issue of the journal *Nuclear Safety,* there has been considerable interest and effort in supplementing REA tests with separate-effects ring tests of cladding tubes in order to predict their survivability—especially under conditions that substantially increase the fuel burnup and the fuel-cycle length. According to commentary in the journal, interest in the cladding performance of highly irradiated fuel during an REA peaked in a number of countries after tests in France and Japan involving high burnup fuel produced cladding failures of 30 and 60 cal/g respectively—values far below the failure criteria established by various regulatory bodies (the U.S. Nuclear Regulatory Commission [NRC] included) for fuel with (the then current) lower levels of burnup.



Macroscopic photographs of failures of (a) a uniaxial tension ring cladding specimen, where failure occurs across the width, and (b) a plane-strain tension cladding specimen, where failure occurs through the thickness. From Nuclear Engineering and Design 186 (1998).



Loading fixtures for the mechanical tests conducted: A) rows of microhardness indents, B) cladding specimen, C) gauge section, D) die inserts, E) loading pins, F) grips to instron, G) lubrication between specimen and die insert, H) applied load.

An ongoing Penn State research program is providing insight into the failure mechanisms and relevant mechanical properties for use in computer codes that attempt to predict cladding response during an REA, says **Donald Koss,** professor of materials science and engineering. Koss has studied the behavior of both unirradiated and irradiated fuel cladding during the past several years with **Arthur T. Motta,** associate professor of nuclear engineering, and with former graduate students **T. M. Link** (now at U.S. Steel), **Douglas Bates** (now in the U.S. Navy), and **Robert Daum** (now at the Argonne National Laboratory), who's still involved.

"One of the fundamental issues

continued on next page

Research Roundup continued from previous page

in predicting the cladding response to an REA is the availability of test materials with appropriate properties," Koss notes. "We have developed a new procedure, the 'Penn State test,' which provides meaningful measures of cladding ductility during an REA." The research is sponsored by the NRC, Argonne National Laboratory, and the U.S. Navy.

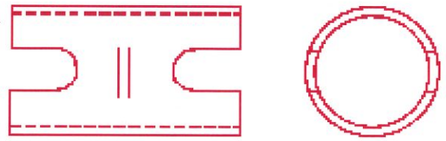
FIVE YEARS WITHOUT A VACATION

At the heart of a nuclear reactor core, nuclear fuel elements are composed of bundled assemblies of fuel rods with their Zircaloy cladding tubes. The chain reaction of the fuel pellets in the tubes heats water to produce steam that powers turbines to produce electricity. On the inside, the tubes must withstand heat buildups to approximately 2000° C at the center of the pellets during reactor operation. On the outside, the tubes are affected by the reactor's cooling water, which keeps the tubes' surface temperature at about 300° C. The fuel elements may stay in the nuclear reactor for five to six years, which makes for stringent quality requirements in terms of dimensional tolerances, mechanical properties, corrosion resistance, and absence of defects to make sure that no fuel rod leaks occur. A current desire by the utilities to extend the life of the fuel elements raises the REA issue addressed by Koss and Motta.

BREAKING UP IS HARD TO DO

Using several identical Zircaloy-4 cladding tubes obtained from AB Sandvik Steel Special Metals, of Sweden, Koss and his colleagues recognized that for in-service conditions in which the cladding fails due to an axial split, the major strain direction is the hoop direction of the cladding tube, which is transverse to the cladding axis. Based on this finding, a new specimen configuration and test procedures were devised, enabling a ring-type specimen to be stretched to failure under what are called "multiaxial, plane-strain deformation conditions."

The team also analyzed the previously used procedures for testing cladding. That analysis showed that the uniaxial ring stretch specimen geometries being used exhibited pronounced non-uniform deformation along their length. As a result, the specimen failed at unreasonably small strains from premature necking, and the data from such tests were not accurate in predicting cladding failure. The fracture path was inclined across the specimen width, which is unlike cladding failure that occurs by "split" fracture along the cladding tube axis.



This drawing shows the plane-strain specimen used for the Penn State cladding studies. It is 0.61 mm thick, 12.7 mm across when flat (left), and has a diameter of 9.53 mm when rolled (right).

Based on the various studies, Koss says that for Zircaloy tubing, data such as uniaxial yield strengths and stress-strain curves are better achieved by using a uniaxial specimen, whereas ductility data that are applicable to REA transients are better achieved using a plane-strain specimen. He adds that, given that failure can be induced on through-thickness planes in plane-strain specimens, ductility values derived from these specimens are more appropriate for predictions of thermally-induced REA-like cladding failures.

THE FRENCH CONNECTION

Koss also reports that the NRC isn't the only regulatory body using the Penn State/Argonne Lab recommendations on designing cladding failure tests. At a recent meeting of mechanical properties experts at the NRC Headquarters in Rockville, Maryland, a representative of the French Nuclear Protection and Safety Institute (IPSN) indicated similar tests are being adapted by the French Atomic Energy Agency for future studies.

"They're evaluating new advanced cladding materials and implementing the 'Penn State test' as one of their tests for failure criteria," Koss reports. "Similar to some of our current work, they'll eventually be using irradiated cladding and investigating different temperature and corrosion level effects using our test and analysis procedure."

CORROSION RESEARCH

With damages costing the United States upwards of $300 billion annually, crevice corrosion (in which a metal in contact with an aqueous solution dissolves within a crevice at greater rate than at crevice-free surfaces) has been a research focus for **Howard Pickering,** Distinguished Professor of metallurgy, for much of his career. Right now, among other projects, he is working on crevice corrosion research with support from the U.S. Steel Corporation, National Science Foundation, Saudi Arabian Oil Company, and Alcoa. In a 1995 review article co-authored with former graduate student **Brian De Force** ('94, '97g Metals) for the *Journal of Materials,* Pickering notes that crevice corrosion was at one time consistently attributed to a difference in oxidant concentration between the bulk and crevice solutions, or to a pH decrease. It is now understood, however, that increases in solution concentration or certain individual solution species are not always necessary for crevice corrosion to occur.

When Bad Things Happen to Good Metals: Examples from MatSE Research

The potential rupturing of the zirconium alloy studied by Donald Koss (see featured research story) is just one example of the many metallurgical challenges being examined by MatSE experts. Here are some more...

Don't Trust the Rust

Inspectors normally use the amount of rust on the **steel** reinforcing bars in concrete as one indication of a structure's remaining lifetime, but this could lead to miscalculations about a structure's safety. According to a 1999 study co-authored by **Digby D. Macdonald,** professor of materials science and engineering, and former doctoral student, **Kalliopi Aligizaki,** the iron oxides that accumulate in concrete and form colored areas up to an inch or more away from the bars also have to be taken into account. During corrosion, the iron in the steel converts to iron oxides, the volume of which can be two to four times greater than the volume of the steel they replace. The resulting increase in volume induces stress in the concrete around the bar, which ultimately causes the cracking.

Getting into the Zone

Within the heat affected zone (HAZ) of welds of high-strength **aluminum alloys,** thermal cycles inherent to the welding process drive solid state transformations—coarsening, dissolution, and growth—of strengthening precipitates and result in significant alterations to the original base-metal microstructure. These alterations cause loss of local strength, to varying degrees, throughout this region. **Paul Howell,** professor of metallurgy, graduate student **Andre Wilson** (Metals), and the Applied Research Laboratory's **Richard Martukanitz** have described a relationship of the local loss in strength associated with the majority of the HAZ for the binary alloys 2219-T87 (Al-6Cu) and 2195-T8 (Al-4Cu-1Li) from detailed stereological analysis.

How Degrading!

Degradation and spallation of thermal barrier coatings severely limit their service in gas and land-based turbines. One important cause of coating spallation is oxidation of the underlying **Nickel-Chromium-Aluminum-Yttrium** bond coat material. **Merrilea Mayo,** associate professor of materials science and engineering, and graduate student **Tabbetha A. Dobbins** (Metals) have examined the bond coat/top coat interface with transmission electron microscopy (with help from **Altaf Carim,** associate professor of materials science and engineering) after mechanical failure due to thermal cycling. They found that the primary oxidation phases were not Al_2O_3, $Ni(Cr,Al)_2O_4$, and NiO, as previously thought, but Al_2O_3, $Ni(Cr,Al)_2O_4$, and metallic nickel, which poses problems due to the thermal expansion mismatch that exists between the phases.

A Golden Opportunity

Smaller computer chip sizes and increased fabrication rates make the standard 25 millimeter **gold** wire connections to chips more susceptible to wire loop "lean," or residual stresses from drawing and spooling operations. Variables include wire manufacturer practices, processing conditions, and alloying additions. **Earle Ryba,** associate professor of metallurgy, and undergraduate **Christopher Von Seggern** (Biochemistry and Molecular Biology) are devising x-ray diffractometer techniques to measure the stress development in the wire as it lies on the spool. The combination of reliable measuring techniques and data analysis procedures could lead to a gold star from industry for the researchers.

Department Details

Merge Ahead

Penn State's Board of Trustees has approved the merger of the Materials Research Laboratory and the Materials Research Institute, to take place on July 1, 2001. The new organization will be known as the Materials Research Institute, and will be co-directed by **Carlo Pantano,** Distinguished Professor of materials science and engineering, and **Gary Messing,** professor of ceramic science and engineering.

The new institute builds on the success in materials research at Penn State, including the activities associated with the Materials Research Laboratory, headed by Messing. MRL helped found and develop the interdisciplinary field of materials in the early 1960s.

The number of Penn State faculty engaged in materials education and research exceeds 150, and University-wide, annual research expenditures in materials top $50 million.

The merger is designed to capitalize on and to spearhead the continued growth in the materials field at Penn State by promoting and supporting interdisciplinary materials research and education throughout the University.

Hellos, Goodbyes

The department is now minus **Tina Shawley,** who first came to Steidle Building to work as the staff assistant in the Polymers Science office and later formed half of the staff teaming the Undergraduate Programs office. She went to the College of Health and Human Development's Noll Physiological Research Center. Her duties have gone to **Debbie Evock,** who comes to us from the Department of Kinesiology's Advising office.

ChangQing Shen, research associate with the Materials Research Institute, was appointed assistant director to **Carlo Pantano** of the Center for Glass Research site for Glass Surfaces and Interfaces. He is working on surface compositions and morphology of various silicate glasses in relation to surface formation and thermal history.

We also welcome (back) **Shannon Zavacky,** who has been with us in the past as a part-time staff assistant, but is now a full-timer helping coordinate the activities of the Center for Electrochemical Science and Technology for its director, **Digby D. Macdonald.**

Accolades!

Congratulations to **Frank Driscoll,** computer support specialist, for receiving top honors for his good work at the MatSE department's 2000 Staff Awards event; to **Kathy Gummo,** staff assistant in our Graduate Program office, who received a College of Earth and Mineral Sciences 2000 Staff Achievement Award for all that she does on the job; and to **William Williamson,** professor emeritus of ceramic science, who celebrated his 90th birthday on January 30, and who remains a familiar face in Steidle Building!

A Visitor from the Past

Chen Zhili, Minister of Education for the People's Republic of China and a former visiting scholar at the Materials Research Laboratory, gave a lecture on "China's Higher Education in the 21st Century" at the University Park campus last November. She studied physics and ceramics in China and worked at MRL from 1980 to 1982. Later, she served in a variety of administrative posts with the Shanghai Institute of Ceramics of the Chinese Academy of Sciences, and with the municipality of Shanghai.

Frank Driscoll can often be found wrestling with other people's computers.

Debbie Evock is now the first person you'll see in Room 124 Steidle.

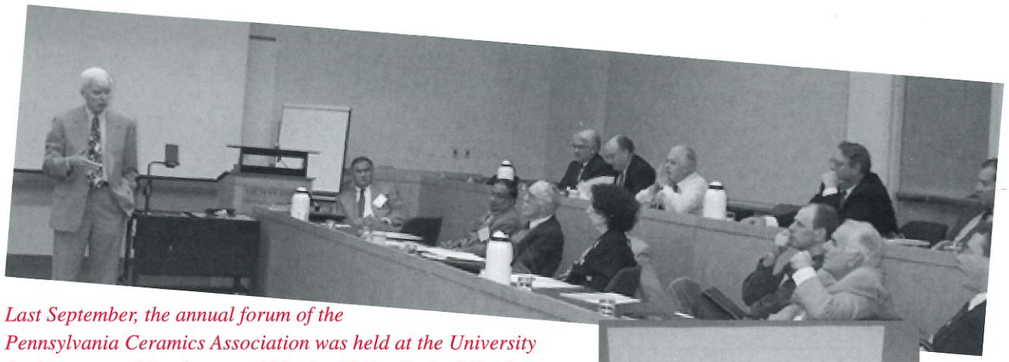
Kathy Gummo receives award at the College level.

Tina Shawley at her farewell party with Paul Painter, her former boss.

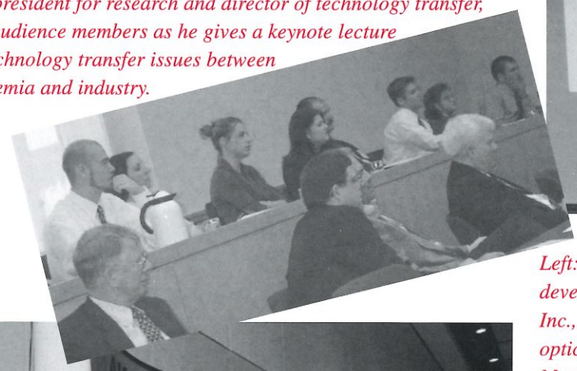
William Williamson celebrates his 90th birthday.

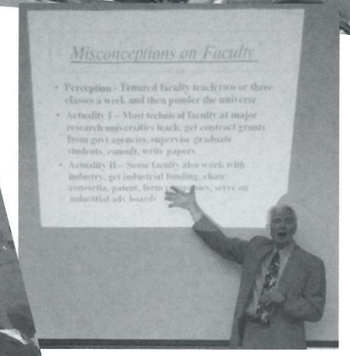
Shannon Zavacky likes it here so much, she's come to work for us twice!

The 55th Annual Forum of the Pennsylvania Ceramics Assoc.

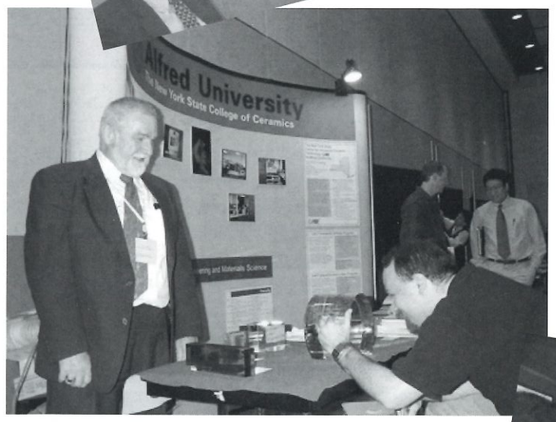


Last September, the annual forum of the Pennsylvania Ceramics Association was held at the University Park campus with a focus on "Meeting Technological Needs Through Industry-University Partnerships." Above, right, and below: Gary Weber ('65, '74g Ceramics), Penn State assistant vice president for research and director of technology transfer, and audience members as he gives a keynote lecture on technology transfer issues between academia and industry.





Left: Alex Marker, director of research and development at Schott Glass Technologies, Inc., demonstrates one of the company's optical glass products to graduate student Matthew Abrams in the forum's exhibition room. Marker also addressed the future of optical glass in the United States and represented Alfred University's New York State College of Ceramics, for which he serves as secretary of the liaison board. Alfred is the home base of the National Science Foundation Industry-University Center for Glass Research, the Penn State satellite research site of which was recently established to study glass surfaces and interfaces.

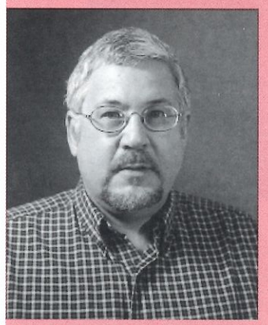


Right: Carlo Pantano, co-director of the Penn State Materials Research Institute, right, and graduate student Mary Shoemaker, center, check out poster presentations by other researchers at the same time as they keep guard over their own poster on "Organofunctional Silane Coatings for Multicomponent Glass." Nearly fifty posters and a dozen research facility displays were shown off during the forum. For more pictures from the event, visit http://www.ems.psu.edu/MATSE/pca2000.html.

Alumni Annals

Visitors to the Valley #1: Andrew K. Birchenall, A Metallurgist Amongst Polymerists

(Editor's Note: This is the first of what is projected to be a series of Q&A features on MatSE alumni who keep in touch with the department for a variety of reasons. We welcome your nominations of individuals for future installments of the series.)



Andrew K. Birchenall

Alumnus Stats: Penn State Degrees—M.S. 1980, Ph.D. 1984 (Metals); Advisor—George Simkovich; Current Position—Senior Research Engineer with DuPont's Corporate Center for Engineering Research; Home and Family—Married with two sons and a daughter, and living in Middletown, Delaware.

Q: During your visit to the 2000 COOP meeting at University Park, you talked about your work and said that at DuPont, metallurgy is a service rather than a product...can you elaborate on that?

A: At one time, DuPont was the world's largest consumer of stainless steel. We had a large staff of metallurgists studying all that can go wrong with stainless steel and developing better alloys. We also had occasional innovations like explosive bonding, since we were in the explosives business.

Those days are pretty much over, but we still operate 195 plants worldwide, and most of those plants are made of metal. The selection, design, procurement, fabrication, and maintenance of this metal and other "materials of construction" form our main workload today.

Frequently, we also find new applications for polymeric DuPont products. We have lots of plant environments in which to test those materials.

Q. How did you come to DuPont?

A: I grew up in Delaware, which then seemed like a subsidiary of DuPont. As part of my Penn State education, I spent two years in Duesseldorf at a Max Planck Institute during the deployment of the Pershing II missiles in

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James D. Beckman ('75, '77g Metals) has been selected as the 2001 **David Ford McFarland Award** winner by the Penn State Chapter of ASM International. A native of Philadelphia, Beckman is executive vice president at Crucible Specialty Metals, a division of Crucible Materials Corporation in Syracuse, New York. He will deliver the 53rd McFarland Lecture on "Competing Globally—Crucible Powder Metal Materials" at 10 a.m. Saturday, April 21, in 26 Hosler Building at the University Park campus. The lecture is free and open to the public. Later that day, he will be honored at a banquet held by the ASM chapter for alumni of the Penn State program in Metals Science and Engineering and other interested guests. The banquet price is $20 per student and $40 per non-student payable to the Penn State Chapter ASM International; mail to the chapter treasurer at 124 Steidle Building, University Park PA 16802. For more information, contact chapter chair Ryan Wolfe at ryanwolfe@psu.edu or Cindy Lake in the MatSE Undergraduate Program office at (814) 865-5765.

John W. Osenbach ('79, '80g, '82g Ceramics) was recently named a **Bell Labs Fellow** in the annual award's microelectronics category. He received the award for outstanding technical work and innovation that has had a large impact on the income and technical visibility of Lucent Technologies (Bell Labs is the research arm of Lucent), where he has been employed since graduating from Penn State. His efforts have included the development and commercialization of materials and technologies for leading edge silicon integrated circuit technology, non-hermetic InP based laser diodes and photodiodes, and optical transceivers used in high-reliability information transmission systems. He was recently promoted to a Consulting Member of the Technical Staff at Lucent, and as a recognized expert on non-hermetic packaging, thin film dielectrics, and reliability, has given numerous invited lectures at leading research institutions around the world.

Doug Pauline ('89 Ceramics) has been sending in job opening

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news from the firms that his **GDP Sales, Inc.** represents in the materials manufacturing arena, including those in ceramics, graphite, thin and thick film metallizing, and TiN and TiCN hardcoating. He can be reached at gdpadv@aol.com, and the job postings, along with others that are sent to our department, can be visited at http://www.ems.psu.edu/MATSE/jobops.html.

Richard M. Spriggs ('52 Ceramics), professor emeritus of ceramic engineering at the NYS College of Ceramics at Alfred University, Alfred, New York, has received the **53rd Annual Albert Victor Bleininger Memorial Award** from the Pittsburgh Section of the American Ceramic Society (ACerS). An internationally renowned contributor to ceramics research and instruction, Spriggs is a fellow, past president, and distinguished life member of the ACerS. The Bleininger Award recognizes distinguished achievement in the field of ceramics, and is named in honor of one of the founders and early presidents of the ACerS. The Pittsburgh Section is the society's oldest.

Gregory J. Yurek ('69, '70g Metals) was among the three Penn State College of Earth and Mineral Sciences alumni selected as **Alumni Fellows** for 2000. The president, CEO, and chairman of the board of American Superconductor Corporation visited the University Park campus in September to interact with faculty and students during the College of EMS's annual Obelisk Weekend. He founded American Superconductor in 1987 with three fellow MIT professors to commercialize a family of high temperature superconducting materials that are important for applications ranging from medical diagnostic equipment to electric power storage and transmission. He is a former co-director of the H. H. Uhlig Corrosion Laboratory at MIT, where he was a professor of materials science and engineering, and has also worked at Oak Ridge National Laboratory. For more on his visit, see http://www.ems. psu.edu/MATSE/yurek. html. The other 2000 Alumni Fellows were **Ray Booker** ('62g, '65g Meteorology) and **Rosalyn Millman** ('83 Geography).

Gregory J. Yurek, left, with department head Richard Tressler and graduate student Hongxia Lu (Ceramics) after a MatSE seminar.

Private Giving from MatSE Alumni to Boost Academic Efforts

Three recent pledges of private support from our alumni to Penn State's $1 billion Grand Destiny fund-raising campaign target the students and programs of the College of Earth and Mineral Sciences.

With a pledge of funds to be received from her future estate, **Dorothy P. Enright** ('48 Ceramics) established an Academic Excellence Fund so that the Dean of EMS may make strategic investments in promising people and ideas within the College.

Howard R. Peiffer ('54 Metals) and his wife, **Rosemarie,** pledged $300,000 to endow a scholarship fund in MatSE for providing recognition and financial assistance to students with superior academic records, or those who have demonstrated promise of outstanding academic success in the department's programs.

Michael Starsinic ('82 Polymers), a Graduates of Earth and Mineral Sciences (GEMS—see information below for more details) alumni society board member, has pledged $25,000 to establish a named scholarship fund for undergraduate and graduate students who exhibit high levels of initiative and creativity in the Polymer Science and Engineering program.

For more details on the gifts, please visit http://www.ems.psu.edu/MATSE/september2000.html.

Thanks, IPAC

Our thanks to MatSE's Industrial and Professional Advisory Council (IPAC) members for their visit to the department last October to hear about our progress and plans for the future, and to share their advice. Six of the nine volunteer IPAC members were able to attend: **Jack Coppola** ('69g, '71g Ceramics), **James Loftus** ('84, '86g, '88g, Polymers), **Sam Mouck** ('82 Ceramics), **Michael Starsinic** ('80, '82g, '83g Polymers), **Robert Statz,** and **John Werner** ('54, '60g Metals).

Looking for GEMS?

The Graduates of Earth and Mineral Sciences (GEMS) group works on behalf of all EMS alumni. Contact it at gems@ems.psu.edu or at (814) 863-4667 for news on events, services, and more.

Faculty Facts

Zi-Kui Liu, assistant professor of materials science and engineering, has been named editor-in-chief of the *CALPHAD Journal,* published by Elsevier Science as an international research journal devoted to the calculation of phase diagrams for materials applications in the metallurgical, polymers, electronic, and nuclear fields, among others. He also invites visitors to check out the new Phases Research Lab facilities in 107 Steidle Building.

Digby D. Macdonald, professor of materials science and engineering and director of the Center for Electrochemical Science and Technology, is the 2001 **H. H. Uhlig Award** winner in the Corrosion Division of the Electrochemical Society (ECS). The winners of seven ECS Society and Divisional Awards, including the Uhlig Award, were announced at the ECS meeting in Phoenix, Arizona, last fall. He has also been approved for a sabbatical during spring 2002 to conduct collaborative research on the passivity of iron and to complete writing a book on passivity and breakdown in electrochemical systems at the University of California, Berkeley.

A multi-institute study of the mechanisms of flammability reduction of polymer—layered-silicate nanocomposites that included **Evangelos Manias,** assistant professor of materials science and engineering, as a co-researcher and co-author was the cover article for the July 2000 issue of *Chemistry of Materials.* Manias continues to work on optimizing the mechanical and flammability properties of syndiotactic-polystyrene nanocomposites with **T. C. (Mike) Chung,** professor of polymer science, through a recent grant from the National Institute of Standards and Technology.

Gary L. Messing, co-director of the Materials Research Institute and professor of ceramic science and engineering, lectured on tailoring ceramic microstructures through templated grain growth at the latest annual meeting of the American Ceramic Society in St. Louis, Missouri (given in conjunction with his acceptance of the society's **Robert B. Sosman Award** for scientific accomplishment), at the Polish Ceramics—2000 conference in Spala, Poland, and at the Third Forum of the International Academy of Ceramics in Sorrento, Italy (in conjunction with his election to the academy). He also recently gave the **Norbert J. Kreidl Memorial Lecture** at the 12th Rio Grande Regional Symposium in Advanced Materials in Albuquerque, New Mexico; spoke at the Mullite 2000 conference in Oban, Scotland; and addressed the Fourth Academic Summit in Tokyo, Japan, focused on research collaborations and student exchanges between the University of Kaiserslautern, Shonan Institute of Technology, and Penn State.

Robert E. Newnham, professor emeritus of solid state science, was appointed an honorary professor of applied physics at the Hong Kong Polytechnic University, and senior advisor to the Centre for Smart Materials. He also recently delivered plenary lectures at the Third Asian Meeting on Ferroelectrics in Hong Kong, the 10th International Metallurgy and Materials Congress in Turkey, and the Sixth International Congress on Applied Mineralogy at the University of Gottingen, Germany; delivered seminars on the future of ceramic engineering and on composite transducers at Anadolu University, Turkey, and at Catholic University, France, respectively; and presented an invited paper on electroceramics, co-authored with **L. Eric Cross,** professor emeritus of electrical engineering, at the Third Forum of the Academy of Ceramics in Italy.

Carlo G. Pantano, co-director of the Materials Research Institute and Distinguished Professor of materials science and engineering, gave an invited talk on leached surface layers on glass at The Surface: A Bug in New and Old Glasses, an international conference held on San Servolo Island, Venice, Italy. He also recently gave invited talks at the 61st Annual Conference on Glass Problems in Columbus, Ohio, and at the 2000 Materials Research Society meeting in Boston, Massachusetts.

Joan M. Redwing, assistant professor of materials science and engineering, received a **Young Author Award** from the American Association for Crystal Growth at the 12th American Conference on Crystal Growth and Epitaxy, held in Vail, Colorado, last August. The award specifically recognizes Redwing's scientific contribution to the understanding of the chemical vapor deposition-based growth of group III-Nitrides and its application to device structures.

Earle Ryba, associate professor of metallurgy, was an invited co-instructor for the ICDD Workshop on X-ray Powder Diffraction in November at the VII Seminàrio Latino-Americano de Anàlises por Tèchnicas de Raios X in Sao Pedro, Brasil. The workshop, sponsored by the International Centre for Diffraction Data, covered the basics of x-ray diffraction, errors in data acquisition, alignment and calibration of instruments, data reduction problems, and use of software for searching the ICDD Powder Diffraction File database.

Richard E. Tressler, professor and head of materials science and engineering, was named the 2001 **Arthur L. Friedberg Memorial Lecturer** by the American Ceramic Society (ACerS), and will present the lecture at the ACerS annual meeting at the Indianapolis Convention Center on April 24. A research autobiography by Tressler is also featured in a recent issue of *Fine Ceramics Report* (Vol. 18, No. 10, 2000), a publication of the Japan Fine Ceramics Association. It covers his research interests and activities from his undergraduate studies in Ceramic Technology at Penn State, beginning in 1959, to his current work on durability of ceramics, fibers, and composites. Tressler and his wife, **Sue,** also received an **Excellence in Historic Preservation Award** from the Centre County Historical Society for the restoration of their pre-1820 log home in Oak Hall.

Materials Research Lab Receives Keck Grant

The W. M. Keck Foundation has awarded an $800,000 grant to the Penn State Materials Research Laboratory (MRL) to provide funding for a new laboratory to support MRL's work in smart materials. MRL will also receive $310,000 in University funds to support the laboratory. For the full story, visit http://www.psu.edu/ur/2001/keck01.html.

Upcoming Events

March 5–9, 2001
Penn State's Spring Break—No Classes

March 24, 2001
College of Earth and Mineral Sciences Expo (EMEX)—Please visit http://www.ems.psu.edu/emex/ for details on this annual chance to introduce your students to our programs.

April 21, 2001
Dedication of the Hintz Family Alumni Center—The alumni home away from home on the University Park campus will be dedicated before the Blue/White Game. An Open House for alumni, staff, students, and the community will also be held on Sunday afternoon, April 22. Watch for more news on the Alumni Web portal at http://www.psualum.com/.

53rd Annual David Ford McFarland Award Lecture and Banquet—Featuring James D. Beckman (see page 8)

Blue/White Game

May 11–13, 2001
Penn State Spring Commencement Ceremonies

Alumni Annals continued from page 8

Germany. My 20-something-year-old brain could dimly perceive that the Cold War was a big deal. My wife was from the South, so I ended up at the Department of Energy's Savannah River Plant in Aiken, South Carolina, working on projects with DuPont and, later, Westinghouse. With the end of the Cold War, I ventured into the private sector and landed at DuPont, back in Delaware.

Q: What other kinds of work do materials scientists do at DuPont?

A: We have hundreds of scientists and engineers developing the polymers and processes that are our products. We have about sixty people across the corporation in the field of "materials of construction." Many of them focus on individual plants or businesses. Some of them focus on individual technologies, like corrosion testing or NDT.

Q: What are your favorite pastimes?

A: I'm involved in kids' issues in general through the Boys and Girls Club, swim teams, and local school tax issues.

Q: What are your favorite Penn State memories?

A: Meyer's Dairy, pick-up basketball at Rec Hall, cow pasture league softball against the dreaded ceramists, and ASM meetings with Jim Fritz.

Student Scoops

Materials Students Contributing Time, Talent, and Resources to Their Local and Professional Communities

Children's Fiction

One day, while brainstorming for projects to get involved in, members of the service/community outreach committee of Penn State's Student Branch of the American Ceramic Society (ACerS) serendipitously exclaimed that choosing a major would have been easier had they learned more about career opportunities in ceramics earlier in life.

That was when the brainstorm spawned "literary" lightning.

Since last spring, book donations to more than 20 Centre Region libraries made possible by Penn State ACerS fund-raising have opened the eyes of elementary and high school youths to the role of materials science and scientists, including ceramists, in daily life. Some ACerS members have also spoken to high school audiences in their hometowns about studies in ceramics and other materials science topics.

The projects are just two examples of recent service efforts conducted by Department of Materials Science and Engineering students through their membership in the Penn State branches of various national and international materials-related organizations. Other projects include helping at departmental recruiting events, working on Habitat for Humanity houses, coordinating a food drive for the State College Food Bank, and managing the David Ford McFarland Award program through the Penn State Chapter of ASM International.

Bellefonte Area High School librarian Betsy Cassidy, center, receives a new book from (left to right) James Adair, students Craig Stringer and Matt Opitz, and John Hellmann.

Science and Tech.

Although wide-ranging in their scope, these and other efforts are coordinated and supported by the recently revived Materials Science Club—an umbrella social, service/community outreach, and professional activities organization for the student branches of the previously mentioned chapters at Penn State, as well as others. Faculty advisors to the Materials Science Club say that fostering both professional and social citizenship is a major goal of the club, which had lapsed into near-oblivion for much of the 1990s before reforming in 2000.

Jennifer Parker at the Habitat house.

"Our students have chosen to express this citizenship concept through a combination of educational outreach, social assistance and professional development activities," explains club advisor **John Hellmann,** associate professor of ceramic science and engineering. "We encouraged them to give something back to the communities that are enabling them to enjoy preparing for an exciting career, and to bring the next generation of materials students to our door—and they rose to the challenge."

The book project focused on donating copies of the recently published "Boing-Boing the Bionic Cat," by **Larry L. Hench,** and "The Magic of Ceramics," by **David W. Richerson**, to public and school libraries in the University Park campus vicinity.

"Boing-Boing," a humorous, but educational account of what a child who is allergic to cats learns about engineers, scientists, and the scientific process when an inventor builds him a mechanical pet, was given to local elementary schools. "The Magic of Ceramics," a non-fiction book intended to introduce older readers to the multitudinous applications of ceramics in

continued on next page

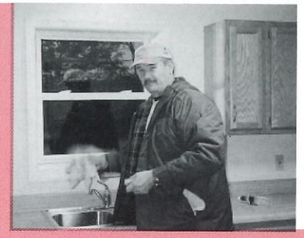
Student Scoops continued from previous page

familiar products and processes—some of them quite surprising to the uninitiated—was given to local high schools. Copies of both books were given to a number of public libraries, including the Centre County Library in Bellefonte, the Centre Hall Area Branch Library, and the Schlow Memorial Library in State College.

Betsy Cassidy, a librarian at Bellefonte Area High School, reports that she has already highlighted "Magic" in a unit of non-fiction books that she presented to the school's seniors.

"I pointed out to the classes that a group that included one of our former students donated the book (and) took the opportunity to stress the importance of book donations to libraries," Cassidy says. "Book donations by special interest groups (such as ACerS) especially impact school libraries because the book can be used in several areas—career focus, current industry investigations, and scientific studies."

Craig Stringer, the former Bellefonte student whom Cassidy referred to, relates that he enjoyed seeing the response of the librarians when the ACerS members gave them the books. "Many of them said they knew teachers in their schools who would find the books useful for their students," he adds. "We think that we've inspired ACerS student branches at other universities to take on similar projects."



Student Daryl Kuban polishes up the kitchen of the Habitat for Humanity house in Bellefonte that Penn State ACerS volunteers recently helped complete.

Lisa Friedman, the Materials Science and Engineering senior who chairs the project, predicts that this spring's ongoing fund-raising will soon allow the project's scope to grow beyond the borders of Centre County. One plan is to solicit alumni help to purchase and deliver copies of the books to all of the ACerS students' former high schools and elementary schools.

Another recent project found ACerS students, along with Hellmann and fellow club advisor **James Adair,** associate professor of ceramic science and engineering, among other community volunteers hammering, painting, carpeting, and cleaning portions of a new three-bedroom house for a low-income family in Bellefonte. The work session was part of one of the national Habitat for Humanity organization's "Blitz Build" efforts to erect houses in 48 hours for families who could not otherwise afford to own a house.

ACerS member **Jennifer Parker** is among several Materials Science Club students who stay in touch with the Penn State Chapter of Habitat for Humanity. She says various club members continue to help with ongoing local house projects as time permits. "We'd like to do a lot more with Habitat in the spring, if we can," she adds.

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The full version of this article and more pictures can be found at http://www.ems.psu.edu/MATSE/jan2001.html.

Penn State ACerS member Anne Hibbard and other students and faculty members also joined in on the house project.

What They're Saying About...Students and Sponsored Research

"As levels of funding from the state remain static over time, our graduate and undergraduate programs will continue to rely on dollar support from sponsored research to some degree. For instance, Materials Science and Engineering has about 115 students holding graduate assistantships each semester, but the General Funds budget available to the department can only cover fifteen to twenty of them. The rest are funded by research sponsors who wish to ensure that students are getting training in topics that are relevant to their needs in applied industrial or laboratory settings. This kind of training is in demand from students, too." —Derek Elsworth, associate dean for research in the College of Earth and Mineral Sciences

Congratulations... to the **Penn State Chapter of ASM International,** one of twelve to receive a Four-Star rating (out of five) from the 1999-2000 Chapter Year Chapter Quality and Recognition Program; ...to graduate student **Jeffrey Haeni** (Materials), recently selected as a **Motorola/SRC Fellow** in the Semiconductor Research Corporation's Graduate Fellowship Program, and also funded to study $SrTiO_3$ derivative structure for tunable dielectric devices through the International Microelectronics and Packaging Society Educational Foundation's grant awards program for the 2000-2001 academic year; ...to recent graduate **Shawn Holmberg** (Metals), one of ten outstanding undergraduate members of ASM International to earn a **George A. Roberts Scholarship** through the organization's foundation, and now working for Ellwood Quality Steel in New Castle; ...and to graduate student **James Lettieri** (Materials), selected as a recipient of a **Ludo Frevel Crystallography Scholarship Award** in both 2000 and 2001 by the International Centre for Diffraction Data.

COOP 2000

"...And Here's Where Things Get Tricky."

Graduate student Aboubakr Abdullah (Metals), center, explains a research project to Tong Lee, left, and Jim Rakowski, both of Allegheny Ludlum, at the poster session during the COOP (Cooperative Program in Metals Science and Engineering) meeting in October. The annual event brings corporate representatives to the University Park campus to learn about Penn State research that's helping industry face technical challenges, and to share news about their companies' metallurgical practices and hiring needs. For more details on COOP, visit http://www.ems.psu.edu/MATSE/coop2000.html.

The Heat is On

ENGINEERING OPEN HOUSE

Letting a perfect stranger hold a blowtorch to your hand is par for the course at the MatSE portion of the Engineering Open House, one of the two major annual events designed to introduce high school and college students to the department's programs. Here, the brave volunteer at right is protected from scorching by a highly heat-resistant ceramic tile like those found on the space shuttle.

Darrell Schlom, left, associate professor of materials science and engineering, demonstrates the marvels of crystal growth to Engineering Open House visitors in Steidle Building last October.

2000–2001 Scholarship Recipients

Many generous alumni and corporations have endowed scholarships that provide support for our talented students. The following list covers awards made for the 2000–2001 academic year. The awards are mainly merit based. Endowed scholarships aid the department's recruiting efforts and help reduce the financial burden students incur while at Penn State. To all those who have helped fund these scholarships, we are deeply grateful.

AVX/Kyocera Foundation Scholarship in Materials Science and Engineering
Kristin Briczinski
Darin Fidurko
Joseph Moretz
Arthur Nwankwo
Nathan Werkheiser

Francis Hamilton Byers Scholarship in Materials Science and Engineering
Darin Fidurko
Trevor Spence
Andrea Statz

C. Philip Cook, Jr. Memorial Scholarship in Ceramic Science and Engineering
Daryl Kuban
Tara Pecora
Craig J. Stringer
Christopher Szepesi

Richard P. and John N. Davis Scholarship in EMS
Jody Crampo

Dorothy Pate Enright Endowed Scholarship in Ceramic Science and Engineering
(new for 2000–2001)
Obiefune Ezekoye
Dana Lemesh
Jamie Morley
Jacqueline Sturgeon

Glass Container Industry Research Corporation Scholarship
Patrick Donahue
Nicholas Smith

George Gleason Memorial Scholarship
David Berry

Donald W. Hamer Scholarship in Electronic and Photonic Materials
Ryan Carr
Anne Hibbard
John McGrorey
Evan Pickett

O. Hommel Scholarship in Ceramic Science and Engineering
Robert Cooley

Floyd A. Hummel, Jr. Scholarship in Ceramic Science and Engineering
Obiefune Ezekoye

GM Minority Recruitment Scholarship
Kevin Urman

Thomas M. and Eleanor W. Krebs Scholarship in Metallurgy
David Whitcomb

Helen R. and Van H. Leichliter Metallurgy Scholarship
Shawn Holmberg

Mr. and Mrs. Frank D. Lovett, Sr. Memorial Award
Christopher Long

Penn State Metallurgy Alumni Scholarship
Mary Horsey
Amy Stauffer
Ryan Wolfe

Pennsylvania Ceramics Association Scholarship
Jody Crampo

PPG Industries Minority Scholarship in Materials Science and Engineering
Obiefune Ezekoye

Anthony J. and Alberta L. Perrotta Scholarship in Materials Science and Engineering
Thomas Taggart

James and Mary Ellen Tietjen Scholarship in EMS
Joseph Evancho

George H. and Madeleine Hager Todd Scholarship
Jason Arndt
Kirsten Hemphill
Brian Marx
Dennis O'Leary
Ta Kwan Woo

William and Estelle Turney Scholarship in Ceramic Science and Engineering
Lisa Friedman
Jamie Morley

Union Carbide Scholarship in Materials Science and Engineering
Brandon Miller
Shanna Yearney

USX Honors Scholarship in EMS
(new for 2000–2001)
Jeremy Rathfon
Brian Watters

Virginia S. and Philip L. Walker, Jr. Scholarship in Materials Science and Engineering
Nathan Murphy

Sam Zerfoss Memorial Scholarship
Jody Crampo
Melvin Gottschalk
Matt Hollenbeck
Jamie Morley
Jennifer Parker
Kyle Zarambo

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Correction

The CAUSE program's Myrna Hill and Fred Samuel Harris Interactive Learning Center, mentioned on this page in the July 2000 issue, is named after the parents of **Donald Harris** ('48 Petroleum and Natural Gas Engineering), the alumnus who created an endowment to benefit the program.

In This Issue...

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