

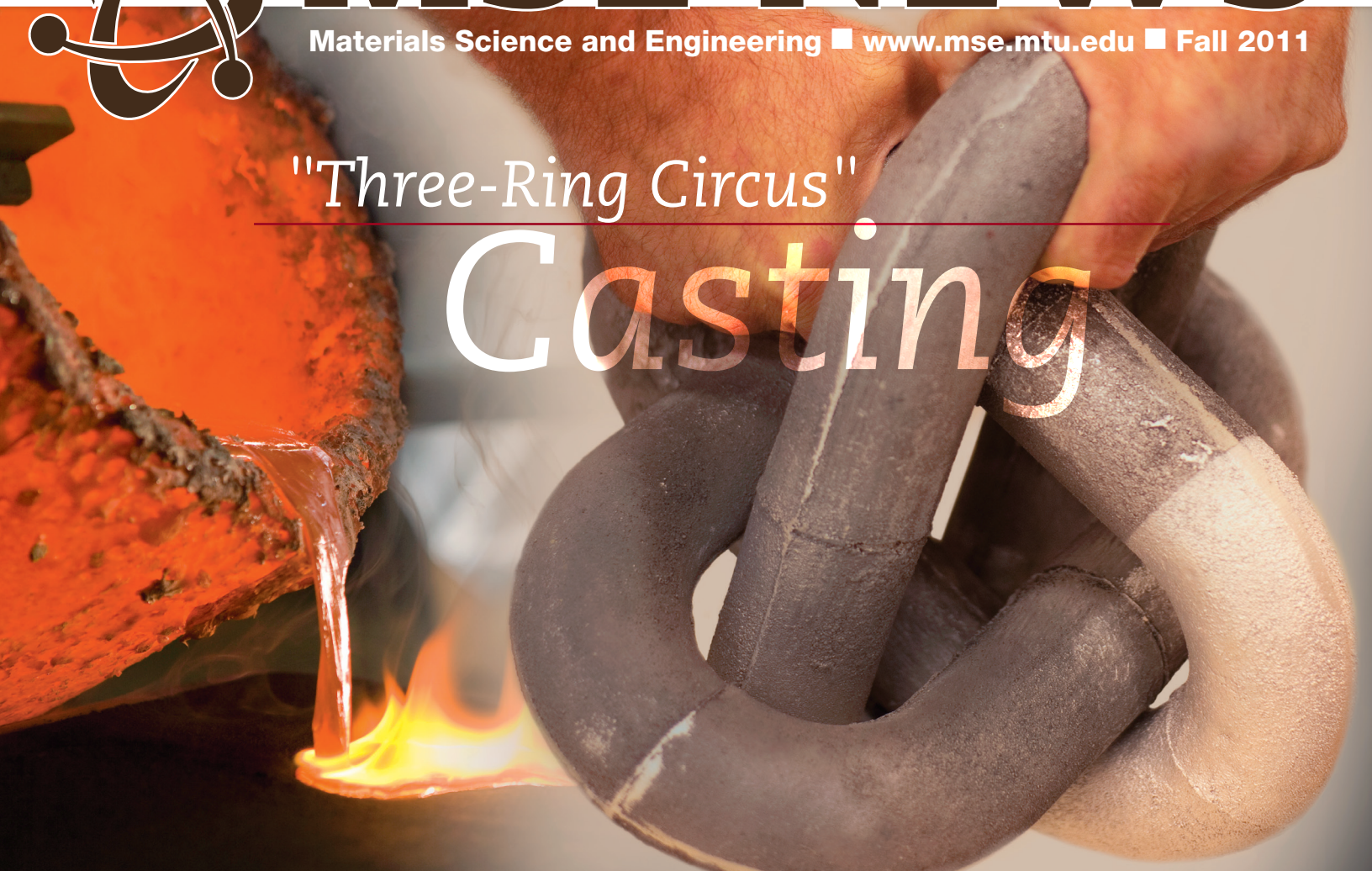


# MSE NEWS

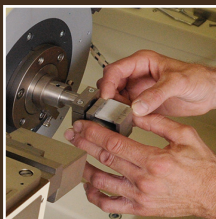
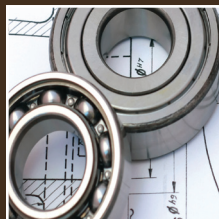
Materials Science and Engineering ■ [www.mse.mtu.edu](http://www.mse.mtu.edu) ■ Fall 2011

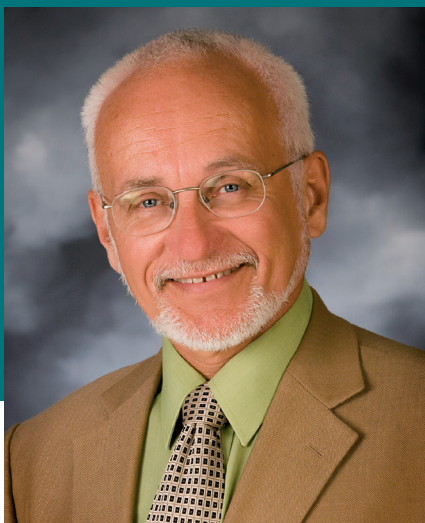
"Three-Ring Circus"

## Casting



MICHIGAN TECHNOLOGICAL UNIVERSITY





## A Message from Department Chair Mark Plichta

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# Chair Chat

Dear Friends:

I hope this letter finds you well. I am now entering my final year as department chair, and I want to take this opportunity to share with you the exciting things that are happening in the department. I cannot easily describe how proud I am of the efforts of faculty and staff to maintain our stature on campus and in the nation as an excellent program at both the undergraduate and graduate levels. Over the past five years:

- Our graduate student enrollment has grown over 100 percent.
- Our research expenditures have grown over 75 percent and continue to increase.
- We have added six new faculty, all of whom are highly active in research.
- Our average faculty publication rate is one of the highest in the College of Engineering.
- We are regaining our visibility at national and international conferences.

Another important change in the department includes the new state-of-the-art MSE Seminar Room to serve as a venue for the John and Virginia Towers Distinguished Lecture Series, a place for guest speakers from industry, most of our graduate-level courses, and dissertation/thesis defenses. This room is quite impressive and was made possible through generous gifts from alumni and industrial partners. Our seminar series each year is strong, thanks to the dedicated effort of Professor Jarek Drelich.

On the opposite page, there is a description of a campaign to generate resources that will enhance our undergraduate program. You will read about our new MSE Design and Computational Center and how you can help. I urge you to strongly consider supporting this endeavor. As all of you know, a laboratory-intensive, hands-on undergraduate curriculum has always been a hallmark of our program, and we are committed to retaining this culture. In addition, there is an increasing need to provide our students with meaningful exposure to other modern engineering tools. In particular, competence in the use of computational MSE software is critical to the success of our graduates in their careers. Unfortunately, laboratory equipment/upgrades and software packages are expensive, and there are limited resources available for their acquisition. We are turning to our generous alumni to help with this project.

As always, I am willing and eager to talk with each of you at any time. Your continued support of our program is needed and deeply appreciated. Thank you and I look forward to hearing from you soon.

Best regards,

A handwritten signature in black ink that reads "Mark R. Plichta".

Mark R. Plichta  
Professor and Chair  
mrplich@mtu.edu



## New Fund and Center: a Challenge, an Opportunity, and an Appeal from Chair Mark Plichta

We are taking our undergraduate education to the next level. Our program has always emphasized hands-on, laboratory experiences. Our graduates begin their careers with the ability to process and fabricate materials using a variety of techniques, from solidification to thin-film deposition, and they excel in the characterization and testing of their creations. However, we often fall short in the preliminary steps of materials design and processing—that is, employing modern tools to predict microstructures and properties of new materials processed in innovative ways. This shortcoming exists in many MSE programs; but with the advent of modern computational methods and development of new software, we now have the opportunity to approach materials design in new ways. We need to change how we educate the modern materials engineer, and it is our plan to set a new standard.

To achieve our aspirations, we recently established the **MSE Undergraduate Laboratory and Computational Fund**. This fund will help create a new curriculum and modern environment for our undergraduate students. We have the plan; we have the interest; but, unfortunately, we do not have all the resources. [We need your help!](#)

We have started the precursory steps in this endeavor. The new facility will benefit all undergraduates; in particular, it will serve as a home for the Senior Design and Enterprise teams. Using funds provided in the past by generous alumni, we were able to renovate and furnish the room, as well as obtain a small portion of the software requirements. What we lack are sufficient funds to purchase the remaining software requirements and perform upgrades of equipment. Our immediate needs include:

- \$40,000 for software packages and associated databases
- \$20,000 for computer interface for an X-ray facility
- \$30,000 for a new computer, software, and controller for the tensile testing machine

Our goal, then, for this first year, is \$100,000.

I am committed to this project and initiated the fund with a personal contribution of \$1,000. I challenge you to make a gift that reflects your appreciation for the strong education you received in the department. Let's be partners in this endeavor. I cannot express how important your generous donations will be to the success of our program. Your gift should be designated to the Michigan Tech Fund. Indicate that it is for the **MSE Undergraduate Laboratory and Computational Fund (Account No. 1601)**. **Thank you!**

# MSE Scientist

Positioned for Success with Unique Program

“

Use science and engineering  
to build better products.

”



Left: Kyle Dean, MSE senior. Right: Assistant Professor Paul Sanders.

**P**ut plainly, Paul Sanders is a metals guy who casts about for research opportunities that apply science and engineering “to build better products”—from wind turbines to hip implants.

Sanders, an assistant professor in MSE, came to Tech in 2009 after working for ten years at Ford Motor Company, including eighteen months in England at Jaguar Land Rover, where he specialized in brakes and wheels.

From his work in industry, he knows that “customer feedback drives engineering.”

From his work in academia, he knows that the needs of industry drive him to stay practical. “We start with the basic research,” he says, “we have applications in mind, and we use engineering to close the gap.”

Sanders is a native of Wisconsin who earned a BS in Metallurgical and Materials Engineering from Tech and a PhD from Northwestern University. “Michigan Tech has a history and reputation of graduating good metallurgical engineers,” he says. So much so, MSE Chair Mark Plichta estimates that nearly 10 percent of the foundry engineers in the country are Tech graduates.

### **‘Tech is unique’**

Sanders’ research focuses on casting metals. Michigan Tech, he reports, has an excellent foundry that is one of a few nationwide and emphasizes metallurgy applied to metal casting.

“Metal casting went out of favor,” he says, “Many universities got involved in nano and bio, and few are doing the big stuff that gets done in industry. We kept our foundry. Now there are only a handful of foundries at universities in North America. We maintained and improved the technology, while most got rid of it, only to find that it’s critical to our future. So we’re unique.”

He partners with Oak Ridge National Laboratory, as well as industry leaders such as ArcelorMittal, Eastern Alloys, East Jordan Ironworks, GE Aviation, and ThyssenKrupp Waupaca. He can give these firms a good deal. “We can cast up to 300 pounds of iron. Some can’t cast less than 3,000 pounds. Doing the work that we do would cost \$5,000 an hour. We can do it for one-hundredth the cost.”

In this kind of work, Sanders deals with three initiatives: aluminum alloys, ductile iron, and porous metals.

### **Aluminum alloys**

The challenge in this work is to design new aluminum alloys that are ductile and strong at high temperatures. “Toughness is what we’re looking for—light material that absorbs a lot of

energy before it breaks.” The applications: lessen the damage in a vehicle crash, make better armor, and develop high-temperature automotive components.

### **Ductile iron**

One rugged application of this material is wind turbines, which entail thousands of pounds of metal, especially the hub that holds the blades. “Everybody wants to put wind turbines offshore. Picture one in the North Sea. It’s a harsh environment—very cold, very strong wind—and these devices are likely to crack in those conditions.” As with aluminum, the overarching goal is “stronger, tougher alloys that are thinner and lighter weight.”

### **Porous metals**

This work goes against the grain: “Usually, pores or voids in metal make them weaker. We’re trying to design in porosity.”

He takes his inspiration from nature. The roots of the lotus plant have long, cylindrical pores. “We’re trying to create the same structure in metal.” One term for this structure is “lotus foam.”

The applications: implants, say, for a new hip. Now titanium is used, and doctors have to rough up the surface of the metal so the bone adheres better. “If we can make pores in the metal, the bone will grow into those pores and anchor the implant more securely.” Metal is denser than bone. “If we can make metal implants porous, and make the density more like bone, they will integrate better with your body. So we need to know how to design the pores and control their size and spacing.”

Besides Enterprise, Sanders, a Six Sigma black belt while at Ford, instructs his students in the statistical tools that enhance manufacturing. The students apply these tools to Senior Design projects, including a heart pacemaker (the materials to hold it in place) and a bio-absorbable stent (material that will dissolve when it’s no longer needed).

As he works in the crucible of metal processing, Sanders foresees a purposeful life. “I like it here, and I like educating students. I don’t have any grand goals for myself. I just want to make a contribution to the next generation. I’ve been helped by many people to get where I am, and I want to return the favor.”



# Student Accomplishments and Awards

- Senior **Lance Taylor** has accepted a position on the student board of ASM International. Taylor was also the MSE Department Scholar for academic year 2010-11, was a finalist for the \$25,000 Ellwood Group Scholarship, and received a TMS Light Metals Scholarship.
- 2011 graduate **Amberlee (Lifer) Haselhuhn** was nominated as the department's 2010-11 "Woman of Promise." She began graduate studies at Michigan Tech in fall 2011.
- 2011 graduate **John Kinzinger** received a Tech award for "Exceptional Enthusiasm as a Student Leader."
- 2011 graduate **Patrick Bowen** was awarded two Charles and Carroll McArthur Undergraduate Research Internships, has had work published in the journal of the American Ceramic Society, received a Michigan Space Grant Consortium Undergraduate Fellowship, a Student Undergraduate Research Fellowship (SURF), and was awarded one of two national student awards from the TMS Extraction and Processing Division. He began graduate studies at Michigan Tech in fall 2011.
- 2011 graduate **Karl Warsinski** published a paper, "Investigation of Lazy S Feature in Self-reacting Tool Friction Stir Welds," in the Friction Stir Welding and Processing VI Conference Proceedings for the spring 2011 TMS Conference. He began graduate studies at Michigan Tech in fall 2011.
- PhD candidate **Joseph Licavoli** received a \$2,500 Ron Ruddle Scholarship from the Foundry Educational Foundation (FEF).
- 2011 graduate **Michelle Loomis** received a \$1,500 George Booth Scholarship from the American Foundry Society, Detroit-Windsor Chapter.
- 2011 graduates **Mark Twilley** and **Michelle Loomis** shared a \$2,000 undergraduate research award from the Northeastern Wisconsin (NEW) chapter of the American Foundry Society (AFS). Both gave talks at the NEW AFS meeting in March and received their awards. Twilley presented "High Strength Low Alloy Aluminum and ASTM B-108 Mold Redesign," and Loomis presented "Microstructural Evolution During Low Cycle Fatigue of an Aluminum Metal Matrix Composite."
- 2011 graduate **Mena Klittich** was named on a patent application for work that she performed on microwave containers during her 2009-10 co-op with Alcan Packaging.

## Students Excel in Casting Competition



A team of MSE students won a state college casting competition sponsored by the American Foundry Society.

The casting was composed of three twelve-inch, chain-like links that joined at right angles. Pat Quimby, MSE laboratory coordinator, affectionately calls it the "Three-Ring Circus." He said the casting was "tricky" and the students "did a bang-up job."

Kyle Deane, a senior from Gaylord, Michigan, helped lead a team of fourteen, and he and others gave up spring break to work on the project. He is the president of the campus chapter of the American Foundry Society, and he works as much as he can in Tech's foundry. "I like to get my hands in things," he says. "Our project was more complex than everyone else's. Winning was a good reward for challenging ourselves."

Student teams were first required to do a computer-aided design of the casting that was judged on completeness, graphic accuracy, proper dimensions, and design rules. The casting itself was judged for precision, complexity, surface finish, and uniqueness. It is featured on the cover photo.

## Senior Design/Enterprise Projects



### Heat Treatment of Creep-Strength Enhanced Ferritic Steel—1st place, 2011 Michigan Tech Expo-Image Contest

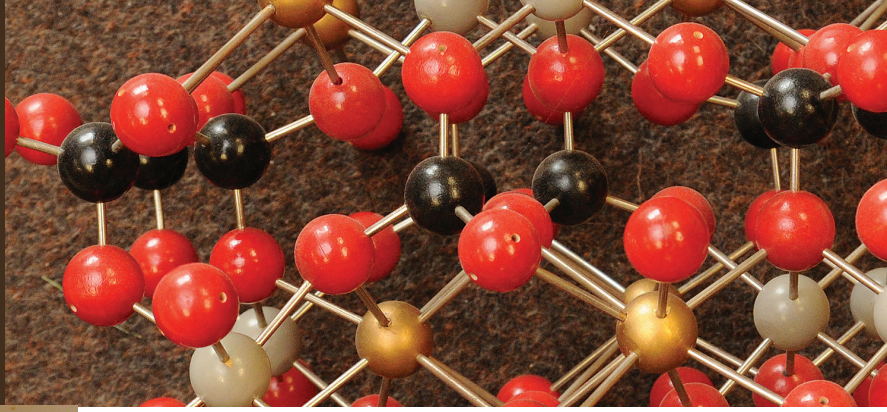
This student team investigated the cooling rate after normalization heat treatment to ensure proper microstructure in components required to withstand high temperatures and pressures. Team members were Kyle Anderson, Luke Gilbertson, Christopher Heczko, Ran Liao (ME-EM), and Helen Ranck; faculty

advisor was Professor Calvin White. The corporate partners were John Shingledecker (MS '03) of the Electric Power Research Institute (EPRI) and Clint Zimpel of BendTec.

### Other 2010-11 Senior Design/Enterprise Projects:

- Bearing Wear Reduction in Steel Aluminizing, sponsored by ArcelorMittal
- Corner Crack Formation in Continuously Cast Steel, sponsored by ArcelorMittal
- Economic Recovery of Alloying Elements from Grinding Swarf, sponsored by the Casting Services Group
- Creep Behavior of EZAC Die-Cast Zinc Alloy, sponsored by Eastern Alloys, Inc.
- Bioabsorbable Metal Stent Degradation Stimulation, sponsored by Boston Scientific

# Department News



## Faculty and Staff

- Chair Mark Plichta is PI and Engineer/Scientist Ed Laitila is co-PI on an initiative to upgrade the department's Energy Dispersive X-ray Fluorescence Detector, a project that received \$27,525 from Michigan Tech's Research Excellence Fund (REF).
- Senior Engineer/Scientist Owen Mills published a paper, "Shape and surface area measurements using scanning electron microscope stereo-pair images of volcanic ash particles," in *Geosphere*, in October 2010. Mills also chaired a session, "Equipment Funding Opportunities and Strategies for Success," at the 2011 meeting of Microscopy and Microanalysis in Nashville, Tennessee.
- In fall 2010, Assistant Professor Paul Sanders accompanied thirty-nine students and alumni on a plant trip to foundries Karl Schmidt Unisia in Marinette and ThyssenKrupp in Waupaca, Wisconsin. Both firms manufacture automotive and elevator components.
- Drs. Yun Hu and Yu Wang have been promoted to associate professors with tenure.

*Associate Professor Yun Hu (center) is pictured with PhD candidates Lei Zhang (left) and her spouse Zheng Zhang (right), both of whom he advises.*

## Advisory Board Provides Leadership and Service



The MSE External Advisory Board (EAB) meets annually with the MSE department to evaluate programs and plans; encourage collaboration among faculty, students, and practicing engineers; and help enhance departmental resources.

**First row, left to right:** Peter Carpenter, Whirlpool Corp.; Jim Brusso, Engel Metallurgical; Sally Klaasen, formerly with IBM Microelectronics

**Second row, left to right:** Greg Olson, Northwestern University; Kathy Hayrynen (emeritus), Applied Process Inc.; Joe Nowosad, ArcelorMittal

**Third row, left to right:** Mike Johnson, Caterpillar Inc.; Paul Prichard, Kennametal Inc.; Paul Jones (emeritus), ThyssenKrupp

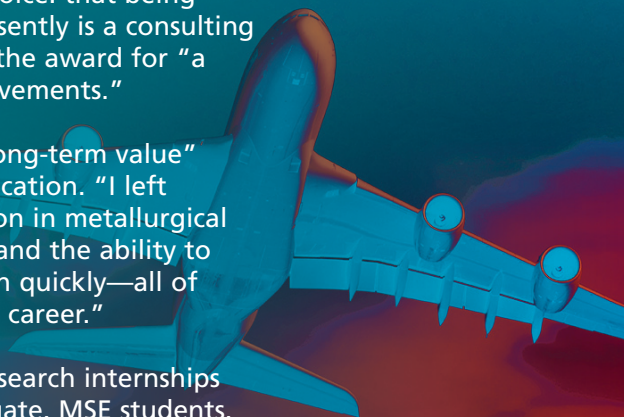
## Giving Back

### *Alumna Directs GE Edison Award to MSE*

Barbara (Stoyack) Link has been with GE Aviation since graduating in 1977. She recently earned GE's Edison Award, which includes a \$25,000 contribution to the university of her choice: that being Michigan Tech. She presently is a consulting engineer and received the award for "a lifetime of career achievements."

Link appreciates "the long-term value" of a Michigan Tech education. "I left with a strong foundation in metallurgical engineering principles and the ability to problem solve and learn quickly—all of which helped me in my career."

The gift will support research internships for female, undergraduate, MSE students, because one of her fond memories of the department is "faculty who took an interest in—and were available to—the students."



## Alumni Updates

**James J. Graham '70** was elected to the board of directors of Texas Rare Earth Resources Group (TRER), and **K. Marc LeVier '77** has been appointed chief executive officer of TRER. TRER is a North American-based mining company currently developing Round Top Mountain in Hudspeth County, Texas.

**Vinod "Vinny" Gupta '75** was nominated for a five-year term on the Ohio Board of Regents by Gov. John Kasich.

**Wayne Heili '88** has been promoted to president, COO, and director of UR-Energy, a junior uranium company with corporate offices in Littleton, Colo., and registered offices in Ottawa, Ontario, Canada.

**Glenn Hoffmeyer '90** was hired by Curis Resources Ltd., of Vancouver, British Columbia, as manager of metallurgy and mineral processing for the Florence Copper Project in central Arizona.

**Erik Luhta '00** is an applications/commissioning engineer with FLSmith Krebs/Mill-Ore Products in Timmins, Ontario, Canada.

**Joseph Wist '92** is an associate professor at Ferris State University in Big Rapids, Michigan. His areas of teaching and research are casting processes, resistance spot welding, and process control and improvement.