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About the Cover

A representative model of a complex immature kerogen structure with inherent chemical and structural heterogeneity is shown. Read more in "Elucidation of the Carbon Dominated, Chemically and Structurally Heterogeneous, Geo-polymeric Material Nanostructure," by Gorakh Pawar and Hai Huang.



May 2019 Guest Editors

Computational Approaches for Energy Materials and Processes Energy Committee and Computational Materials Science and Engineering Committee

Science and Engineering Committee Donna Guillen, Idaho National Laboratory Xiabo Chen, RMIT University Douglas Spearot, University of California, San Diego

Aluminum and Magnesium: High Strength Alloys for Automotive and Transportation Applications: Part I

Aluminum Committee and Magnesium Committee Dmitry Eskin, Brunel Univeristy

Metallurgical Kinetics: Part I

Pyrometallurgy Committee Camille Fleuriault, Gopher Resource Joseph Grogan, Gopher Resource

Effective Production and Recycling of Powder Materials: Part II Powder Materials Committee Kathy Lu, Virginia Polytechnic University

About JOM:

The scope of *JOM* (ISSN 1047-4838) encompasses publicizing news about TMS and its members and stakeholder communities while publishing meaningful peer-reviewed materials science and engineering content. That content includes groundbreaking laboratory discoveries, the effective transition of science into technology, innovative industrial and manufacturing developments, resource and supply chain issues, improvement and innovation in processing and fabrication, and life-cycle and sustainability practices. In fulfilling this scope, *JOM* strives to balance the interests of the laboratory and the marketplace by reporting academic, industrial, and government-sponsored work from around the world.

About TMS:

The Minerals, Metals & Materials Society (TMS) is a professional organization that encompasses the entire range of materials and engineering, from minerals processing and primary metals production to basic research and the advanced applications of materials.

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in the final analysis

"Always spend at least 15 minutes with your Journal every day."

-William Schmidt

May 2019

Number 5

Volume 71

Back in the days when a smartphone was comprised of Bakelite with pushbuttons rather than a dial, I was pursuing my undergraduate degree with all of the tenacity and discipline that my 19-year-old and easily distracted brain could muster. One of the classes that kept my attention and served me well was Economics under Prof. Schmidt—an idiosyncratic wisenheimer who could be effectively portrayed by Christian Bale (under a lot of makeup), should a biopic ever be made. One of the requirements of the professor's class, outside of being conversational about the "fact-tors" of production, was to acquire a daily subscription to *The Wall Street Journal*. Even though the *Journal* was not published on weekends back in the late 1970s, the cost of a five-days-per-week newspaper was a heavy one for a perpetually tapped-out undergraduate. Still, I was a reasonably dutiful student and I complied. I'm glad that I did as decades later I still find *The Wall Street Journal* a worthy way to spend 10 or 15 minutes each day. I'm especially pleased when the news of business, commodities, technologies, and markets reveals a nugget with particular relevance for our TMS enterprise.

For example: A few mornings ago I found my attention diverted by a passing reference to the Periodic Table of Elements. Specifically, the European Chemical Society had released a stylized graph on the sustainability of commoditized elements (the "90 elements that make up everything"). The core emphasis was on 31 elements employed in today's smartphones, with the elements being grouped as:

- Under "serious threat in the next 100 years" (Ga, As, Y, Ag, In, Ta)
- Under "rising threat from increased use" (Co, Dy)
- Having "limited availability [with] future risk to supply" (Li, Mg, P, Ni, Cu, Sn, Sb, Nd, W, Au, Pb)
- Being in "plentiful supply" (H, C, O, Al, Si, K, Br, La, Pr, Eu, Gd, Tb)

Some of the supplies are further complicated by coming "from conflict minerals" (Sn, Ta, W, Au). And, while the graph makers cite 31 smartphone elements, I've seen other reports stating that upwards of 70 elements are used in newer iPhones. That is an amazingly complex materials system to pack into a handheld, 138 gram device. Multiply that by 2.1 to 2.5 billion people worldwide who own smartphones (according to Statista), and we have a yawning electronic maw designed to consume materials as much as data—especially when many smartphone owners feel compelled to upgrade their devices every few years. Our poor Periodic Table is under stress from all of our swiping, streaming, and tweeting! Alas, poor Mendeleev.

What can be done? Perhaps the solution is in the factors of production that I learned 40 years ago—the profit-driven leveraging of land, labor, capital, and entrepreneurship. Can we create more appealing financial incentives to persuade phone owners to recycle their smartphones rather than putting them in a drawer or a landfill? Can we develop trusted technology to give consumers confidence that their privacy will not be compromised when recycling an old phone? Are there regulations to enact that will change the supplier or technological landscape? Are there materials substitution opportunities? Will we develop telepathic abilities that eliminate our need for hardware to connect to the cloud? All of the above? Some of the above? None of the above? If only I was smarter than my smartphone.

Whatever the solution, I do feel certain that it will consist of two givens—it will be driven by profit opportunities in the marketplace *and* it will be driven by developments in materials technology. No question.

How can I be so sure? Because for decades I've been reading my journals: *The Wall Street Journal* and *JOM*.



James J. Robinson Executive Director

"We have a yawning electronic maw designed to consume materials as much as data."

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member news

Share the good news about your professional accomplishments! Contact Kaitlin Calva. JOM Magazine Managing Editor, at kcalva@tms.org. Please note that only news submitted by current TMS members will be considered.



Wei Chen



Charles J. Kuehmann

TMS Members Elected to the National Academy of Engineering

Five TMS Members Join Ranks of NAE

TMS congratulates its distinguished members who have been elected to the U.S. National Academy of Engineering (NAE) for 2019. Election to the NAE is among the highest professional distinctions accorded to an engineer and honors those who have made outstanding contributions to "engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature" and to "the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/ implementing innovative approaches to engineering education."

The following TMS members will be formally inducted during a ceremony at the NAE's annual meeting in Washington, D.C., on October 6, 2019.

Wei Chen

Chen is the Wilson-Cook Professor in Engineering Design and professor of mechanical engineering at Northwestern University in Evanston, Illinois. She was elected "for contributions to design under uncertainty in products and systems, and leadership in the engineering design community." Chen, a member of the Society since 2017, participated in the development of the recent TMS studies, Verification & Validation of Computational Models Associated with the Mechanics of Materials and Advanced Computation and

Data in Materials and Manufacturing: Core Knowledge Gaps and Opportunities.

Charles J. Kuehmann

Kuehmann is vice president of materials engineering at SpaceX and Tesla Motors in Palo Alto, California, He was elected "for contributions to the creation and commercialization of computational materials design." Kuehmann, a TMS member since 1985, delivered the allconference plenary presentation at the TMS 2018 Annual Meeting & Exhibition.

Christopher A. Schuh

Schuh is department head and professor, materials science and engineering, at the Massachusetts Institute of Technology in Cambridge, Massachusetts. He was elected "for contributions to design science and application of nanocrystalline metals." Schuh joined TMS in 1996. He has received the 2004 AIME Robert Lansing Hardy Award and is a TMS Fellow, Class of 2015.

Sheldon Lee Semiatin

Semiatin is senior scientist, materials/ processing science and research leader in the Metals Processing Group at the U.S. Air Force Research Laboratory, Wright-Patterson Air Force Base in Ohio. He was elected "for contributions to thermomechanical processing of aerospace alloys and emerging intermetallic materials." Semiatin, a TMS member



Christopher A. Schuh



Sheldon Lee Semiatin



John G. Speer



TMS Members Elected to the National Academy of Engineering

since 1978, has received several awards, including TMS Fellow, Class of 2008, and the 2017 Bruce Chalmers Award.

John G. Speer

Speer is the John Henry Moore Distinguished Professor and director, Advanced Steel Processing and Products Research Center at the Colorado School of Mines in Golden, Colorado. He was elected "for the conception, invention, and reduction to practice of quenching and partitioning steel." Speer served as the 2018 president of the American Institute of Mining, Metallurgical and Petroleum Engineers (AIME), of which TMS is a member society. He has been a member of the Society since 1992 and is currently an active participant in the TMS Steels Committee.

Kyle Brinkman Named Department Chair

Kyle Brinkman began his new role as chair of the Materials Science and Engineering Department at Clemson University on March 1. Brinkman plans to continue teaching and conducting research, as he has worked as an associate professor and headed a research group at Clemson since 2014.

An active TMS member since 2009, Brinkman received the 2011 Functional Materials Division (FMD; formerly Electronic, Magnetic & Photonic Materials Division) Young Leaders Professional Development Award, the 2015 TMS/Federation of European Materials Societies (FEMS) Young Leaders International Scholar Award, and attended the 2016 Emerging Leaders Alliance conference through support from the TMS Foundation. During his membership, he has served on the Young Leaders Committee, Energy Conversion & Storage Committee, and the FMD Council.



Kyle Brinkman Photo courtesy of Clemson University.

TMS Welcomes New Members

The TMS Board of Directors approved professional membership for the following individuals at its March 2019 meeting. Please join us in congratulating and welcoming them to all the privileges and benefits of TMS membership.

Abdul-Jabbar, Najeb M.; Los Alamos National Laboratory, United States

Acharya, Amit; Carnegie Mellon University, United States

Agboola, Joseph; Federal University of Technology, Nigeria

Ahmed, Karim; Texas A&M University, United States

Ahn, Yeon-sang; POSCO Technical Research Laboratories, South Korea

Aldanondo, Egoitz; IK4-LORTEK, Spain

Alexandre, Rex; BeAM Machines, United States Anameric, Basak; UMD NRRI CMRL, United States

Andersen, Dag Herman; Hydro Aluminium, Norway

Araujo, Ana L.; AK Steel Research and Innovation Center, United States

Balint, Roland; Abo Akademi University, Finland

Behera, Ajit; National Institute of Technology Rourkela, India

Berfield, Thomas A.; United States

Bernard, Renan; CRM Group, Belgium

Besmann, Theodore; University of South Carolina, United States Bhattacharya, Sumit; Argonne National Laboratory, United States

Bratberg, Johan; Thermo-Calc Software AB, Sweden

Briot, Nicolas J.; University of Kentucky, United States

Brück, Sven; Universität Siegen, Germany

Bruno, Nickolaus M.; South Dakota School of Mines and Technology, United States

Budd, Tom; Manufacturing Technology Inc. (MTI), United States

Bülbül, Fatih; Universität Siegen / Institut für Werkstofftechnik, Germany Cao, Peng; University of Auckland, New Zealand

Chaitanya, Vimal; New Mexico State University, United States

Chakkedath, Ajith; Intel Corporation, United States

Chesher, Robert James; AMC Consultants, Australia

Chidambaram, Dev; University of Nevada, Reno, United States

Chien, Jonathan D.; Magretech, United States

Cho, Kyeongjae; University of Texas at Dallas, United States



TMS Members Elected to the National Academy of Engineering

- Crane, Nathan; Brigham Young University, United States
- Creasy, Terry; Texas A&M University, United States

Crooks, Mark; Lucideon Ltd., United Kingdom

Cummings, Chris; Skamol Americas, United States

Cutiongco, Eric Cruz; Barnes Aerospace, United States

Das, Tapas; ALS -Industrial, Australia

De Boer, Maarten P.; Carnegie Mellon University, United States

Denison, Mark; Matalco, United States

Dhakar, Krishnakant; Maulana Azad National Institute of Technology Bhopal, India

Dhar, Rishi; United States

Dhindaw, Brij K.; Indian Institute of Technology Bhubaneswar, India

Dikici, Burak; Atatürk Üniversity, Turkey

Dirbeba, Meheretu Jaleta; Abo Akademi University, Finland

Elbert, David C.; Johns Hopkins University, United States

Esfarjani, Keivan; University of Virginia, United States

Esleben, Katharina; Universität Siegen, Germany

Foley, David C.; Shear Form Inc., United States Fota, Kai; Universität Siegen, Germany

Fox, Michael E.; Global Advanced Metals, United States

Gadelhaq, Mahmoud Hisham Abdelhay; Ejust, Egypt

Galetz, Mathias C.; DECHEMA-Forschungsinstitut, Germany

Gao, Youping; Castheon Inc., United States

Grieser, Jason F.; Geofortis Pozzolans LLC, United States

Guerre, Catherine; CEA Saclay, France

Gunduz, Ibrahim Emre; Naval Postgraduate School, United States

Guo, Xiping; Northwestern Polytechnical University, China

Guraya, Teresa; Spain

Han, Bing Q.; Schlumberger, United States

Hassebrock, Joel D.; United States

Hemdan, Ahmed Samir; Egypt

Hennebel, Tom; Umicore, Belgium

Hitzler, Leonhard; Technical University Munich, Germany

Hofmann, Felix; University of Oxford, United Kingdom

Holcomb, Matthew; Grid Logic Incorporated, United States

Holman, Mitchell C.; Gulfstream Aerospace Corporation, United States

Hsu, Fu-Yuan; National United University, Taiwan Huang, Haiying; University of Texas at Arlington, United States

Huang, Yan; Brunel University Bcast, United Kingdom

Hunt, Maia; Rain Carbon, United States

Hurlimann, Michel; R&D Carbon Ltd., Switzerland

Ikhuoria, Esther Uwidia; University of Benin, Nigeria

Iorio, Luana E.; GE Aviation, United States

Jeong, Gyeong; South Korea

Jinschek, Joerg R.; The Ohio State University, United States

Jun, Jiheon; Oak Ridge National Laboratory, United States

Kang, SeungYeon; United States

Karpov, Dmitry; Paul Scherrer Institute, Switzerland

Keppens, Veerle; University of Tennessee, United States

Kernan, Brian D.; Desktop Metal, United States

Khan, Athar Said; PSFCL Pakistan Steel Mills, Pakistan

Kim, Hwi-Jun; KITECH, South Korea

Kim, Jefferson K.; Mando Halla Group, United States

Koike, Mari; Nippon Dental University, Japan

Kondoh, Katsuyoshi; Osaka University, Japan

Kosiba, Eva; Canada

Krishnamurthy, Ramanathan; Purdue University, United States Kulkarni, Kaustubh N.; Indian Institute of Technology Kanpur, India

Lee, Dongwoo; Sungkyunkwan University, South Korea

Lee, Woochul; University of Hawaii at Manoa, United States

Lee, Yousub; Oak Ridge National Laboratory, United States

Li, Hong; PPG Industries, United States

Li, Ling; Virginia Polytechnic Institute, United States

Li, Xiaopeng; University of New South Wales, Australia

Liu, Juan; University of Colorado Boulder, United States

Liu, Kun; University of Quebec at Chicoutimi, Canada

Liu, Weishu; Southern University of Science and Technology, China

Low, Ray J.; UQ Materials Performance, Australia

Lucak, Allison; Steel Warehouse, United States

Luedtke, Louis; GDC Industries LLC, United States

Ma, Jie; Shanghai Jiao Tong University, China

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Mallik, Archana; National Institute of Technology Rourkela, India Mangolini, Filippo; University of Texas at Austin, United States

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Maul, Dave; Space Exploration Technologies, United States

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Mehta, Apurva; SLAC National Accelerator Laboratory, United States

Mezin, Herve Hm; Carbone Savoie, France

Mohanty, Manoj K.; United States

Morse, Stephen; Selee Corporation, United States

Mueller, Franz; Universität Siegen, Germany

Munoz, Jorge A.; University of Texas at El Paso, United States

Nafisi, Shahrooz; University of Alberta, United States

Nagraj, Samant Kumar; Metallo Belgium N.V., Belgium

Neill, Alastair Scott; Rare Earth Salts, United States

Niemi, Jonne K.; Abo Akademi University, Finland

Ochulor, Ezenwanyi Fidelia; University of Lagos, Nigeria Okerberg, Brian; PPG Industries, United States

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Oliver, Warren; KLA-Tencor, United States

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Ormerod, John; JOC LLC, United States

Panton, Boyd; United States

Paquette, Mark; BakerHughes, United States

Pathak, Udayan Balvant; Tata Motors Limited, India

Patterson, Marlann M.; University of Wisconsin-Stout, United States

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Do you have business or industry news of interest to the minerals, metals, and materials community? Submit your announcement or press release to Kaitlin Calva, JOM Magazine Managing Editor, at kcalva@tms.org for consideration.

In Case You Missed It: Business News from the Field

EGA Enters Agreement with UAE Cement Industry

Dubai, United Arab Emirates: Emirates Global Aluminium (EGA) announced that they have entered into an agreement with the United Arab Emirates (UAE) cement industry to supply carbon dust. A byproduct that is generated during the process of producing smelting anodes, carbon dust can be used as an alternative fuel. The UAE cement industry plans to use freshly produced carbon dust as a fuel source, reducing the emissions from mining and transporting coal to their facilities.

Arconic to Break Up and Sell Businesses

Pittsburgh, Pennsylvania, USA:

Arconic, a lightweight metals engineering and manufacturing company, has announced plans to separate its business portfolio. The company will split into Engineered Products & Forgings and Global Rolled Products and is considering the sale of businesses that do not best fit into either of these divisions. Additionally, Arconic's board has appointed John C. Plant, current chair of the board, to serve as chair and chief executive officer, and



Calama, Chile: Copper producer Codelco is targeting mid-2019 to launch underground operations at its Chuquicamata mine. The site, which has been operating as an open-pit mine for more than 100 years and is one of the world's largest open-pit copper mines, produced 330,900 tonnes of copper in 2017. Codelco, the state copper producer of Chile, projects that the underground mine will produce 320,000 tonnes of fine copper and 15,000 tonnes of molybdenum after transitioning to underground operations. (Photo courtesy of Codelco.)

Elmer L. Doty, current director, to serve as president and chief operating officer.

SMS Group Contracted for Compact Cold Mill

Ravenna, Italy: Metal industry partner SMS Group has been contracted by Italian steel company Marcegaglia to supply a high-performance compact cold mill for their plant in Ravenna, Italy. The mill will be considered high-performance because it has been designed to process a comprehensive material mix, including high-carbon and duplex steels, chrome-manganese alloyed steels, and silicon steels. SMS Group and Marcegaglia aim to have the new compact cold mill fully operational by April 2020.

Global Bioenergies Begins Demo Production of Isobutene

Evry, France: French bioenergy research company Global Bioenergies has successfully produced demo-scale runs of bio-isobutene from wheat straw hydrolysate. This project is part of a larger program called OPTISOCHEM, which began in June 2017 and was granted €9.8 million by the Bio Based Industry-Joint Undertaking (BBI-JU). The next phase of the project is conversion of the bioisobutene into oligomers and polymers for use in lubricants, rubbers, cosmetics, solvents, plastics, or fuel applications.

Argonne Utilizes Machine Learning to Identify Materials for Solar Cells

Lemont, Illinois, USA: In a partnership with the University of Cambridge in England, the U.S. Department of Energy's (DOE) Argonne National Laboratory has developed a "design-to-device" approach that can pinpoint promising materials for use in dye-sensitized solar cells (DSSCs). Scientists have spent countless hours developing and testing thousands of different dyes for DSSCs. This project aims to increase the efficiency of such endeavors by utilizing supercomputers to identify high-performing, low-cost dye materials through an automated workflow that employs a combination of simulation, data mining, and machine learning techniques.

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Osman El Atwani

young professional technical notes

This occasional feature highlights the scientific interests and professional accomplishments of a young TMS member who has contributed to the technical content of the current issue of JOM as an author, advisor, or guest editor. The development of this feature is a special project of the TMS Young Professionals Committee. For additional information contact Kaitlin Calva. JOM Magazine Managing Editor, at kcalva@tms.org.

What Drives Osman El Atwani Forward in Nuclear Materials Research

Kaitlin Calva

In the April 2019 issue of *JOM*, Osman El Atwani and his co-authors provided insights into the performance of nanocrystalline materials under extremes as part of the technical topic, Deformation and Transitions at Grain Boundaries. Their paper, "Interplay Between Grain Boundaries and Radiation Damage," describes both limitations of current studies and also suggests future works to overcome those limitations.

"My current research focuses on developing nanocrystalline and ultrafine metallic materials and investigating their performance under irradiation and mechanical extremes," said El Atwani of his work at Los Alamos National Laboratory (LANL). He started out at LANL as a Director's Postdoctoral Fellow in 2016, adding the G.T. Seaborg Postdoctoral Fellowship in 2017. The following year he received a Postdoctoral Distinguished Performance Award before beginning his current position as scientist 2 (Materials Science and Technology Division, MST-8) in January 2019. "It is probably the most exciting time in my career as I was introduced to more challenges in working in different materials," he reflected. "This step was not going to be possible without the tremendous help of Stuart Maloy and other mentors I have worked with before."

The mentors El Atwani has worked with have made a great impact on his career, as he noted that his work in nuclear materials began with the help of his Ph.D. advisor at Purdue University, Jean Paul Allain (currently at the University of Illinois at Urbana-Champaign). As a materials engineering student, El Atwani was interested in this area, but it was not until a discussion with Allain that really pushed him to take the next step and get involved. "My advisor was very eager to work in this area and we were determined to make an impact in this field. He made the field look very exciting to me. We started with building our facility, Particle and Radiation Interaction of Hard and Soft Matter (PRIHSM), to characterize materials with multi-tools in-situ." He recalled that, "it was a tiresome but fun process where I learned how to proceed and advance in this field."

Looking to the future, El Atwani talked of building on his achievements and his current work in the areas of nuclear power and understanding phenomena at the nanoscale/ to move the field forward. "Advancing nuclear power through next generation fission reactors and fusion devices is very exciting. I hope to see the first nuclear fusion power plant."

In addition to guidance from his mentors, El Atwani acknowledged the role that his membership and engagement in TMS played in helping to advance his career goals. "I met most of my collaborators through TMS. I was introduced to LANL scientists at TMS, which led me to apply to LANL and start my career," El Atwani said. "The TMS annual meeting is a place to communicate and discuss results, meet scientists and engineers, and move forward with collaborations and future plans."

The lessons El Atwani has learned throughout his career also make for good advice to others seeking a career in research. "This field requires a lot of brainstorming, learning, and planning," he said. "Identify your goals and spend time to find the pathway for success. This means you have to recognize the tools you need to master and the collaborators who can complement your experience. Collaboration is as important as the experience of the researcher, and TMS is one of the best places to start this process."

And when it comes to publishing results, he advises to not just look at a journal's impact factor, but to also find a journal where your work can make its own mark. "Try to impact the society with your work," he said. "While other people's judgments can be important and affect you, remember that your own judgment is what drives you forward."



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The TMS Foundation: Success in 2018

Kaitlin Calva

The story of the TMS Foundation's 25th anniversary year is a good one. Considerable strides have been made enhancing the profile of the Foundation and spreading the word about its good work among the wider TMS membership-progress that is reflected in our increasing number of donors and donations. In 2018, the Foundation established a new endowed award, continued supporting a variety of programs, and, taking into account all of its fundraising and revenue sources, had one of its best years financially since its revitalization began in 2013. The 2018 year-end appeal reached its goal and raised more than \$100,000 by the campaign's conclusion on December 31, 2018. Altogether, 374 generous individuals made contributions, including 84 new donors for the yearthat's up from 2017's 325 and 74 donors, respectively. Overall, the TMS Foundation raised \$513,721 last year and saw its highest number of annual donors in the last five years.

In addition to the highly visible year-end appeal, the Foundation took on new ventures and expanded others throughout the year, such as the William D. Nix Award. Endowed and fully funded by Nix's Ph.D. students in recognition of the tremendously positive impact he has had on their lives, the new Society-level honor will confer its first award in 2020.

In addition, the first recipients of the Acta Materialia Inc. Undergraduate Scholarship were announced in



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On other fronts, the Foundation maintained its commitment to advancing STEM (science, technology, engineering, and mathematics) initiatives by lending a financial hand to both the *Materials Explorers*[™] program and the TMS Bladesmithing Competition. It also continued to fund a number of other scholarships for deserving students, leadership development programs for early career individuals, and prestigious honors recognizing talented professionals, including TMS's two diversity and inclusion awards.

"So, five years into its revitalization, and the Foundation is sustaining its growth quite successfully," said Garry W. Warren, TMS Foundation Board of Trustees chair. "Thank you to all who not only made our 25th anniversary a year to celebrate, but who also shared the Foundation's story and helped us build our image. Our success is not possible without your generosity and ongoing commitment to securing the future of our profession."



Raymundo Arroyave (left), Functional Materials Division (FMD) chair, presents Stephen McDonnell (right), assistant professor at the University of Virginia, with the 2018 FMD Young Leaders Professional Development Award during TMS2018.



Cayla Harvey (left), University of Nevada – Reno, receives the 2018 Structural Materials Division (SMD) Scholarship from SMD vice-chair Daniel Miracle (right) at the TMS 2018 Annual Meeting & Exhibition (TMS2018).



Sung Woo Nam, assistant professor at the University of Illinois, presented a lecture as one of the two 2018 TMS Early Career Faculty Fellows during the Young Professional Tutorial Luncheon held at TMS2018.

1871 Legacy Circle

This society recognizes individuals who have provided for the Foundation through planned giving.

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To secure your place on the 2019 TMS Foundation Honor Roll, visit www.TMSFoundation.org/Contribute to make an online donation. Or contact TMS Foundation staff at TMSFoundation@tms.org or 1-724-776-9000 with questions or for more information on additional donation options.



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TMS meeting headlines

View all upcoming meetings online at www.tms.org/Meetings.

Other Meetings of Note

19th International Conference on Environmental Degradation of Materials in Nuclear Power Systems-Water Reactors August 18–22, 2019 Boston, Massachusetts, USA

The 10th Pacific Rim International Conference on Advanced Materials and Processing August 18–22, 2019 Xi'an, China

11th International Conference on Porous Metals and Metallic Foams (MetFoam 2019) August 20–23, 2019 Dearborn, Michigan, USA

2019 Liquid Metal Processing & Casting Conference (LMPC 2019) September 8–11, 2019 Birmingham, United Kingdom

Materials Science & Technology 2019 (MS&T19) September 29– October, 3, 2019 Portland, Oregon, USA

ICTP 2020: The 13th International Conference on the Technology of Plasticity July 26–31, 2020 Columbus, Ohio, USA

14th International Symposium on Superalloys (Superalloys 2020) September 13–17, 2020 Seven Springs, Pennsylvania, USA



July 21–25, 2019 JW Marriott Indianapolis Indianapolis, Indiana, USA Discount Registration Deadline: May 31, 2019 www.tms.org/ICME2019

- The 5th World Congress on Integrated Computational Materials Engineering (ICME 2019) is recognized as the hub of interaction among software developers and process engineers along the entire production chain, as well as for materials scientists and engineers developing new materials.
- Attendees will gain insights on recent advances, new challenges, and the roadmap for overcoming them, giving them the opportunity to discuss and influence actual trends in the field.

TMS METALLURGICAL AND MATERIALS PROFESSIONAL ENGINEER (PE) LICENSING EXAM REVIEW COURSE

August 14–17, 2019 TMS Headquarters Office Pittsburgh, Pennsylvania, USA Discount Registration Deadline: July 8, 2019 www.tms.org/PEReview2019

- The highly-experienced course instructors will share their expertise in a small group setting to allow for a more customized learning experience.
- Registration for this course includes refreshment breaks and lunches, printed course notes, and an electronic copy of the TMS PE Review Course Study Guide (available in advance of the course).
- During the course, instructors will review exam specification and knowledge areas, as well as provide refresher training in a number of other areas.



September 9–13, 2019 Hydro Aluminium AS Årdal Årdal, Norway www.tms.org/Anode2019

• The TMS Anode Technology for the Aluminum Industry Course (Anode 19) features networking events and a tour of the Hydro Aluminium AS Årdal plant.



November 10–14, 2019 Aluminium Bahrain Plant Askar, Kingdom of Bahrain Discount Registration Deadline: September 24, 2019 www.tms.org/IAE2019

- The TMS Industrial Aluminum Electrolysis Course (IAE 19) is a five-day program centered on linking the theory and practice of industrial aluminum production.
- The course is designed to help attendees save costs and improve productivity and emissions, and includes a tour of the Aluminium of Bahrain Plant.

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TIMS 2020 149th Annual Meeting & Exhibition February 23–27, 2020 San Diego Convention Center and Marriott Marquis & Marina San Diego, California, USA Submit an Abstract! www.tms.org/TMS2020

 Abstract submissions are now open for several topics areas as well as the 9th International Symposium on Lead and Zinc Processing (Pb-Zn 2020), an international conference co-located with the TMS 2020 Annual Meeting & Exhibition (TMS2020).



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call for papers

JOM is seeking contributions on the following topics for 2019 and 2020. For the full Editorial Calendar, along with author instructions, visit www.tms.org/EditorialCalendar.



November 2019: Manuscript Deadline: June 1, 2019

Topic: Advanced Characterization and Testing of Irradiated Materials

Scope: This topic focuses on the characterization and testing of radiation-affected materials through scanning and transmission electron microscopy, atom probe tomography, micro-mechanical testing, x-ray diffraction, etc.

Guest Editors: Dhriti Bhattacharyya, Fan Zhang, and Peter Hosemann

Sponsors: Advanced Characterization, Testing, and Simulation Committee and Nuclear Materials Committee

Topic: Solid Oxide Fuel Cells: Recent Scientific and Technological Advancements

Scope: Relevant topics include, but are not limited to, understanding and enhancement of the oxygen reduction reaction at the cathode; understanding and mitigation of chromium poisoning of cathodes; enhancing the stability, electrochemical activity, and sulfur tolerance of anodes; new materials and processing techniques for electrolytes; enhancing interfacial stability between electrodes and electrolyte; and advanced materials and coatings for interconnections and balance of plant.

Guest Editors: Soumendra Basu and Amit Pandey **Sponsor:** Energy Conversion and Storage Committee

Topic: Crystal Orientation Dependence of Mechanical and Thermal Properties in Functional Nanomaterials

Scope: The emphasis of this special topic will be on the latest advances in the investigation and understanding of various crystal orientation phenomena toward functional nanomaterials design, and characterization in singlecrystal, bicrystal, and polycrystalline metallic, ceramic, oxide, composite materials, etc. using theoretical, computational, and experimental methods. **Guest Editors:** Ning Zhang and Chang-Yong Nam **Sponsor:** Nanomaterials Committee **Topic: Progress with Lead-Free Solders Scope:** Pb-free solders are now in widespread use and can out-perform Pb-based materials in many applications. Despite this success, there is an ongoing need to develop next-generation interconnection materials for smaller joints that can operate in more extreme environments and that are more reliable. This topic covers recent advances in solder alloy design for harsh environments, new interconnection materials and bonding technologies, and advances in the understanding of electronics reliability.

Guest Editors: Chris Gourlay and Babak Arfaei **Sponsor:** Electronic Packaging and Interconnection Materials Committee

Topic: Ceramic Materials for Nuclear Energy Applications

Scope: This topic covers experimental and computational studies of ceramics, both practical reactor materials and surrogate material, for nuclear energy research and applications. Papers of interest include, but are not limited to, fabrication, microstructure characterization, measurement and computation of properties, and degradation in operating conditions.

Guest Editors: Yongfeng Zhang and Xian-Ming Bai **Sponsor:** Nuclear Materials Committee

December 2019: Manuscript Deadline: July 1, 2019

Topic: Advances in Surface Engineering

Scope: This special topic aims to capture recent advances in processing, characterization, simulation/modeling, and applications related to surface engineering of materials. Areas of interest include surface protection from wear and corrosion, surface characterization techniques, surface alloying, and nanostructured surfaces.

Guest Editors: Tushar Borkar, Rajeev Gupta, Sandip Harimkar, and Mary Lyn Lim **Sponsor:** Surface Engineering Committee



Topic: Aluminum: Shape Casting and Forming

Scope: This topic covers processes and manufacturing technologies to produce final shapes for aluminum applications.

Guest Editor: Dmitry Eskin

Sponsors: Aluminum Committee and Shaping and Forming Committee

Topic: Extraction and Recycling of Battery Materials

Scope: This topic covers the fundamentals and latest developments in battery recycling including lead acid, nickel-cadmium, nickel-metal-hydride, and lithium ion batteries. Papers discussing applications of primary processes for the treatment of battery materials are also welcome.

Guest Editors: Xiaofei Guan, Camille Fleuriault, and Joseph Grogan

Sponsors: Pyrometallurgy Committee and Recycling and Environmental Technologies Committee

Topic: Functional Nanomaterials for Energy Harvesting on a Flexible Substrate

Scope: The scope of this topic will address nanomaterials for energy harvesting on a flexible substrate. Specifically, recent advances in the fabrication, characterization, and synthesis of energy harvesting nanomaterials, including piezoelectric nanowires, nanofibers, and thin film, for flexible substrate will be covered.

Guest Editors: Jiyong Chang and Chang-Yong Nam **Sponsor:** Nanomaterials Committee

January 2020: Manuscript Deadline: August 1, 2019

Topic: Design, Development, Manufacturing, and Applications of Refractory Metals and Materials

Scope: This topic encompasses the latest advances in the design, development, manufacturing, and applications of refractory materials, including metals, alloys, carbides, nitrides and borides, and more. Papers are invited on topics including experimental and theoretical research of the process-microstructure-property relationship in refractory metals and materials.

Guest Editors: Ravi Enneti and Chai Ren **Sponsors:** Surface Engineering Committee and Steels Committee

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Visit jom.tms.org to access manuscript preparation guidelines and information on how you can become involved as a *JOM* peer reviewer. *JOM* advisors will also find tools to support them in managing a *JOM* topic.

For further information on contributing to *JOM*, contact *JOM* Editor Maureen Byko at mbyko@tms.org.

Topic: ICME-Based Design and Optimization of Materials for Additive Manufacturing

Scope: Papers will be solicited in the following areas:

- Machine learning and artificial intelligence enabled additive manufacturing (AM) modeling techniques
- Modeling and simulation of AM process to understand the process-structure-property relationship
- Modeling of morphology evolution, phase transformation, and defect formation in AM parts
- Modeling of residual stress, distortion, plasticity/ damage in AM parts
- Multiscale/multiphysics modeling strategies, including any or all of the scales associated with the spatial, temporal, and/or material domains
- CALPHAD (Calculation of Phase Diagrams)-based method for AM material informatics

Guest Editors: Jing Zhang

Sponsor: Additive Manufacturing Committee and ICME Committee

February 2020:

Manuscript Deadline: September 1, 2019

Topic: Energy Materials

Scope: This special topic aims to publish high quality papers for the material characterization and features of energy materials, including submissions on semiconducting materials, alloys, and composites in energy applications. Especially the papers related to solar energy, wind energy, fuel cells, and thermal applications and energy storage materials are welcome in the synthesis and characterization scheme. **Guest Editors:** Shadia J. Ikhmayies and H. Hilal Kurt

Sponsors: Invited

See the Full Editorial Calendar at jom.tms.org





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