MSE LEMENTS
Materials Science and Engineering Department
Fall 2004

New MSE faculty reflect diversity in backgrounds, experience

The strength of any research and teaching program lies not only in the range of its faculty members' academic interests, but also in the variety of their life experiences and personal backgrounds.

This year the Department of Materials Science and Engineering is proud to welcome to its ranks three dynamic personalities: a celebrated senior scientist, an accomplished young researcher whose stature grows each passing year, and a promising newer PhD to help accelerate the department's rising profile in polymers.

IOWA STATE UNIVERSITY

New MSE faculty
reflect diversity in backgrounds, experience

Dan Shechtman: *Pioneering the impossibile*

As a visiting scholar in his thirties at the National Institute of Standards and Technology, **Dan Shechtman** discovered the icosahedral phase in rapidly solidified aluminum transition metal alloys, opening up the field of quasi-periodic crystals (QCs) as an area of study in materials science.

The discovery, Shechtman says, took crystallographers by surprise because it challenged an accepted "truth" that the hundreds of thousands of crystals studied since research in the field began in 1912 were ordered and periodic. In short, Shechtman's insight was impossible according to the terms of 1980s' x-ray crystallography.

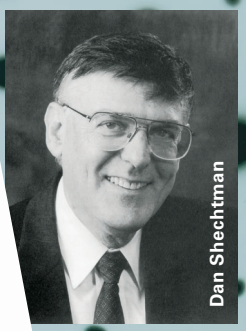
"They rejected quasi-periodicity because I made the discovery by electron diffraction," Shechtman recalls. "That wasn't an accepted tool, and it took about three years before my colleagues could produce large enough stable quasi-crystals for x-ray diffraction experiments."

No sooner had skepticism turned to astonished acceptance than Shechtman found his world set on its ear. "It was a mixed blessing," he remembers. "On the one hand, scientific glory. On the other, tremendous pressure, being constantly on the alert to fulfill expectations."

As Shechtman joins colleagues in MSE and Ames Lab, where he will study the structure and properties of intermetallic compounds, the former trailblazer has become one of the world's most respected figures in crystallography and materials science. Over 7,000 scientific articles and 40 books dedicated to QCs have been published. There are numerous meetings and conferences on quasicrystals every year. And next year the Ames Lab will host the 9th International Conference on Quasicrystals, bringing to Iowa State some of the world's leading researchers.

His groundbreaking work was recognized in 1988 with The International Award for New Materials of the American Physical Society, the first of many recognitions. Elected earlier this year to the European Academy of Sciences, Shechtman is also a member of the Israel Academy of Sciences and the National Academy of Engineering in the United States.

A native of Tel Aviv, Shechtman received his BS, MS, and PhD from The Technion in Haifa, where he remains Distinguished Professor of Materials Science. He and wife Zipora, who studies and teaches group counseling at the University of Haifa, have four children.


Dan Shechtman

Ersan Üstündag:
Living up to all the buzz

"I was just in France doing a synchrotron experiment," **Ersan Üstündag** recalls. "I learned again what it's like: you don't sleep for three days but have so much fun. Fortunately, they have good coffee in France!"

Judging by his accomplishments, you might figure the department's new Glenn Murphy Professor of Engineering for a man in search of all the good coffee he can find. Barely eight years out of his Cornell PhD, Üstündag has four books and nearly 80 refereed publications in the mechanics of materials. He's given over 40 invited lectures and serves as reviewer for various journals and government agencies.

Fortunately for wife Tugba and daughter Ezgi, Üstündag gets considerable help from colleagues and students—people, one suspects, who may be nearly as well caffeinated as he is. He'll need that help as he builds a new x-ray microdiffraction facility at the Berkeley National Lab synchrotron. "It will be the world's best," he says, surpassing the facility at Argonne National Laboratory.

You'd better brace yourself with an espresso or two before questioning that assertion: Üstündag has been a visiting scientist at Los Alamos since 1997, where he already led a project to build the world's first dedicated engineering neutron diffractometer.

"Diffraction using neutrons or x-rays is nondestructive," Üstündag offers. "You can look at something without disturbing it. That allows us to study volumes as low as a fraction of a micron or as big as this coffee cup and determine exactly what happens in the microstructure if you apply a certain load or temperature—or both." Such levels of accuracy allow engineers to refine safety factors considerably, he adds, resulting in significant savings in materials and fuels while actually increasing safety.

Üstündag's research includes the micromechanics of composites, internal stresses in bulk metallic glasses and composites, the constitutive behavior of ferroelectrics, thin film mechanics, and solid-state reactions. But it's clear what part of all this puts the buzz in his coffee.

"I participate in as many experiments as possible—just go there and do it—because I really enjoy it," Üstündag says. You usually build your own instruments, which is fantastic."

He smiles, and almost as an afterthought adds, "Oh. And then you start getting data, which is even more fun!"

Zhiqun Lin: *Seeking breakthroughs in the lab and classroom*

This fall **Zhiqun Lin** enjoys a privilege of faculty new to the tenure track: a semester without teaching duties, during which he'll prepare his spring classes, set up his lab, work on funding proposals, and identify and develop promising collaborations with other research faculty.

"It gives you a lot of freedom and time to prepare," Lin says. "It's really wonderful."

It's a job he has been preparing for much of his life. Lin was born in Fujian province in 1972. He graduated with a BS in chemistry from Xiamen University in Fujian, then earned his MS in macromolecular science from Shanghai's Fudan University. In 1998 he entered one of the world's top programs in polymer engineering at the University of Massachusetts, where he would earn another master's on his way to the PhD.

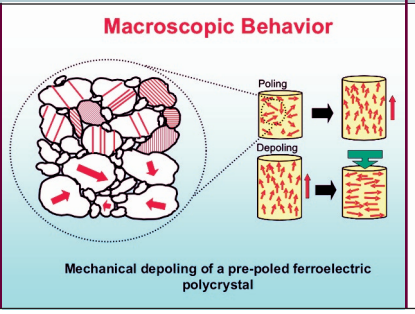
While at UMass, Lin worked with high-school teachers from several towns in the NSF Research Experience for Teachers program. "Two years later," he recalls, "an NSF program director shared with me a comment from a teacher in Massachusetts. To my surprise, it was the same teacher I had taught at UMass. She said that what they had learned in our lab was tremendous, and they had passed on these findings to their own students. I felt so emotional—like my efforts had finally paid off."

Few experiences can beat the rewards of teaching breakthroughs like that, and Lin anticipates many more such moments in classrooms at Iowa State. But he's also looking forward to pursuing a vigorous research program in polymers, including the investigation of their nanoscopic structures, hierarchical structure formation and assembly, and surface and interfacial properties.

Compared to Lin's UMass alma mater, the community of polymer specialists in Ames is relatively small. But, he says, Iowa State researchers such as chemistry's **Klaus Schmidt-Rohr** and chemical engineering's **Surya Mallapragada** (who also holds a courtesy appointment with MSE) and **Balaji Narasimhan**—not to mention MSE colleague **Vladimir Tsukruk**—are some of the top people in their fields, and Lin is eager to make his own contributions, both singly and in collaboration.

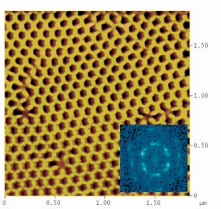
Lin and wife Haiqing Shen have a two-year-old daughter, Nicole.

Ersan Üstündag

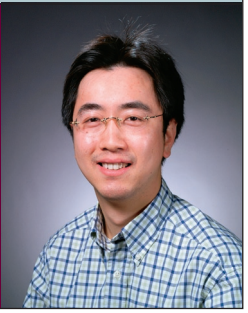


Mechanical depoling of a pre-poled ferroelectric polycrystal

Recent Research Highlight



AFM Image of the Porous Aluminum Oxide (PAO) Template. Image Size: 1.8μm x 1.8μm.



Zhiqun Lin

Greetings from Istanbul!

I am sipping a cup of tea and looking over the Black Sea through my window at Koc University. As some of you may know, I am spending part of my sabbatical in Turkey. This has been an outstanding opportunity to get out of the crazy day-to-day pace I had in Ames and reflect, catch up with research, and most of all "re-energize" for the future.

It has become almost routine for me to announce in my annual *Elements* column several noteworthy achievements by our students and faculty, and this year is no exception. The department moved into Hoover Hall, furnishing all our teaching and research labs with state-of-the-art instrumentation, an undergraduate enrollment over 180 (one of the largest MSE programs in the nation), complete restructuring of the graduate program, and research expenditures approaching $15 million per year are the most prominent items in a long list of accomplishments.

As you will read in this issue, in spite of larger graduation numbers and a soft economy, placement of our graduates has been excellent. This is by no means a fluke, but instead comes from long-term efforts in recruitment, a dedicated faculty preparing students for their careers (see the article on **Chris Hansen**), and our friends and colleagues in industry eager to offer our graduates opportunities both as interns and engineers.

You will also read in this issue about our educational outreach programs, particularly two dynamic programs run by **Larry Genalo** and **Ralph Napolitano**. I believe we are making a significant impact in creating excitement among Iowa youth for the engineering and science disciplines.

Special recognition goes to our ASM/TMS student chapter, recipient of the national "Most Outstanding Chapter" award. This is the highest recognition any chapter receives! Our students worked really hard during the year to earn this award. I want to thank all the students who contributed to this achievement and, in particular, their able leader **Emily Kinser** and faculty advisor Professor **Scott Chumbley**.

We are very pleased with the progress we made last year, but more challenges lie ahead. Continued budget concerns, the need for more scholarships (exacerbated by higher enrollment and tuition increases), an accreditation visit in 2006, and recruitment and retention of outstanding faculty will keep us busy next year.

Mufit Akinc, Chair

Jiles named editor-in-chief of *IEEE Transactions on Magnetics*

MSE's **David Jiles** has been named editor-in-chief of *IEEE Transactions on Magnetics*. The journal is published by the Magnetics Society, the world's leading organization for the study of magnetism and magnetic materials.

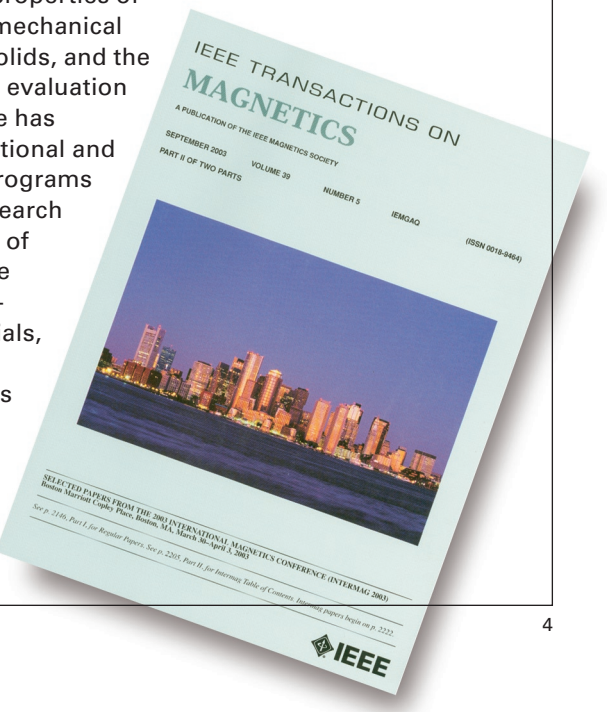
"It's good to have the *Transactions* here," Jiles said. "Iowa State is an important academic center in magnetics, and it adds to our prestige if someone here is editor-in-chief."

Jiles has been an editor of the *Transactions* since 1992 and a Fellow of the Magnetics Society since 1994. Besides being primary liaison between the society and its flagship publication, he will coordinate a group of about ten colleagues in reviewing up to 200 archival submissions and 1,000 conference papers each year.

The high demand, Jiles says, reflects the growth in magnetics as a leading technological field. "We publish six times a year," Jiles said, "but we're about to go to twelve for faster turnaround—everyone wants to get published sooner. We're probably going to get even more papers."

Jiles received his PhD in applied physics from the University of Hull in 1979. He came to Iowa State in 1984 and was promoted to senior scientist at Ames Laboratory and professor in the MSE department in 1990, when he was awarded a DSc in physics and space research from the University of Birmingham. In 1992 he was appointed a professor of electrical and computer engineering. He was named Anson Marston Distinguished Professor in 2003.

Jiles and his research group have pursued investigations into magnetism and magnetic materials, condensed matter and materials physics, the electronic properties of materials, the mechanical properties of solids, and the nondestructive evaluation of materials. He has coordinated national and international programs conducting research into the effects of structure on the magnetic properties of materials, with over 400 research papers and 2 books to his credit.



Ames kids get real science "experience" at Iowa State

What does the internal structure of a material look like? How are atoms arranged in crystals? How do different materials respond to high and low temperatures?

Students from Edwards Elementary School and the Boys & Girls Club of Ames recently got a glimpse into these and other questions at the Materials Science Experience (MSExperience), a new program that introduces K-12 kids and teachers to the fascinating world of materials science. "The challenge is not necessarily to provide answers, but to get young people to look at the world and start asking questions," says **Ralph Napolitano**, MSExperience director and assistant professor in the MSE department.

The initial 'pilot' phase of the MSExperience was launched in the fall of 2003. The program concluded this summer, when a group of fifth-grade students from the Boys & Girls Club of Ames, guided by Napolitano and a team of Iowa State students, conducted a series of interactive, hands-on experiments in which they explored the atomic structure of materials, the influence of temperature on material properties, the behavior of interfaces in materials, and the microstructure of materials. The visiting students recorded observations in specially designed "Junior Scientist Activity Logbooks," and each received a "Certificate of Scientific Achievement" at the conclusion of the program.

Diana Schmidt's fifth-grade class from Edwards Elementary School was the first group to participate in the program. Several days after their "experience," Napolitano visited the class to answer follow-up questions and engage students in further discussion. "It's important for kids to see that science is performed by real people in real places, and that this is something kids can aspire to," says Napolitano. "More generally, exposure to the university is important for children whose families, like mine, have no prior experience with higher education."

"This learning experience was an all-time favorite for my students," Schmidt says in praise of the program. "Treated as fellow scientists, they performed experiments, created models of atoms, and made observations with state-of-the-art equipment. I highly recommend this as a way to inspire our future scientists."

Ron Chieves, program director at the Boys & Girls Club of Ames, offers similarly positive student responses to the "Experience." Particularly memorable, he says, were highlights such as the controlled shattering of tempered glass and the use of high-powered microscopes. About the program in general, Chieves adds, "the interaction between the ISU students and the younger kids was wonderful. In an environment that doesn't 'feel like school,' this activity is a great 'hook' and left the kids asking, 'What's next?'"

"What's next," according to Napolitano, is that beginning in the fall of 2005, this exciting new program will be expanded to reach more kids in the Ames area and, ultimately, throughout the state of Iowa.

For more information, contact Ralph Napolitano at the Iowa State University Department of Materials Science and Engineering (ralphn@iastate.edu) or visit the Materials Science Experience Web site at www.mse.iastate.edu/MSExperience.

Edwards Elementary students Justin Grall and Cody Stettin investigate wetting and capillary behavior in Iowa State's new Hoover Hall.

"The challenge is not necessarily to provide answers, but to get young people to look at the world and start asking questions," says Ralph Napolitano, MSExperience director.

Ready for your upgrade?

Introducing Internet Explorers, version 7.0

If you said "an on-line Web browser," you're only half right, at least in the case of MSE Professor **Larry Genalo's** annual program for high-school girls on the Iowa State campus, which just completed its seventh summer.

Quick:

What's an "Internet Explorer"?

Strictly speaking, Genalo's young charges aren't so much *browsers* as they are *creators* of content for the Web—specifically, science- and engineering-based Web pages targeted at younger, middle-school-age girls who form the other half of this dynamic learning equation.

The girls spent six weeks in residence on the Iowa State campus, where they learned Hypertext Markup Language (HTML), researched scientific topics in depth, and designed Web pages geared toward middle-school students.

At least as valuable as the scientific knowledge and computer skills they acquired, though, was the opportunity to live in dormitories and gain a host of experiences similar to those of typical college students. As Genalo notes, that kind of exposure is especially significant to the program's core clientele, who sometimes come from rural and inner-city populations that might not have the same resources or educational expectations as girls from larger or suburban schools.

Shortly after arriving in Ames, the interns were oriented to campus life and had the opportunity to work with elementary schoolchildren through the College of Engineering's "Toying with Technology" program.

"That gave them the chance to work with younger kids a bit," Genalo says. "They were exposed to the mentality of children and could see what they're capable of."

The girls were then assigned for three weeks to the labs of Genalo or one of his MSE colleagues, where they wrapped their hands—and minds—around real-world research topics. Afterward, they developed lesson plans based on their lab experiences and research, then designed and posted their pages to the program's Web site.

"Two of them did polymers with **Vladimir Tsukruk's** group, two did 'smart' materials with **Mufit Akinc**, and a couple did magnetic refrigeration with scanning electron microscopes in **Scott Chumbley's** group," Genalo says. "The real challenge for them was to understand, for instance, what we mean by polymers or how a scanning electron microscope works—then write a lesson plan fifth-graders could understand."

Since its inception, nearly 100 girls from Iowa, other states, and even foreign countries have gone through the program. Many of these have gone on to pursue college degrees in engineering and other scientific areas. Indeed, Genalo views Internet Explorers as an important tool for helping to increase the representation of women and minorities in these fields.

Chelsea Klocke, however, offered somewhat of a challenge to Genalo in this regard. The high-school senior from Decorah plans on coming to Iowa State—but her current interests lie elsewhere.

Chelsea Klocke receives assistance from Larry Genalo.

Students participate in various engineering activities.

"I've always been interested in architecture and design," says Klocke, "and I thought engineering might really help with an architecture major."

There isn't much science or engineering background in her family, Klocke adds—her parents own a grocery store in Decorah—and her computer skills had, admittedly, taken a back seat to other pursuits in her academic career to date. "I know them better than my mom, but I'm not very good at computers," she acknowledges. "HTML is very intimidating. If I'd known that I was going to come here, I would have paid more attention in computer class!"

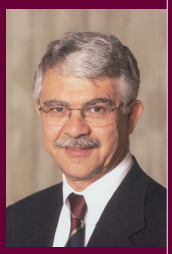
Still, Genalo stresses, regardless of their youthful inclinations, high-aptitude students such as Klocke are prime candidates for recruitment to careers in science and engineering. And if his previous experience with Internet Explorers is any indication, Klocke's flirtation with architecture could be short-lived.

"The first year I had a bunch of girls from Baton Rouge—they weren't coming back here in the winter!" Genalo laughs. "But with *Iowa* girls, we've had a very high success rate getting them to Iowa State, majoring not just in science, but in engineering too."

Internet Explorers was launched in 1998 in its current form with funding from the National Science Foundation. Corporate backers have included General Motors, Square D Corporation, Goodrich Delavan, Microsoft, Lockheed Martin, and Procter & Gamble. On campus, the program has the support of the College of Engineering, the Department of Materials Science and Engineering, and the Program for Women in Science and Engineering (PWiSE).

For more information about the program, or to visit Web pages designed by Internet Explorers alumnae, visit www.eng.iastate.edu/explorer/.

MSE chair to assume national post



Department Chair **Mufit Akinc** has been elected vice chair of the University Materials Council (UMC), the official organization of department chairs, heads, and directors of materials science and engineering programs in the United States and Canada.

Besides conducting surveys that benchmark enrollments, degrees awarded, faculty salaries, research funding, and graduate student stipends, the UMC serves as a forum to share best practices in areas such as student recruitment, academic accreditation, emerging research, and patent rights policies in the field of materials science.

Akinc was elected to the UMC Executive Council in 2002. Election as vice chair automatically positions him to become UMC chair elect next year, then chair of the organization. He previously served as materials science curriculum chair for the National Technological University between 1998 and 2003.

Akinc joined the faculty of the Iowa State MSE department in 1981 and was named chair in 1995. Under his leadership, the department has risen to become one of the nation's premier programs in materials science. MSE faculty on average graduate twice as many PhD students as other departments in the Iowa State College of Engineering, and the department's programs account for nearly one-third of the college's research dollars, or $15 million annually.

In the race to understand aluminum-silicon microstructures, *Napolitano speeds toward the checkered flag*

Ralph Napolitano has three computer screens mentally arrayed in front of him. He's got CAD software showing a component design on one, process software running a casting simulation on another, and a prediction of his alloy's microstructure on the third.

"Suppose you're building a race car," Napolitano says, "and you want to design an aluminum engine block. You have high pressure requirements in one location of your casting, so you need high strength. In other places, you may be more interested in, say, wear resistance. The design requirements are quite complex, with different critical properties in different parts of the casting."

Fundamental science with far-reaching application

Napolitano doesn't build race cars or even cast engine blocks. However, the fundamental science he studies makes high-tech casting applications possible by providing knowledge to develop new alloys, improve process technology, and adopt state-of-the-art casting simulation and design tools. Still, given the enthusiasm with which he fills the space between his chair and yours with imaginary monitors, readouts, and assorted schematics, you might think he'd been a high-tech gearhead for years.

"So you pour the molten metal—the aluminum silicon alloy—into a mold," he continues. "The silicon morphology that develops during freezing generally controls the overall properties, and this is inherently linked to the cooling rate in any given part of the casting. Because cooling rates depend on the mold design and other casting parameters that dictate how heat is extracted, we need to include microstructural simulation in the design process itself."

He returns to the design console. "O.K. So you calculate heat transfer through the mold—*everywhere* in the casting. You also calculate the way the liquid metal fills the mold and how it continues to flow during the freezing process. You calculate all these things so you know *exactly* what's happening *anyplace*—at every X-Y-Z coordinate at every instant in time."

You think you have a handle on all this. But no sooner are you ready to put the pedal to the metal in that Formula One wonder than Napolitano waves the black flag on your fantasies: you can skip the pit stop—it's off the track for your team and back to the lab to work on the science.

Critical pieces to a complex puzzle

"The real problem lies in using these heat transfer and flow calculations to predict the microstructure," Napolitano says. "In some cases we can do this effectively; in others we can't. The fact is, we're still missing a few small but critical pieces to the puzzle."

In his quest for this critical knowledge, Napolitano is focusing these days on aluminum silicon alloys—a system, he notes, that has been studied at great length due to its tremendous commercial significance. His interest in this system doesn't have its roots in Formula One racing, but rises instead from the many microstructures the alloy may exhibit during freezing.

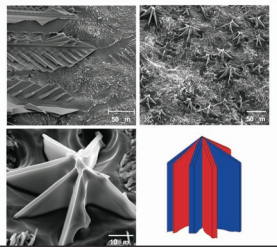
"By freezing these alloys faster or slower, we can produce an incredible variety of microstructures," Napolitano notes. "In particular, we hope that the growth transitions we observe at both very high and very low rates will answer some basic questions about the behavior of the solid-liquid interface and the way nature ultimately selects a microstructure."

Probing the whims of Mother Nature has proven fruitful, and Napolitano's recent work has uncovered a peculiar mode of silicon growth he loosely describes as a "hybrid mechanism." These crystals, Napolitano observes, reveal a faceted growth pattern, yet simultaneously exhibit traits more commonly associated with dendritic crystals—the kind of branching one sees in snowflakes as they give off heat to assume their particular shapes.

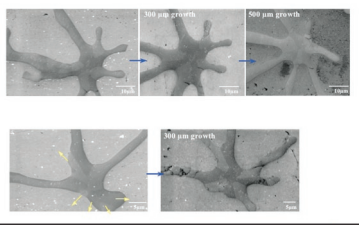
Competition is key to understanding

"Each crystal is really a complex, intertwined array of *two* crystals," he explains, "and it's the orientation *between* the two crystals—a highly specific one—that gives rise to two very characteristic types of twin planes.

3-dimensional approach to faceted Si



Twin boundary migration



3-D RECONSTRUCTION OF 8-POINTED STAR-SHAPED

Our recent results suggest these boundaries can spread rather easily and their resulting migration causes a branched morphology that wouldn't otherwise be possible. In a nutshell, it's the fundamental *competition* between growth mechanisms that we're trying to understand."

And therein lies the challenge: in order to both predict *and* control the microstructures that give castings their specific properties, engineers need component and process design tools that incorporate these essentially "competitive" aspects of the phase transformations that lead to these highly varied microstructures.

"The reason for this competition and its resulting bi-crystal structure in the first place is that the silicon phase is partitioning and must push the aluminum away by diffusion as it grows," Napolitano says. "It's trying to become dendritic, but because the silicon wants to remain faceted, it can't do it, at least not quite the way a normal dendritic alloy would. It has to do it differently—Mother Nature usually gets her way."

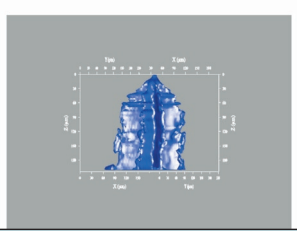
Predicting microstructures, perfecting tools

Still, better understanding the morphologies of the Al-Si alloy, Napolitano cautions, will not result in superior alloys so much as in superior processes for creating and controlling microstructures during the casting process. He returns to his imaginary screens to illustrate.

"From a materials *engineering* standpoint, the critical leap is from screen two to screen three," he says. "You have the temperature history, and from that you want to predict the microstructure. If you can do this well, then you can change the component's design in a fully integrated manner. But to build the required predictive tools, you need to understand the connections—that's the science I'm after.

And once he passes that science to you?
Well, gentlemen (and ladies), start your engines.

3-D RECONSTRUCTION OF 8-POINTED STAR-SHAPED



Do you remember?

(Could you forget?)

Often people ask us about a former colleague or an old professor from the department. Where are they now? What are they doing? Admittedly, academia can be somewhat of a vagabond existence at times: even people with tenure will pull up roots and move on to greener pastures—or at least they seemed greener at the time! Others will spend their entire careers in one place, teaching generations of students. We've wondered ourselves where some of our old friends are, so we did a little detective work and came up with the following. *(Please let us know if the information below needs updating!)*

Retired/Resigned:
Michael Berard, Windsor, Cal.
Orville Hunter, Columbia, Mo.
William L. Larsen, Ames, Iowa
David Martin, Ames, Iowa
Joshua Otaigbe, Hattiesburg, Miss.
John (Jack) W. Patterson, Jr., Ames, Iowa
Alan Pelton, Raychem Corp.
Christopher Schilling, Midland, Mich.
Tom E. Scott, Leechburg, Penn.
Karl Sieradzki, Tempe, Ariz.
John (Jack) F. Smith, Ames, Iowa
Jay R. Smyth, Phoenix, Ariz.
William A. Spitzig, Bridgeville, Penn.
Krishna Vedula, Lowell, Mass.
John Verhoeven, Ames, Iowa
Monroe S. Wechsler, Chapel Hill, NC
David R. Wilder, Ames, Iowa

Deceased:
Otto Buck
O. Norman Carlson
Premo Chiotti
Charles M. Dodd
Francis (Frank) X. Kayser
David Peterson
Elmer Rosauer
Harley Wilhelm

Whereabouts Unknown:
Chih-Wen Chen
John Marcinkowski
Christopher Squire
Bekir Unustun

Swedish honor
benefits Steve Martin's students, research

Unless you're into the Iowa heat, you could do worse than summer in Sweden.

That's precisely what MSE Professor **Steve Martin** and several of his students did this year and will continue into the next. It's all part of Martin's designation as "Chalmers Jubilee Professor" for 2005, in honor of the 175th anniversary celebration of Chalmers University in Göteborg, Sweden. Martin has been associated with Chalmers since 1984, when he worked on Brillouin light-scattering techniques to measure the sound propagation properties of materials.

Created by the Swedish government in 1979 to mark Chalmers' 150th anniversary and offered to outstanding scientists around the world in various fields, the honorary professorship enables Martin to enhance his investigations into developing better fuel cell materials. The combined strength of sample preparation methodologies at Iowa State and Chalmers' advanced characterization facilities, Martin says, will help to increase the base of knowledge needed to advance the technology.

Steve Martin with students Chad Martindale and Carly Nelson in the town of Upsalla, Sweden.

This past August Martin took MSE grad students **Chad Martindale** and **Carly Nelson** with him to Sweden for two weeks. The first week they participated in a Chalmers summer school on new materials for hydrogen-oxygen fuel cells in Smögen, a small fishing village on the Swedish west coast. Martin gave a plenary lecture during the session and Nelson was one of three winners named in the summer school's poster contest.

"The summer school and conference was particularly interesting for Chad," Martin remarks, "because he'd just gotten back from an international collaboration project for seven months in Dortmund, Germany, doing NMR measurements on some of these same fuel cell materials we're studying."

The second week of the trip was dedicated to an international conference on the solid-state proton conductors that separate the anode from the cathode in fuel cells. In addition, Martin gave an invited talk on his research, and Nelson and Martindale presented posters on their research. He added that "Carly benefited a great deal from the school and conference because she is just getting started on her MS graduate degree on a fuel cell project working in collaboration with the Honda Research Center in Columbus, Ohio. These two experiences really helped jump start her background in the broad area of fuel cell research and development."

As a result of Martin's "Swedish connection," Chalmers grad student **Maths Karlsson** is spending the Fall '04 term at Iowa State, where he's investigating the temperature dependence of the infrared spectra of materials Martin and his collaborators are using in their fuel cell research. Martin will build on Karlsson's findings at Iowa State when he returns to Chalmers next summer, when he hopes to bring Iowa State undergraduate **Andrea Siefers** with him to continue the student exchange.

"It's really all about the students," Martin stresses. "I've worked hard to combine this with as much student activity as I can. And it's working."

Iowa State ASM/TMS

most outstanding chapter in nation

The Iowa State student chapter of the American Society of Materials and The Minerals, Metals, and Materials Society (ASM/TMS) recently received the "Most Outstanding Chapter" award for its activities and organization over the past academic year. The award was presented at the TMS Materials Science and Technology 2004 conference in New Orleans this past September.

"This is the highest award possible for ASM/TMS student chapters," said Chapter President **Emily Kinser**, who also served as president last year. "We beat out all the other chapters across the country." Five other North American chapters were cited for their excellence. Besides the prestige of the recognition itself, Kinser noted, the award came with a $750 cash prize, which will be used to help fund chapter activities. The Iowa State chapter's faculty advisor is MSE Professor **Scott Chumbley**.

Kinser, a native of Walnut, Iowa, who also holds a bachelor's degree in political science, is a first-year graduate student in the master's program in materials science at Iowa State. She has been active in politics for a number of years, serving as a page in the Iowa Senate while in high school and helping to organize caucuses and party conventions at the county, district, and state levels. Last spring, Kinser was recognized by the department with the Student Leadership and Service Award. She hopes to continue in a doctoral program in engineering and public policy at an eastern university.

"Our success has really been a team effort. Our officers have been there every week, selling pizza, organizing field trips and public service projects," said Kinser, who added that the organization had a solid leadership base for the future. "We have several juniors who are stepping into leadership roles and getting more hands-on experience than officers were asked to previously."

According to Kinser, future goals for the organization include establishing scholarship opportunities through chapter alumni and developing a base of corporate sponsors to help fund activities, particularly student attendance at national and regional conferences. She noted that, while other student chapters typically send only a handful of students, with help from faculty members the Iowa State chapter sent no fewer than 24 members to last year's national conference in Pittsburgh. This year, 31 students attended the conference in Ohio.

MSE department chair **Mufit Akinc** congratulated Kinser and her student colleagues on the recognition. "It is the culmination," he said, "of the tireless efforts Emily and her officers put into making this a reality. We look forward to even more national recognition of our students in the near future."

"This is the highest award possible for ASM/TMS student chapters," said Chapter President Emily Kinser.

Sound advice—
Part of "materials advantage"

The Department of Materials Science and Engineering is proud to announce the lineup of its Industrial Advisory Council (IAC) for the coming year.

Since it works behind the scenes with departmental faculty and administration, the role of the IAC may seem mysterious to some. There's really no mystery, though: IAC members keep academic engineering programs "grounded" in the needs of industry and business, offering real-world perspectives on the efficacy of MSE's programs. This gives us critical input on how we can improve these programs and help prepare our graduates to better meet the needs of their future employers.

IAC members also help us to identify funding and other development opportunities for the department, as well as individual opportunities for our students in the form of co-ops or internships with their own firms. And while a number of IAC members are themselves alumni of the department, others serve because of longstanding ties between their firms and engineering at Iowa State or simply because of their interest in and dedication to higher education.

Here, then, are eleven more reasons why MSE sets the standard for excellence in engineering research and education at Iowa State!

Returning Members:

Darrell R. Degeus, Chair
Technical Director
Abrasives Laboratory
3M Abrasive Systems Division
St. Paul, Minnesota

Donald J. Bray
General Manager, R&D
Poco Graphite, Inc.
Decatur, Texas

Mike Covault
Seagate Technology
Minneapolis, Minnesota

Gerald (Skip) Fehr
Vice President, Technology
Integrated Packaging and Assembly Corporation
San Jose, California

Robert Gaster
Manager, Metals Research
John Deere Technical Center
Deere and Company
Moline, Illinois

Larry D. Hanke
Principal Engineer
Materials Evaluation and Engineering, Inc.
Plymouth, Minnesota

Michael J. Readey
Program Manager
Advanced Ceramic Technology
Peoria, Illinois

Dean Wiley
Owner
International Technologies Consultants, Inc.
Brighton, Michigan

Chris Hansen:
Summer dreams take flight year-round

Some college students spend their summers painting houses; others cut grass, flip burgers, or sweep floors—whatever it takes to get back to school in the fall.

Chris Hansen:
I conducted research on the use of a polyethylene-fiber epoxy-matrix composite material as a multi-functional material in space structures," the MSE senior relates, "with its primary function being that of a galactic cosmic radiation shielding material."

Not in his dreams, his dorm room, or even in a lab at Hoover Hall, but at NASA's George C. Marshall Space Flight Center in Huntsville, Alabama. And not just *one* summer, but the past *two*.

Hansen, a native of Hills in eastern Iowa, was part of the NASA Undergraduate Student Research Program, where he performed composite design, test panel and part fabrication, curing, mechanical testing, and high-impact testing of components. As part of the program, he made a final technical report and presentation to NASA engineers.

While at Iowa State, Hansen works primarily with Dr. **Rohit Trivedi** and Dr. **Shan Liu** at Ames Lab on digital imaging of solidification systems and Al-Si systems. He's co-president of Barton House residence hall, vice president of Honors Student Board, a mentor for the Gilbert School District, and a leader in the Salt Company, a student ministry.

Hansen, who plans to go for his PhD after a stint with Teach for America, is as high on MSE as the department is on him. "Iowa State MSE faculty provide an excellent education in materials science," he says, "that far outweighs the opportunities at other universities."

New Members:

Eldon D. Case
Professor
Chemical Engineering and Materials Science
Michigan State University
East Lansing, Michigan

Ted Grabau
Director
R. A. Engel Technical Center
Fisher Controls International, Inc.
Marshalltown, Iowa

Phillip D. Krotz
Commodity Manager
Rockwell-Collins, Operations
Cedar Rapids, Iowa

The MSE difference: Quality of students, opportunities show in graduate placement

If you're an alumnus, it may not be news to you that MSE students do a little better than the average Iowa State engineering graduate. Still, every now and then we like to remind alumni and friends just how hard we work to ensure the quality of the MSE degree and the respect it commands in the marketplaces of employment and ideas.

Take last year, for example. In a job market widely acknowledged as "soft," MSE bachelor's degrees went to the head of the class when it came to landing good jobs.

"Everybody who was looking for employment was placed by graduation—this at a time when a lot of schools are having trouble," says Associate Professor **Kristen Constant**. "A couple of people weren't actively looking, and even they found jobs within a month. But we've always had very good placement," she adds. "We've consistently been first or second in the college."

The success of the department's graduates in finding good jobs is no accident, but instead the result of recruiting talented and dedicated students to the field—not to mention talented and dedicated scholars to teach them. And it's not just jobs that distinguish MSE: the department also places a number of its graduates each year in some of the top programs in the nation. Of the 17 people graduating with the BS last spring, Constant notes, seven chose to go to graduate school instead of entering the workforce.

"That's a reasonably strong showing," Constant acknowledges. "But it's not unusual for us." Indeed, according to a six-year comprehensive survey she conducted both for accreditation and program purposes, Constant says, in any given year between 35% and 40% of MSE undergraduates go on to grad school—easily the highest rate in the entire college.

Constant cites several reasons for the high rate of students who continue their educations, not only in materials science, but also in medicine, law, and even the humanities. "This year nearly 70% of incoming students in our department were in the Freshman Honors Program, so the students coming in are strong, ambitious people," she observes. "And we have a lot of research faculty, so many students get experience in labs. They understand they have a lot more options with a graduate degree."

Also, Constant notes, today's undergraduates take full advantage of internships, co-ops, and international study opportunities. Some MSE students, including senior **Pete Sokolowski** in Germany and first-year grad student **Emily Kinser** in France (see "ASM/TMS 'Most Outstanding Chapter,'" p. 11), participate in international research programs. Others, such as senior **Chris Hansen**, in the photo to the right, have research experiences with government agencies and private industries that yesterday's students could scarcely dream of.

Expect more such opportunities in the future: the department had between 25 and 30 employer-generated requests for co-ops or interns last year alone, a bellwether of even more and better employment opportunities for MSE grads down the road. Based on past experience, Constant is confident she can fill them all.

"Things have changed," she says. "There are more people like Chris and Emily out there. Students were told to differentiate themselves—and they're doing it. Ask them, 'What makes you special?' Well, they're going to show you!"

In a job market widely acknowledged as "soft," MSE bachelor's degrees went to the head of the class when it came to landing good jobs.

MSE scholarship recipients 2004–2005

David R. Wilder Scholarship		Eric Patterson
Rockwell Women's Scholarship		Shannon Jurca
Mary and Donald Martin Memorial Scholarship		Brad Stumphy
David C. Lovell Presidential Scholarship		Nathan Fischer
Otto and Martha Buck Scholarship		Rebecca Ahrens
Frank Kayser Scholarship		Lucas Hale
Engineers Week Scholarships	Keith Bormann Sara Moeller Sarah Nevole Kristin Schipull Grant Thomas	Kent Heitman Andrew Nelson Sean Odeen Sarah Shiley
Roderick Seward, Flossie Ratcliffe, and Helen M. Galloway Scholarship	Andrew Heidloff	Jenny Wittmaack
David T. Peterson Scholarship		Timothy Sklenar
Murray Gautsch Scholarship		Andrea Siefers
Richard and Marilyn Engle Endowed Engineering Scholarship	Joshua Haroldson	Brett Krull
L. C. "Doc" and Lina Allen Endowed Scholarship		Brett Engle
Samuel Walker and Jennie Morrison Beyer Scholarship		Ryan Haase
Materials Science and Engineering Scholarships	Ryan Anderson Neal Porter Eric Wagner Noah Wiese	Daren Breid Charles Rossa Jason Walleser
Arie and Catherine Breed Scholarship in Engineering		Adam Hendrickson
Gordon Stiles Endowed Scholarship		Mitchell Smith
Floyd Herman Cook Scholarship in the College of Engineering		Wilber Lio
College of Engineering Scholarship		Mitchell Hunt
Deere Foundation Scholarship	Laura Kahler	Kelly Lawson
2004–2005 MSE National Merit and George Washington Carver Scholars	Andrew Becker Christopher Hansen Timothy Hosch Wilber Lio Paul Matlage Travis Norton Scott Williams	Qingzhe Chen Jonathan Havenga Joshua Huffman David Lopez Sarah Nevole Timothy Sklenar

Scholarship recipients

Success by the numbers: Annual awards banquet reflects growth of MSE

Mufit Akinc surveyed the crowd from the podium. "The first of these banquets we had about 24 people," the MSE chair said. "Last year there were 130. This year: 185."

There are many ways to measure success, not all numerical. But in the case of MSE, the numbers don't lie: thanks to the support of alumni and industrial partners, the department was able to recognize and reward an unprecedented number of students and faculty at its annual awards banquet last spring.

"We're making significant progress toward our goal of providing every student who needs it with financial assistance," Akinc continued, citing significant increases in tuition the past several years that have made "access to higher education more challenging than ever."

The fruit of the department's aggressively pro-student philosophy was amply displayed at the banquet in several special awards given to particularly outstanding students such as **Amber Schneeweis**, who was recognized with the MSE Outstanding Senior Award.

Schneeweis's recognition was especially meaningful for her mentor, Professor **Larry Genalo**. "I can't take credit for recruiting Amber to the department," Genalo quipped, "but I can take credit for recruiting her father—who recruited me to a fishing trip!" Schneeweis has since earned her master's degree as part of the department's joint BS/MS program, and is currently pursuing her PhD at Northwestern University.

Other student awards went to senior **Emily Kinser**, recognized with the MSE Student Leadership and Service Award, and PhD student **Bora Mavis**, who received the MSE Graduate Research Excellence Award.

Special recognition was given to several outstanding MSE faculty members as well, including Associate Professor **Kristen Constant** for "Excellence in Teaching." Ames Lab scientist and MSE Assistant Professor **Ralph Napolitano** received the "Excellence in Research" award, and MSE chair **Mufit Akinc** was recognized for "Excellence in Service" to the department.

Guest speaker was retiring Dean of the College of Engineering **James Melsa**, who spoke on the shifting model of corporate and scientific leadership from a nineteenth-century model based on the principles of "trench warfare" to a more collaborative approach for the 21st century. Melsa's leadership in helping MSE to rise to prominence over the past ten years was acknowledged by Akinc, who presented him with a gift on behalf of the department.

Among other special guests were several members of the department's Industrial Advisory Council, including IAC chair **Don Bray**, **Robert Gaster** of Deere and Company, **Michael Readey** of Caterpillar, Inc., and **Dean Wiley** of International Technologies Consultants, Inc. Also attending were IAC founding members **Dick Stilwell** and **Jim Watson**, the latter accompanied by his wife Janice.

Seniors Emily Kinser and Amber Schneeweis

Kristen Constant, Mufit Akinc, and Ralph Napolitano

Dean of the College of Engineering James Melsa

MSE faculty and staff

Materials Science and Engineering Department
Iowa State University
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Send comments, questions, and news items to our NEW location :

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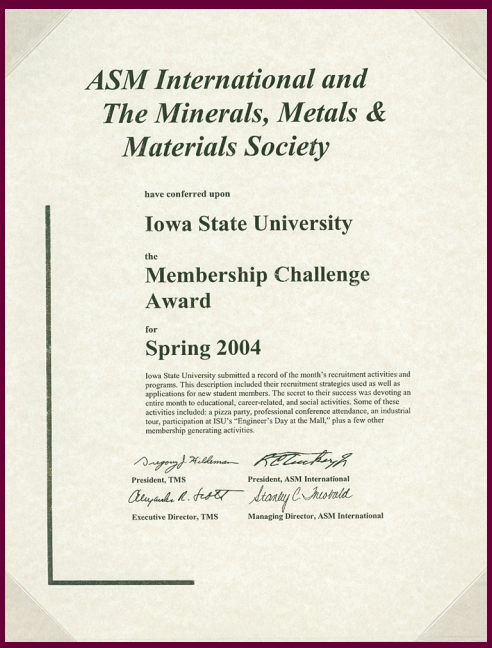
Phone: 515 294-1214
Fax: 515 294-5444
E-mail: mse@iastate.edu
Web site: www.mse.iastate.edu/

Iowa State University's MSE department received the Membership Challenge Award for an outstanding month's recruitment activities and programs.



ASM International and The Minerals, Metals & Materials Society

have conferred upon

Iowa State University

the

Membership Challenge Award

for

Spring 2004

Iowa State University submitted a record of the month's recruitment activities and programs. This description included their recruitment strategies used as well as applications for new student members. The secret to their success was devoting an entire month to educational, career-related, and social activities. Some of these activities included: a pizza party, professional conference attendance, an industrial tour, participation at ISU's "Engineer's Day at the Mall," plus a few other membership generating activities.

President, TMS — President, ASM International

Executive Director, TMS — Managing Director, ASM International

IOWA STATE UNIVERSITY