Newsletter of the Materials Science and Engineering Department

ELEMENTS

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

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Fall 1998

Switch to new curriculum under way

MatE degree replaces CerE and MetE in '99

Students wanted it ... industry needed it …
external reviewers recommended it ...
faculty approved it ... alumni supported it …
The department is doing it.

MSE is changing to a new undergraduate curriculum that will result in one degree: materials engineering. Effective next fall, students will major in Materials Engineering with a specialization in two of the following areas: ceramic materials, metallic materials, electronic materials, and polymeric materials. Students who are juniors or seniors next fall will continue with their CerE or MetE degree programs.

"Going to a single degree will open additional employment opportunities to our graduates," says MSE Department Chair Mufit Akinc. "This will help them get more job offers and better paying jobs."

Associate Professor Kristen Constant, who coordinated the faculty committee that revamped the curriculum, says the group spent about two years collecting information through surveys to alums, students, and the MSE industrial advisory council. "The feedback was positive," she says. "Current students were almost unanimously in favor of the new program."

Students will have considerable exposure to all four areas before selecting their specializations at the end of their sophomore year. All MSE students will take the same courses during their sophomore year, including two that familiarize them with each area of concentration. "Students will come out with depth in two areas of materials rather than just one," Kristen says.

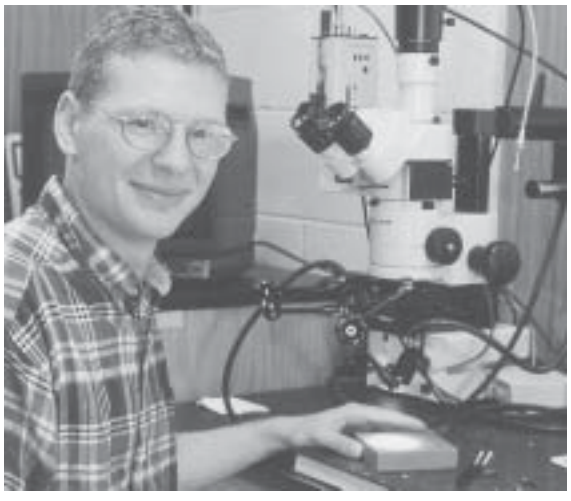
One of the most novel features of the new curriculum, however, is a vertically integrated design course sequence that provides hands-on experience early in a student's program. Sophomores, juniors, and seniors will work together to research and experiment on industry-related projects. "Students get involved earlier in their program," Kristen says. "Seniors act like project managers, sophomores get their feet wet, and juniors do the bulk of the work. It's a more realistic design experience."

For faculty, the change is major. "It's like starting over. Most courses have been repackaged. It's taken a lot of commitment from faculty to make this happen," Kristen says. "But it was exciting to step back and define learning objectives and develop a course!"

An overview of the new curriculum

	New	Existing
Degree	Materials engineering	CerE MetE
Required courses	Engineering core Materials Design	Engineering core Ceramic or metals
	Specialization courses Two of the following: •Ceramic materials •Metallic materials •Electronic materials •Polymeric materials	
	Additional departmental programs: •Design experience teams •3rd or 4th specialization •B.S./M.S. concurrent program	

Everyone benefits from co-op and internship programs



Co-op and internship experiences, like Eric Johnson's at Sauer Sundstrand, are invaluable.

Eric Johnson, MetE 4, compares his internship experience at Sauer Sundstrand's metallurgical lab to detective work. "Everyday there's a new case to solve," he says. "Some are easy, and some are real in depth."

Eric works full time during the summer at the hydrostatic transmissions manufacturing plant in Ames, and part time during the school year. He analyzes parts ranging from particles of contaminant materials all the way to drive shafts.

Eric wants to continue this kind of work once he graduates. He also knows, through a previous internship experience, what he doesn't want to pursue. "I worked in a heat treating facility before. It was OK; but I prefer to do metallurgical analysis for my career."

Associate Professor Kristen Constant, coordinator of MSE's co-op and internship program, says that is one of the great benefits of this program. "Students learn what areas of the field they like or don't like."

She says companies want to hire students with industrial experience. Industry representatives she works with say they like to 'preview' potential employees, and they consider co-op and internship experiences invaluable to their companies.

Vic Gostomski, Sauer Sundstrand's manager of engineering at the Ames plant, agrees with Kristen. "This is a tremendous value to Sauer Sundstrand. Students learn our terminology, how to communicate with peers and other departments, what's important to the company and our customers, and that the bottom line in any business is to make a profit."

Continued on page 3

Hello again!

Although summer is usually meant for vacation and relaxation, it's been an extremely busy time in MSE! In addition to regular summer activities like orientation for incoming freshmen, honor workshops for high school juniors, and the popular annual workshop for high school science teachers, faculty participated in several other college-wide activities.

Associate Professor Larry Genalo conducted another stellar "Internet Explorer" program. Sixteen bright high school girls learned how to use the Internet effectively while experiencing campus life for six weeks. Several already expressed interest in joining the MSE department next year. Thanks to the faculty—especially Associate Professor Kristen Constant—the MSE presentations received top ratings from the students week after week.

Associate Professor Scott Chumbley was awarded an instructional NSF grant to acquire and set up an environmental scanning electron microscopy facility. High schools around the state will be able to use the facility by remote access over the Iowa Communications Network, enabling their students to study the microstructure of materials. Plans involve training future high school science teachers.

Already, the department's multi-faceted activities geared toward K-12 education and recruitment are starting to pay dividends. Our freshman class this fall is the largest and the brightest. The challenge is now to meet their high expectations.

Within our MSE family, we have several new additions. We are very pleased to welcome Vitalij Pecharsky and Alan Constant as tenure-track faculty. And Carmen Neri joined the department as administrative specialist after Diane Miller was lured away by the private sector last spring.

It's been a busy summer, and I anticipate an even busier fall! I hope you can join us at our departmental reception during the TMS fall meeting in Rosemont, Illinois, on October 12. I look forward to catching up with *your* news at the reception!

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News from MSE

Honors and awards

Kristen Constant, associate professor, was named an Iowa State University Wakonse Fellow. In the Lakota Indian language, wakonse means "to teach . . . to inspire." The Wakonse Foundation conducts a five-day annual Conference on College Teaching, bringing together about 100 faculty who are not only exemplary teachers, but also inspire other faculty to enrich their own teaching. Faculty learn about themselves as teachers, explore new teaching methods, and join a growing network of dedicated professionals who share resources and offer mutual support. Kristen also was an invited speaker at the first Gordon Conference on Materials Education in July.

Professor David Jiles was elected a Fellow of The Institute of Mathematics and its Applications.

Assistant Professor Joshua Otaigbe served as discussion leader for the Gordon Research Conference on Composites. In addition, he recently accepted a joint appointment to the faculty of the Department of Chemical Engineering.

MSE undergrads Chad Spore, MetE3, and Benjamin Van Zante, CerE3, received the Center for Nondestructive Evaluation's 1997-98 Founder's Prizes. Chad has been working on magnesium-neodymium castings and directional solidification of tin-cadmium. Benjamin has worked in silicide processing at Ames Lab while learning about NDE techniques and defect management at Texas Instruments. Both students worked at John Deere this summer. CNDE alumni, friends, and industrial partners contribute to the prize, a $1,500 scholarship awarded to ISU juniors with a declared minor in NDE who have demonstrated exceptional academic performance.

Recent patents

John Verhoeven, distinguished professor, recently received a patent, *Air Melting Technique for Preparing Cu-Cr Alloys* with Paul Berge, BSMetE'88, MSMSE'94, Ames Lab assistant scientist; Edwin Gibson, formerly of Ames Lab; and Seong-Tcho Kim, MSMSE'93, formerly with MSE. These alloys, previously prepared by expensive vacuum induction melting techniques, have superior strength/conductivity properties when compared to the best commercially available alloys. The new patent presents an economical air melting technique for preparing the alloys that matches the properties of the vacuum induction alloys.

Distinguished Professor Karl Gschneidner, Jr., and Associate Professor Vitalij Pecharsky, received a patent last April for *Active Magnetic Refrigerants Based on Gd-Si-Ge Material and Refrigeration Apparatus and Process.* The patent describes a new class of improved active magnetic refrigerant materials that have 25 to 125 percent better cooling capacity than any magnetic refrigerant material known before.

Adjunct Professor Iver Anderson received a patent, *Atomizer with Liquid Spray Quenching* with Matthew Osborne, BSCerE'91, MSMet'93, PhDMet'97, who is with the ISU Research Park now. The patent provides a method of producing metal powders by rotating disk atomization or other centrifugal atomization process, utilizing a liquid spray quenching ring(s) to rapidly cool and solidify the droplets. The spray quenching enables the atomizer to be much more compact and to produce rapid solidification effects in very large droplets.

Bill McCallum, adjunct professor, recently received a patent for *Production Method for Making Rare Earth Compounds* with Tim Ellis, PhDMet'93, Kevin Dennis, Robert Hofer, and Daniel Branagan, PhDMet'95. Typically, rare earth intermetallic compounds, such as $Nd_2Fe_{14}B$, are produced by melting the elemental constituents together. This requires the production of pure rare earth metals, which is an expensive step. This patent covers a process that produces rare earth intermetallic compounds from rare earth carbides that are produced directly from rare earth oxides without first producing the rare earth metal.

New research funding

David Cann, assistant professor, recently received a University Research Grant for *Structure-Property Relationships at Nickel-Barium Titanate Interfaces in Multilayer Capacitor Applications.* In the research, David will examine interfacial phase evolution and its implications on the electrical properties of barium titanate-based multilayer capacitors. University Research Grants provide "seed money" to begin research which is expected to continue developing and to attract funding from other sources.

Kristen Constant, associate professor, received a Carver Trust Grant for a research project, *Using Microtransfer Molding to Fabricate Photonic Band Gap Materials.* The grant is for using microtransfer molding (similar to patterning surfaces by printing) to fabricate photonic band gap materials. These materials prohibit the propagation of radiation (light) of particular frequencies and have a number of potential uses in both commercial and military applications. Carver Trust Grants are for bold, innovative projects that hold potential for continuing development and for attracting other funds.

MSE faculty Scott Chumbley and Kristen Constant and faculty from ISU's College of Education received a National Science Foundation grant that will enhance K-12 student and teacher understanding and learning of the microscopic world around them. The funding is the first step in establishing an instructional program and classroom dedicated to bringing the capabilities of the scanning electron microscope (SEM) into elementary and secondary classrooms. The classroom will consist of an environmental SEM fully connected to the World Wide Web and the Internet. During summer workshops, teachers will learn how to use the SEM in the classroom. Classes at the elementary level will be able to access SEM images in real time. Secondary-level students will be able to control SEM operating parameters and conduct their own investigations. The project, called EXCEL (EXtended Classroom for Enhanced Learning), will take about three years to complete.

Two new labs created with Perkin-Elmer gift

Last spring during a reception and ceremony, MSE celebrated the generosity of Perkin-Elmer Corporation whose contribution of nearly $400,000 worth of equipment helped establish two new labs. The major donation enabled MSE to create a Materials Characterization Teaching Lab and a Comprehensive Thermal Analysis Research Lab.

The company gave a nearly 50 percent discount to Iowa State for thermal analysis equipment and donated three additional pieces of equipment, a special computer, and a plotter.

MSE Professor Steve Martin demonstrates equipment for Engineering Dean James Melsa at the reception in the new lab made possible by Perkin-Elmer.

"Students and faculty will use the equipment to analyze characteristics of various materials," says MSE Professor Steve Martin. "Once we have a better understanding of materials and their properties, superior products can be produced."

Steve's Glass and Optical Materials Research Group will characterize thermal properties of new and unique glass materials, including those used for laser surgery and in solid state lithium batteries.

"Contributing to excellence in education has long been a company objective," says Joseph E. Malandrakis, vice president of sales and service in North America for Perkin-Elmer's Analytical Instruments Division. "We are proud to be a partner with ISU in this materials science initiative which will advance the intelligent use of resources and improve the quality of life."

The Perkin-Elmer Corporation is a leading supplier of systems for life science research and materials and chemical analysis. It develops, manufactures, and markets analytical instruments used in pharmaceutical, biotechnology, plastics, environmental testing, food, agriculture, and chemical manufacturing markets. Based in Norwalk, Connecticut, the Perkin-Elmer Corporation has more than 5,700 employees in nearly 100 countries.

MSE in brief

Faculty: *19 tenured or tenure-track faculty and 7 adjunct faculty*
- 4 distinguished professors
- 10 fellows in professional societies
- authors of 7 undergraduate textbooks
- authors of 125 publications per year

Students: *90 undergraduate students*
- 17 women
- 5 minority
- 2 international
- 36 Interns/co-op/summer engineering experience

Research: *$9.07 million total expenditures in FY97*
- 1% increase over FY96
- 3% industrial funding

Outreach: *More than 25 industrial partnerships*

Continued from page 1

Co-ops and internships

Sauer Sundstrand currently has 34 interns and five co-op students, mostly in engineering. Vic says, "The best thing about hiring a graduate who completed an internship or co-op with our company is that they walk through the doors and start work immediately."

Loni Pringnitz, assistant director of Engineering Career Services, says students with internship or co-op experience are twice as likely to be promised employment in an engineering-related position prior to graduation than students without that experience.

Kristen Constant will lead undergrad programs

Kristen Constant

Associate Professor Kristen Constant recently was appointed assistant chair of the MSE department. She will coordinate undergraduate curriculum, preparation for the ABET2000 accreditation review, undergraduate recruitment, freshman orientation, advising, co-op/intern programs, and learning enhancement.

"She has the knowledge, talent, passion, and energy to lead our undergraduate education activities," says MSE Chair Mufit Akinc. "In the past several years, she has assumed this role informally. Essentially this appointment is a formal recognition of those efforts."

Two join MSE faculty

Vitalij K. Pecharsky, employed as a scientist at Ames Laboratory since 1995, has also accepted a half-time joint appointment as an associate professor in MSE. This fall, he will teach MSE 516, *Chemistry of Crystalline Materials*, and ENGR 160, *Engineering Problem Solving with* FORTRAN.

Vitalij K. Pecharsky

Vitalij received his B.S./M.S. in chemistry in 1976, and his Ph.D. in crystallography in 1979 from L'viv State University in L'viv, Ukraine. His research efforts were rewarded with a gold medal from the USSR Department of Higher Education. Following a brief stint as a scientist, Vitalij joined the Department of Inorganic Chemistry at L'viv State, eventually achieving the rank of associate professor.

Vitalij has published more than 130 articles on intermetallic and inorganic crystals. He and his coworkers won recognition for the best research paper published in 1993 in *Advances in Cryogenic Engineering*. With Distinguished Professor Karl Gschneidner, Jr., he won the 1997 Department of Energy Materials Sciences Award for Significant Implication for DOE Related Technologies in Metallurgy and Ceramics for research on magnetic refrigeration. Vitalij belongs to several professional societies and served as an officer of the Ukrainian Crystallographic Committee.

Alan Constant

Alan Constant has accepted an assistant professor position half time with MSE after six years as a scientist with the ISU Microelectronics Research Center. During those years he forged ties with the department, teaching three MSE courses and supervising one graduate and four undergraduate students. Concurrently, Alan received funding from Allied Signal Corporation and the Naval Research Laboratories for his work in thin film deposition and microfabrication.

Alan received his B.S. in MSE from Cornell University in 1981, and his Ph.D. in MSE from Northwestern University in 1987. While at Northwestern, he received fellowships from 3M and IBM and was a graduate assistant for six years. He then worked as a senior process development engineer for Digital Equipment Corporation for four years.

Alan's research interests include thin film electronics on polymers, electronic materials, thin film deposition, and semiconductor processing. This fall he will teach MSE 271, *Materials Science and Engineering*. He will continue in a joint appointment as a scientist at MRC.

In memoriam

Frank Kayser

Members of the Iowa State community were deeply saddened by the death of retired MSE Professor Frank Kayser, who died of cancer on May 7. He was 71.

A native of Toledo, Ohio, Frank graduated from the University of Notre Dame with a bachelor's degree in metallurgy in 1948. He earned his master's and doctoral degrees in metallurgy from the Massachusetts Institute of Technology in 1950 and 1963, respectively. Frank began his career at ISU as an assistant professor in the department of metallurgy in 1963; he became an associate professor in 1972, and in 1979 was named professor in the MSE department. He retired from ISU in 1996.

Frank Kayser

Frank's lengthy teaching career was marked by numerous achievements and awards. He was voted Outstanding MSE Professor of the Year 10 times; won the Iowa General Assembly Teaching Excellence Award in 1989; won the Outstanding Advisor Award for the Iowa State Alumni Association in 1986; and received two university-wide superior teaching awards, in 1977 and 1989. He published more than 40 papers and was instrumental in the career placement of metallurgy students.

"He (was) a great teacher – certainly the best I had," said Larry Hanke, Metallurgy'78, at Frank's retirement reception. "It was obvious that he really cared about his students."

Frank is survived by his wife, Eileen, and five children.

David Peterson

David Peterson, one of Iowa State's most distinguished scientists, died of cancer on April 30. He was 75.

Dave was born in Blue Earth, Minnesota. He earned a bachelor's degree in chemical technology from Iowa State in 1947. His doctoral degree in physical chemistry was awarded just three years later, in 1950. Dave began working at Ames Lab in 1942 during the Manhattan Project and continued there until his retirement in 1987.

"Ames Lab has lost another giant in the scientific community," said MSE Adjunct Professor Iver Anderson. "Dave was a world renowned expert on the absorption of hydrogen in metals and one of the finest chemical metallurgists in the field. As a reviewer and key reader for the best technical journals in metallurgy and materials science, Dave was a steadfast guardian of the highest quality for scientific literature."

Dave is survived by his wife, JoAnne, and a son and a daughter.

Scholarship will honor Peterson

In memory of David Peterson, his family has established a fund to endow the David Peterson Memorial Scholarship. Alumni are invited to honor Peterson with a gift to the fund. Please make checks payable to the ISU Foundation and note that the gift is for the David Peterson Memorial Scholarship Fund.

Schilling studies in Poland

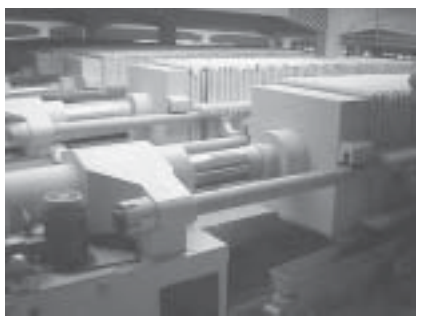
Associate Professor Chris Schilling recently returned from a busy, eight-week research sabbatical at the University of Agriculture in Cracow, Poland. Although his main focus was to conduct joint research with Professor Piotr Tomasik to analyze polysaccharide-based molding formulations for technical ceramics, Chris experienced a great deal more.

After delivering an invited speech at the 8th International Starch Conference in Cracow (which resulted in an invitation to present at an industrial starch conference in Germany next year), Chris initiated a collaboration with Vladimir Kislenko, a chemical engineering professor from L'viv Polytechnic University, Ukraine, and an internationally recognized expert in the mathematical modeling of the kinetics of polymer sorption onto mineral surfaces.

"Because I hadn't applied for a visa to Ukraine, I couldn't visit Professor Kislenko in L'viv. So, we met at the border in a cafe, where we outlined a proposal for him to conduct modeling studies and perform research at ISU," says Chris. "I was surprised at how difficult it was for him to cross the border and return. Due to the extreme food shortage, a queue of at least 200 cars waited to bring food across the border into Ukraine."

Of visits to four Polish ceramic manufacturers, Chris says he was "absolutely impressed with the aggressive modernization" of these factories. "Before 1989, Polish factories were 1920s vintage. Since '89, they have become privately owned and are quickly modernizing," Chris says.

"The factory for electrical insulating porcelain has a state-of-the-art computer control of manufacturing, recently expanded production facilities, and a growing export market with recent ISO 9000 certification," he says. "I learned that the glass, steel, and refractories industries also are rapidly modernizing in Poland."



Ceramic manufacturers in Poland have modernized rapidly since 1989. Top: A modern isopress is used for production of chinaware (Cmielow Corp.). Bottom: A filter press used for processing electrical insulating porcelain (Zapel Corp.).

Solving a glazing mystery

Professor David Martin often tries to teach technology using historical context. In his most recent project, he and students Rachel Kenney and Greg Hughes applied a mysterious glazing technique used by ancient Egyptians.

Students learn ancient glazing technique.

Archeologists opened Egyptian tombs and found thousands of blue and blue-green statues made of desert sand, ash, and animal dung. But no one could determine how blue-green glazing could cover every millimeter of the statues.

It remained a mystery until the 1950s, when archeologist Hans Wulff discovered artisans in Qom, Iran, using the ancient Egyptian technique to make beads for donkey harnesses.

Dave used Wulff's notes to recreate the mysterious process. "Sand beads and figures bonded with soda and gum are immersed in a powder of lime, ashes, copper slag, and soda or salt," said Dave. "We cook it overnight at 1800 degrees and a corrosive vapor forms that permeates the powder, attacking and glazing everything."

Dave plans to travel to museums around the U.S. to make latex castings of the original Egyptian statues and recreate them in his lab.

Other international activities

MSE faculty are involved in various international activities, including the following.

- Distinguished Professor Rohit Trivedi served as an organizer of the international conference on Solidification Microstructures in Switzerland.

- Professor and Chair Mufit Akinc presented an invited paper at a conference on high-temperature structural ceramics held in Turkey and attended by select scientists from the U.S. and Europe. While in Turkey, he made arrangements for reciprocal student exchange programs with Middle East Technical University and Bagazici University. Both universities are accredited by the ABET.

- Assistant Professor Brian Gleeson gave two invited presentations at the Symposium on High-Temperature Corrosion of Advanced Materials in Sapporo, Japan.

- Assistant Professor Joshua Otaigbe presented two invited papers at the University of Lagos in Nigeria in June.

Trivedi publishes new book

Distinguished Professor Rohit Trivedi recently published *Materials in Art and Technology.* The book evolved from the basic course on materials processing he taught for more than two decades to undergraduates from all disciplines.

"*Materials in Art and Technology* introduces people to the world of materials and their technologies and underscores the important role that materials have played throughout history in revolutionizing cultures and the lives of people," Rohit says. "Many materials and technologies were developed and perfected by artists and artisans, and these techniques are integrated with the modern day advancements that have led to the explosive growth in the space, communications, and transportation industries." The book is aimed at individuals interested in working with metals, ceramics, and polymers, and would serve as an excellent resource for students.

The 400-page book includes 200 illustrations. It is available from Taylor Knowlton, Inc. For information, send a fax to (515) 268-8131, or e-mail to <editor@taylorknowlton.com>. Information is also available on the web at <http://www.taylorknowlton.com>.

1998-99 MSE scholarship recipients

Thomas Anderson	$ 500	Ceramic Engineering Alumni
Scott Beckman	$ 500	Ceramic Engineering Alumni
Adam Buckalew	$ 500	MSE Freshman Scholarship
Cynthia-Jo Clark	$ 500	MSE Freshman Scholarship
Jane Clayton	$2,600	David R. Wilder Scholarship
Stephanie Connor	$5,000	David C. Lovell
Sara Huntrod	$ 500	MSE Freshman Scholarship
Kristin Johannsen	$ 500	MSE Freshman Scholarship
Kevin Joy	$ 500	MSE Freshman Scholarship
Henry Kang	$ 500	Ceramic Engineering Alumni
Laura Keehner	$ 500	Ceramic Engineering Alumni
Theron Lewis	$ 500	Metallurgical Engineering Alumni
Brian Madsen	$ 750	Samuel Walker Beyer
Meagen Marquardt	$ 500	MSE Freshman Scholarship
Chad Martindale	$ 500	Ceramic Engineering Alumni
Melissa McConnell	$ 500	MSE Freshman Scholarship
John Meyers	$ 500	Metallurgical Engineering Alumni
Angela O'Connor	$1,000	Paul E. Morgan
Brian Radtke	$ 500	MSE Freshman Scholarship
Sarah Schmidt	$ 500	Ceramic Engineering Alumni
Joseph Schramm	$ 500	MSE Freshman Scholarship
Chad Spore	$2,666	Frank McCutcheon
Kevin Sutherland	$ 800	Murray Gautsch
Benjamin Van Zante	$ 500	Ceramic Engineering Alumni
Jason Wells	$ 500	MSE Freshman Scholarship

Thank you for your support!

MSE alumni information exchange is online

Now, MSE alums can go online and catch up with each others' news. The MSE department has developed an alumni feedback form for our homepage. You can find it at <http://mse.iastate.edu/people/alumform.html>. The form will help you bridge the graduation gap and provide you with an easy way of contacting your classmates and friends from MSE. You can provide your news update and contact information and let us know if you want it posted on our alumni web site at <http://mse.iastate.edu/people/alumni.html>. Check it out! It's a quick way to let us and other MSEs know what's new with you!

Or, if you prefer, you can E-mail us at<mse@iastate.edu> with a statement of permission to publish your E-mail address in our Cybercontacts section of this newsletter. Either way, let's keep in touch!

We appreciate your support!

We would like to acknowledge the generous assistance of faculty, alumni, and friends of the MSE department who have responded to our appeals for donations to support undergraduate scholarships. Your gifts are most helpful in attracting and retaining the best possible undergraduate students.

When you support one of our alumni scholarship funds or endow a named scholarship, you help us help some of the finest students in the country prepare for a lifetime career in the materials field.

Please join other alumni and friends in providing scholarship support to help deserving students pursue their career goals. Remember that many companies will match your gifts to Iowa State, and all gifts are tax deductible.

*Make checks payable to lSU Foundation, with a note designating the gift to MSE Scholarship Fund or MSE General Fund (not limited to scholarship use). Send checks to the Foundation, or to the MSE Department, 3053 Gilman Hall, Iowa State University, Ames, Iowa 50011-3114.

Cybercontacts

Barry Johnston, BSCerE'86
moscico@rollanet.org

Barry has changed employment from RESCO Products in Bonne Terre, Missouri, to MO-SCI in Rolla, Missouri.

Julia Campbell McGuire, BSCerE'93
jmcguire@lh.net

Jessica (Porter) Taylor, MetE'95
jessica.j.taylor@boeing.com

Jessica is currently working for the Boeing Commercial Airplane Group in Seattle as a senior engineer at Boeing Materials Technology. She provides support to wide-body airplanes (747/767/777) in the area of fasteners. This fall, she begins graduate studies at New Mexico State University in industrial/manufacturing engineering. It is a joint program with the University of Washington and Boeing.

Aaron Spaete, CerE'97
aspaete@ti.com

Aaron is participating in the TSA (Technical Sales) Program for Texas Instruments. He recently completed first rotation planning a DSP product family in Houston, Texas, and is currently working in second rotation as a buyer for Ericsson Cellular at their NA manufacturing facility in Lynchburg, Virginia.

Paul S. Oh, MSCerE'73, PhD CerE'75
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Paul is with the Optical Cable Corporation in Roanoke, Virginia, where he is vice president of sales for the Far East and Pacific.

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From our labs

High-temperature materials for tomorrow

MSE Professor and Chair Mufit Akinc and Adjunct Associate Professor Matt Kramer are in the second year of a $900,000, three-year Department of Energy project to develop a new generation of high-temperature structural materials. Existing materials in heat exchangers and turbines can withstand operating temperatures of 800 to 1000°C. That power-generation equipment could operate much more efficiently if those temperatures could be increased.

Certain stoichiometries of molybdenum and titanium silicides have outstanding high temperature strength and creep resistance, but their oxidation resistance is poor for high temperature structural use. Mufit and former graduate students Mitch Meyer, BSCerE'91, MSMSE'91, PhDMSE'95; and Andy Thom, BSCerE'88, PhDMSE'95 discovered that boron additions allow the materials to form glassy, passivating surface layers that nearly halt oxidation at temperatures as high as 1500°C. The current project will more fully characterize these boron-doped silicides for eventual use in heat exchangers, heating elements, turbochargers, jet engine components, and gas turbines.

If successful, their work may increase the energy efficiency of heat engines and heat exchangers by 10-15 percent, allowing more electricity to be produced from a ton of coal and substantially lowering transportation fuel costs and air pollution. MSE graduate student Bruce Cook and Ozer Unal of Ames Lab also are working on this research.

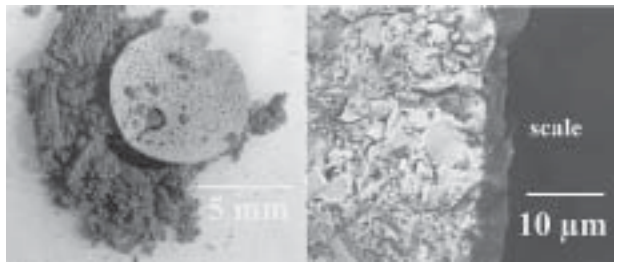

Figure above left is an optical micrograph showing complete disintegration of a pellet of Mo_5Si_3 after 35 hours at 800°C in an oxidizing atmosphere while the SEM micrograph on the right shows that for B doped Mo_5Si_3 only a 5 μm scale forms after 280 hours in the same atmosphere.

Developing a heat-resistant new magnet

Adjunct Professor Bill McCallum and Assistant Professor Alan Russell are developing neodymium-iron-boron magnets that retain their magnetic properties at higher operating temperatures. If successful, the results of their one-year, $165,000 NASA project will be part of a possible Stirling engine power source for deep-space probes.

Many attempts have been made to raise the operating temperature of the $Nd_2Fe_{14}B$ magnets by adding different elements to the overall composition. However, the resulting materials have low resistance to the forces of demagnetization, making them unsuitable for the rapidly reversing magnetic fields of a Stirling engine.

Rather than make material with a uniform composition, Bill and Alan are attempting to produce particles that each have two different compositions — one at the outer edge where reverse magnetic domains nucleate and another at the core to retain magnetic power at higher temperatures. "To produce this gradient structure, we have to learn to control the composition on a very fine scale," Bill says.

Alan notes that, although the project's roots are in the space program, the development of magnets with higher operating temperatures would benefit many terrestrial applications.

Next March, they will present their results. If their findings are favorable, NASA will consider moving to a second phase, which would involve attempts to produce the new magnets in sizes large enough for use in a Stirling engine.

Join us in Rosemont! Fall 1998

Reception for ISU alumni & friends

Monday, October 12
6:00 – 9:00 p.m.
Ozark B – Lobby, Hyatt Regency
Rosemont, Illinois

MATERIALS WEEK '98

ASM International Materials Solutions Conference & Exposition
October 12-15
Rosemont Convention Center
Rosemont, Illinois

ISU's MSE department is hosting the reception in conjunction with Materials Week '98.

Hope you can join us there!

ELEMENTS
Newsletter of the Department of Materials Science and Engineering

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