Dear Alumni, Colleagues and Friends,

Greetings from Rolla! Three years have passed since the last Newsletter was written. My apologies for such an extensive absence. Many wonderful things have happened during this time period; too many to even contemplate including all of them into a short newsletter. I always marvel at the accomplishments of the students, faculty, and alumni. Enrollments in Ceramic and Metallurgical Engineering are at all-time highs (117 MetE and 171 CerE Fr/Soph/Jr/Sr), making us the 4th largest undergraduate MSE program in the country. Our labs are stretched to the limits! But we have a solution that involves adding an addition to McNutt Hall that is described herein – I think you’ll be pleased with what we seek to do. With 18 faculty our student:faculty ratio is ≈ 16:1, a highly desirable ratio, but one that carries with it a responsibility to maintain high research productivity. It’s no accident that MSE still leads the campus in research per faculty member. A simple matter of maintaining standards set by faculty 50 years ago.

This newsletter reports on many items that all reflect one thing: student success is priority #1. I know you will enjoy reading about all the great things going on. You can be proud of the student groups and all of the service activities they do to inspire the next generation of engineers and scientists. It’s no wonder they won national awards again at the MS&T conference 2013 and 2014. Thanks again to Bill Horst (’51 MetE) and his wife Ann for endowing the Thomas J. O’Keefe Student Professional Fund – having a budget allows the student groups to strategically plan activities throughout the year. Many distinguished alumni and leaders came to the department to give lectures, most notably Chris McReynolds and Bill Horst, the Thomas J. O’Keefe Lecturers.

The Phonathon will be held during mid-October this year, beginning on October 11th. I hope you received this newsletter just a few days before the event. The university has changed the way Phonathon is run – only paid callers are used as compared to the marathon sessions the MSE students and faculty enjoyed in previous years. All of the Phonathon funding is used to support freshmen scholarships and the labs, so we hope you will contribute strongly as before.

You may not realize this, but it is not an understatement to say that without the strong support of our alumni the department would cease to exist. Alumni created the endowments that allowed us to give $313K in scholarships to the undergraduates this year, and provided over $300K to help run the labs. Eighty percent of the cost of running our labs is covered through gifts and endowments.

Is it even possible to appropriately thank you for such tremendous support? The only way imaginable is to focus our undivided attention on giving today’s students the tools they need to succeed. It’s our passion, and our responsibility. And you may be rest assured that we are steadfast in this mission.

Herein you will also read of the tragic news of the passing of Professor Kent Peaslee, who left this earth in May 2013 the day before graduation. Kent continues to inspire us all, and students still walk across the stage who became engineers because of his influence.

We hope this newsletter finds you and yours in good health & spirits.

Wayne Huebner
September 2015
Welcome Dr. Caizhi Zhou

Dr. Caizhi Zhou joined the MSE faculty in January, 2013 as one of the Roberta and G. Robert Couch Assistant Professorships to attract new faculty members to the steel field. He earned his PhD in Chemical Engineering and is now a Research Assistant Professor in the MSE Department working on biomaterials. He has one son and one daughter.

Welcome Dr. Ron O’Malley

Dr. Ron O’Malley joined the MSE Department in January 2014 as the F. Kenneth Iverson Chair of Steelmaking Technologies and the Director of the Kent D. Peaselee Steel Manufacturing Research Center (PSMRC). Ron brings to these appointments over 30 years of experience in the steel industry, principally at Nucor Steel as Chief Metallurgist and at Amco/AK Steel research where he rose to the position of Principal Research Engineer in steelmaking and casting technology. The PSMRC currently has 14 corporate members and is funding 10 graduate students to study a variety of issues related to steel manufacturing, including inclusion engineering and clean steel manufacture, generation 3 advanced high strength steel development, measurement and modeling of high temperature deformation processes, and continuous casting mold flux and mold heat transfer research. Ron is teaching the graduate course on Kinetics Theory for Materials (MSE 6170 (423)) and undergraduate/graduate courses on Principles of Steelmaking (MTE 4450 (358)) and Deformation Processing (MTE 3440 (321)).

Dr. Caizhi Zhou

Professor Ron Kohser retired in July 2014 after 38 years of dedicated service to the students of Missouri S&T. Ron’s legacy at Missouri S&T is mostly felt through his excellence in the classroom, and recruiting/advising thousands of students during his career. He is most famous for always telling students they will work 10,000 days in their life, while stressing the importance of loving what you do so you never work a day in your life. Ron’s door was always open to students, gladly dropping what he was doing to help, listening carefully, and giving sage advice or help. He always had high expectations for the students, and treated them as adult engineers from day one. He was an advisor for Freshmen Engineering Academic and many student organizations including Phi Eta Sigma and the Campus Crusade for Christ. For many years he directed the Jackling Institute and the ASM Summer Camp, recruiting literally thousands of students to UMR / Missouri S&T. The faculty, staff, and students miss Professor Kohser dearly! He and his wife Barb moved over the Lake of the Ozarks, where they built a new home on a bluff overlooking the lake.

Dr. Ron O’Malley

Professor Dr. Joseph Newkirk

Professor Joe Newkirk was named a Fellow of Alpha Sigma Mu, the International Professional Honor Society of Materials Science and Engineering, and also received the 2014 Faculty Service Award for his work with student groups, graduate faculty council, and service to professional societies, such as the Charing ASM International Hand- book Committee. He recently was a conference organizer and key speaker for the International Conference on Materials Science Applications In Metallurgy, Machine Building And Power Engineering in Ekaterinburg, Russia. This was his second trip to Russia at the invitation of the Russian Federation.

Curators’ Professor Emeritus Delbert E. Day was honored with the 2013 President’s Award for Lifetime Contributions to the International Glass Community of the 23rd International Congress on Glass in Prague, Czech Republic, in July 2013. The many contributions to glass science and technology cited by the ICG President included Delbert’s work on ion dynamics, phosphatate waste glasses, and glasses for biomedical applications, his long career teaching generations of students about glass science and engineering, and his founding of Mo-Si Corp., now one of the premiere specialty glass operations in the United States. Prof. Richard Brow, representing the American Ceramic Society at the Congress, had the pleasure of receiving the award for Delbert in Prague, then delivering it to him (picture to the right) later that summer. In April 2015, the Phelps County Regional Medical Center (PCRMC) broke ground for the Delbert E. Day Cancer Institute (DDCI). The DDCI, shown above as an artist’s rendition of the planned facility, recognizes in part Delbert’s own contributions to the treatment of liver cancer with his development of radioactive glass spheres (Theraspheres®) and his more recent research on novel bioactive glasses for hard and soft tissue repair and regeneration.

Dr. Joseph Newkirk

Joe receiving 2014 Missouri S&T Service Award from Provost Marley

Delbert E. Day Cancer Institute

Dick Brow and Delbert Day

Dr. Caizhi Zhou

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Dr. Caizhi Zhou joined the MSE faculty in September 2015 as one of the Roberta and G. Robert Couch Assistant Professors of Materials Science & Engineering. He earned his PhD in MSE from Iowa State University, followed by a postdoctoral research associate position at Los Alamos National Laboratory before joining us. His research involves modeling techniques that link atomistic interactions to micro- and meso-scale properties to understand fundamental deformation and strengthening mechanisms for materials in extreme environments, including super-alloys at high temperature and nano-scale systems.

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Awards and Honors

MS&T 2013 in Montreal

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Delbert E. Day Cancer Institute

Dick Brow and Delbert Day

Kent D. Peaslee, Kenneth J. Iverson Steelmaking Chair

The MSE Family was shocked by the sudden and unexpected passing of Curators’ Teaching Professor and Kenneth J. Iverson Steelmaking Chair Kent D. Peaslee on May 17th, 2013. The previous month, Kent had just finished his term as President of the Association for Iron and Steel Technology, and he was preparing for the inaugural meeting of the Steel Manufacturing Research Center at S&T when he passed away in his sleep. Kent received his BS from the Colorado School of Mines, Kent worked in the steel industry for thirteen years, before he and his family moved to Rolla to begin life as a graduate student. Kent received his PhD in Metallurgical Engineering from UMR in 1994, then stayed on to become one of the most highly regarded and accomplished faculty members at the University. Over his career he received ten outstanding teaching awards and the 2007 Governor’s Award for Excellence in Teaching, five faculty excellence awards, and four times was named the METE Professor of the Year. More importantly, he inspired hundreds of students who learned from him how to make steel, how to model heat flow, how to recycle materials, and how to craft a top ten list of corny jokes.

Kent’s research and teaching was influenced by the time he spent in steel mills, and this experience gave him an authority that was recognized by both students in his classroom by the industry representatives who signed on to become part of his research center. Those colleagues honored his memory at their first meeting by renaming Kent’s center the Kent D. Peaslee Steel Manufacturing Research Center, where it serves today to remind new generations of students and researchers about the gifts and vision of Rolla’s Steelmaking Professor.

Ceramic engineering faculty and alumni were well-represented at the 2013 annual meetings of the American Ceramic Society, held in Montreal, Quebec, Canada. Prof. Richard Brow finished his term as ACerS President, and had the opportunity to host the annual awards banquet where Geoff Bremauskas (CerE’01, ’92) received the Karl Schwartzwald Professional Achievement Award in Ceramic Engineering Award as the “nation’s outstanding young ceramic engineer.” Prof. Bill Fahrenholtz delivered the Greaves-Walker Lifetime Service Award from the National Institute of Ceramic Engineers and Prof. Greg Hilmas delivered the Arthur Friedberg Memorial Lecture. Myra Ferris (Card’15) and Jake Ivey (Card’14) won both parts of the Mug Drop Competition for producing the toughest and most aesthetically pleasing entries, and Steven Ashlock (Card’14) took top honors in the inaugural “ceramic disc golf” competition.
Each year the University of Missouri System honors faculty on the four campuses with awards to recognize the contributions of faculty in the teaching, research and service missions. In 2013 Professor Wayne Huebner received the UM President’s Award for Mentoring in recognition of two decades of mentoring faculty across campus.

Congratulations Wayne!!

We could fill the pages of this newsletter with images from the graduation ceremonies over the last three years! Being in a room with 5,000 happy people every commencement exercise is truly a memorable event. We have pictures from every graduation, so if you would like a copy of your graduating class simply send us a note and we will send one to you!

The student groups engage in many community-service activities including: 1) sponsoring a fall can drive for a local food bank; the students and faculty compete, with the losers being pied, 2) running the Composite Materials Merit Badge in February as part of Merit Badge University, and 3) hosting Open Foundry Days where students can cast an aluminum object using the lost foam technique. On top of this they host seminar speakers, organize field trips, coordinate mentoring activities to assist with classes, run an etiquette dinner for students preparing to interview, host a Materials Day for local high school students, run tours during Open House, etc.!

In April 2014 a group of nine MSE students and three faculty were asked to represent Missouri S&T at the 3rd USA Science & Engineering Festival, the largest science festival in the United States. Over a period of 4 days ≈300,000 people came to the convention center, mostly K-12 students and their teachers. The MSE students prepared 10,000 mini-demo kits to hand out. Many hands-on experiments were performed with the students, including demonstrating tempered glass, pulling “glass” fibers from Jolly Ranchers, bending heat–treated aluminum nails, shape memory wire, and fiber optics. An unforgettable experience!

Each year the Mines and Metallurgy Academy chooses one student from each degree program to honor at their spring induction ceremony. Candidates are nominated by their peers, and then an extensive review process is performed by Academy members to choose awardees. Criteria include not only academic credentials, but demonstrated leadership attributes. Shown at the left are the Met & Ceramic scholars for the past three years. Jennifer works at CenterTech, Ryan is pursuing a Ph.D. at UC-Berkeley, Lindsay is pursuing a Ph.D. at the Colorado School of Mines, Brittany works for Watlow Electric, Calum works for ArcelorMittal, and Cora works for Bechtel. All rising stars!

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<th>MSE Alumni Support the Students!</th>
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<tr>
<td>Metallurgy scholarships: $208,250</td>
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<tr>
<td>Ceramic scholarships: $104,650</td>
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<tr>
<td>MSE undergrads also received over $100,000 in scholarships from professional organizations</td>
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Keramos & Material Advantage Groups win National Awards at MS&T 2014 in Pittsburgh!

Funding from the O’Keefe Student Professional Development endowment are used to partially offset registration and travel expenses for students to attend these conferences every year. About ¼ of our students participate annually, with most students going at least once during their undergraduate career. For the past two MS&T conferences in Montreal and Pittsburgh, the department provided a bus for their safe journey.

Phonathon Dates: October 11-22, 2015

Missouri S&T Students Win Awards at MS&T 2014 in Pittsburgh

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Congratulations Wayne!!

Students/Student Group News

MSE is home to six separate students groups. Over the course of a year they perform an incredible array of service and professional development activities, many of which are highlighted in accompanying pictures and summaries. Their activities are sponsored by the Thomas J. O’Keefe Student Professional Development endowment; this gift was bestowed upon the department by Ann and Bill Horst (MetE ’51). Without a doubt, this gift transformed the activities of all six groups, inspiring them to reach out to the next generation of future engineers!

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Phonathon Dates:
October 11-22, 2015
Caterpillar-APEC Scholars Program

The inclusion of experiential learning is an important educational opportunity at Missouri University of Science and Technology. The University has a mission to integrate application with education, and part of the University strategy is to provide experiential learning to all students. Additionally, the University has a broad initiative to connect arts and science in new ways to augment student education. Student interest in applied glassforming and metalworking has increased, and there is significant impetus for shop space dedicated and designed specifically for student exploration of these materials. Dedicated glassblowing and blacksmithing shop space will expand available experiential learning on campus. It will also offer a tangible way to link materials engineering science to the deeper human history of art and craft. The main focus of the building is to aid students’ exploration of process. There was also a strong desire to use a bold architectural statement at a prominent edge of campus.

McNeil Addition Plans for a Glassblowing and Blacksmithing Studio
The new 20,000 sq. ft. facility will serve multiple functions. Its main purpose will be as the shop for glassblowing and blacksmithing, but it will also add critically-needed lab space to support the CerE and MetE undergraduate programs. As part of the accessibility to the public, the new facility will also contain an event space which will expose, display, and feature students working and student work product. There should be several points of access where the public can range from very active to very passive viewing of the work space.

Potential benefits of the BME Minor:
A minor program in BME could have significant benefits for undergraduate students at Missouri S&T. A BME minor coupled with a B.S. degree in engineering or science should enhance the potential of Missouri S&T graduates for careers in the biomedical industry, admission to graduate school to pursue biomedical engineering, or admission to medical or dental schools.

Curriculum Requirements:
Minimum 15 credit hours required, consisting of:
1 required course: “Introduction to Biomedical Engineering”
≥ 4 elective courses (≥ two at or above 4000 level)

New Biomedical Engineering Minor begins Fall 2015
What is Biomedical Engineering (BME)?
BME applies engineering principles and methods to medicine and biology with the goal of improving the quality and effectiveness of patient care. BME includes areas such as biomaterials, biomechanics, cell, tissue and genetic engineering, biosensors, biomedical imaging, rehabilitation engineering, orthopedic bioengineering and clinical engineering.

Biomedical engineers are employed in universities, industry, hospitals, research facilities, in academia, and government agencies.

According to the ASEE, BME is one of the fastest growing engineering disciplines in US universities. BME was rated the most valuable college major in terms of salary and career prospects by the US Bureau of Labor Statistics in 2014.

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The highest honor a department can bestowed upon an alumnus is the awarding of a Professional Degree (PD). Each year departments are allowed to nominate recipients, and five are chosen to receive the PD at each commencement. The competition is fierce; typically 40 are nominated from amongst 57,000 alumni. MSE is blessed with incredibly accomplished alumni, and we are proud that for each of the last two spring commencements Kevin James and Linda Harrell were honored.

**General News**

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**Caterpillar-APEC Scholars Program**

Missouri S&T has received funding from Caterpillar to establish the CAT-APEC Scholars Program. This program, administered by the Department of Materials Science and Engineering, will award four $1,250 scholarships to MSE undergraduates each semester.

APEC is the Asia Pacific Economic Cooperation, with 22 member nations. Their purpose is to "build a dynamic and harmonious Asia-Pacific community by championing free and open trade and investment, promoting and accelerating regional economic integration, encouraging economic and technical cooperation, enhancing human security, and facilitating a favorable and sustainable business environment."

**ABET-accredited CerE & MeE Undergraduate programs**

- Alfred University
- Missouri S&T
- University of Alabama
- Colorado School of Mines
- South Dakota School of Mines and Technology
- Montana Tech
- University of TX, El Paso
- University of Nevada, Reno
- University of Utah

**McNet Addition Plans for a Glassblowing and Blacksmithing Studio**

The inclusion of experiential learning is an important educational opportunity at Missouri University of Science and Technology. The University has a mission to integrate application with education, and part of the University strategy is to provide experiential learning to all students. Additionally, the University has a broad initiative to connect arts and sciences in unique ways to augment student education. Student interest in applied glass forming and metal working has increased, and there is significant impetus for shop space dedicated and designed specifically for student exploration these materials. Dedicated glassblowing and blacksmithing shop space will expand available experiential learning on campus. It will also offer a tangible way to link materials engineering science to the deeper human history of art and craft. The main focus of the building is to aid students’ exploration of process. There was also a strong desire to use a bold architectural statement at a prominent edge of campus. 
Research Highlights

Building on traditional core strengths in ceramic and metallurgical engineering, the department is conducting leading edge research in a wide variety of areas. The formation of the Peaslee Steel Manufacturing Research Center (PSMRC) led by Prof. Ron O’Malley has resulted in tremendous growth in the scholarly activity and visibility of the students and faculty associated with the PSMRC. With 15 consortium members, including steel and foundry producers along with refractory and consumable suppliers, the PSMRC is supporting several graduate and undergraduate students working on a diverse set of projects. Among the topics being investigated are grain refinement of austenitic steels during solidification, modeling and simulation of rounds and beams during hot working, development of 3rd generation advanced high strength steel, and non-metallic inclusion engineering for improved properties.

Parker Freudenberger, a second year graduate student in the Materials Science and Engineering Department, spent ten weeks this summer in Japan working with researchers there to develop novel phosphate optical glasses. Parker spent the first half of the summer at Ehime University in Matsuyama working in the group headed by Profs. Hiromichi Takebe and Akira Saito. For several years, Profs. Takebe and Saito have exchanged research results on phosphate glasses with Prof. Richard Brow, and Prof. Saito spent September 2014 in the Materials Research Center at S&T using techniques developed by Brow and his students to characterize these glasses. After a month at Ehime University, Parker moved north to Otsu City, near Kyoto, to complete her work in the research labs of Nippon Electric Glass, where she was hosted by Dr. Shingo Nakane. Over the summer, Parker prepared and characterized a series of alkali-alkaline earth phosphate glasses that will be used for a bio-resorbable optical device being developed at S&T by Prof. Chang-Soo Kim (ECE) and Prof. Brow in a project supported by the University of Missouri Research Board. Parker’s travel was supported by the International Materials Institute on New Functionality for Glass and by the National Science Foundation (DMR-1207520).

Graduate Student Spotlight

At the forefront of materials research is Integrated Computational Materials Engineering (ICME), which is defined as “the integration of materials information, represented in computational tools, with engineering product performance analysis and manufacturing process simulation”. This enables the design and manufacture of materials from atoms to bulk components using modeling and simulation based on experimental data. Prof. Mohsen Asle Zaeem and Prof. Caizhi Zhou are actively involved in the ICME research community. Prof. Zaeem was using phase-field modeling of grain growth and phase transformations to study and predict the influence of processing conditions and ambient. Simulation on the dynamics of dislocations of crystal plasticity under high strain rates is being studied in Prof. Zhou’s research group.

Three dimensional, additive manufacturing has been highlighted in the national news the last couple of years for the ability to fabricate parts from teeth to guns using computer aided design files to build up material layer by layer into a finished product. Prof. Joe Newkirk’s group has been collaborating with colleagues in the Mechanical and Aerospace Engineering program to develop and optimize direct metal deposition. Funded by NASA for space applications, the group is investigating bulk metallic glasses, shape memory alloys, and functionally graded materials. The approach allows tailoring of compositions and cooling rates that can produce near net shape components.
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The department is very active in biomaterials research and education through the Center for Biomedical Science and Engineering led by Prof. Len Rahaman. One of the many projects being investigated is on bioactive glass as a delivery device for therapeutic ions in wound healing. Doping of the glass with metal ions, such as copper, has been shown to stimulate angiogenic gene expression of fibroblasts in vitro and angiogenesis in vivo. Borate glasses with copper doping enhance healing of skin wounds in laboratory testing.

As part of the campus wide strategic plan four signature research areas were selected for focus faculty hiring. Three of the signature areas, Advanced Materials for Sustainable Infrastructure, Advanced Manufacturing, and Enabling Materials for Extreme Environments, have strong ties to the department. Prof. Aditya Kumar was hired under the Advanced Materials for Sustainable Infrastructure signature area for his expertise in cement. The Enabling Materials for Extreme Environments area is led by Prof. Bill Fahrenholtz and builds on the work he and Prof. Greg Hilmas have done on ultrahigh temperature ceramics for aerospace applications but will now expand into other applications such as nuclear fusion and ballistic impact.

The MSE Fall Picnic sponsored by Nucor Corporation was held on September 21, 2015. Approximately 150 faculty, staff, students and representatives from Nucor, SSAB, Tinker Air Force Base, Dal-Tile, Kohler, Caterpillar and Honeywell attended.

Notice the nice pink shirts (courtesy of Nucor) that our faculty are sporting. . . Wayne’s favorite color. . . .

Pictured: Greg Hilmas, Mark Schlesinger, Gary Pennell of Nucor, and Wayne Huebner.
The department is very active in biomaterials research and education through the Center for Biomedical Science and Engineering led by Prof. Len Rahaman. One of the many projects being investigated is on bioactive glass as a delivery device for therapeutic ions in wound healing. Doping of the glass with metal ions, such as copper, has been shown to stimulate angiogenic gene expression of fibroblasts in vitro and angiogenesis in vivo. Borate glasses with copper doping enhance healing of skin wounds in laboratory testing.

Award winning new steels formulated at Missouri S&T

The AIST Metallurgy Technology Division has selected a paper, "Developing a Third-Generation Advanced High-Strength Steel With Two-Stage TRIP Behavior," written by Scott Pisarik, David Van Aken, Krista Limmer and Julia Medvedeva to receive the 2015 Gilbert R. Speich Award. This award was established in 1992 in honor of Gilbert R. Speich, for his contributions to the field of ferrous physical metallurgy and was re-established as an AIST award in 2005. The award is presented to the author of a physical metallurgy technical paper judged to be the best of class by the AIST Metallurgy Technology Division.

Work on 3rd generation advanced high strength steels started in the MSE department 7 years ago with an NSF-DOE grant to develop a nano-accicular duplex steel. The aim of this study was to meet automotive industry mechanical property goals for steel with 1000 MPa ultimate tensile strength and 30% total elongation or 1500 MPa ultimate tensile strength with 20% total elongation. This initial NSF-DOE work resulted in new lightweight TRIP (Transportation Induced Pasticity) steels using aluminum additions to manipulate the unstable and intrinsic stacking fault energy to create an epsilon martensite and austenite microstructure that transformed to alpha martensite during plastic deformation. Although not nanocrystalline in nature, these new steels met the property goals by the two-stage or dual TRIP behavior: austenite first TRIPs to epsilon-martensite and then the epsilon-martensite TRIPs to alpha-martensite. This work has continued with industrial support from AK Steel, ArcelorMittal, Nucor and US Steel through the Kent D. Peaselee Steel Manufacturing Research Center. Interestingly, the original goal of obtaining a nanocrystalline steel has been achieved only recently. Ph.D. student Dan Field has made a nanocrystalline dual phase steel with dual TRIP character by conventional processing, cold working and annealing of hot band steel. This nanocrystalline steel obtained a yield strength of 790 MPa, an ultimate tensile strength of 1300 MPa, and a total elongation of 28%. Electron backscatter diffraction (EBSD) was used to characterize the nanocrystalline structure and an average grain diameter of 112nm was measured for the steel consisting of alpha-ferrite (blue), gamma-austenite (green) and epsilon-martensite (red).

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Missouri S&T Chooses four Signature “Best-in-Class” Areas

- MSE faculty involved with 3 of these
- Prof. Fahrenholtz & Prof. Hilmas are leading Enabling Materials
- 32 faculty hires over the next 3 years
All of the Phonathon funding is used to support freshmen scholarships and the labs, so we hope you will contribute strongly as before.