

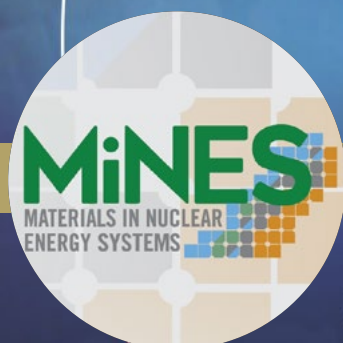
JOM THE MAGAZINE

APRIL/MAY 2022

www.tms.org/JOM

News and insights about TMS, its members, and the professions it serves

MEET JUD READY 2022 TMS PRESIDENT



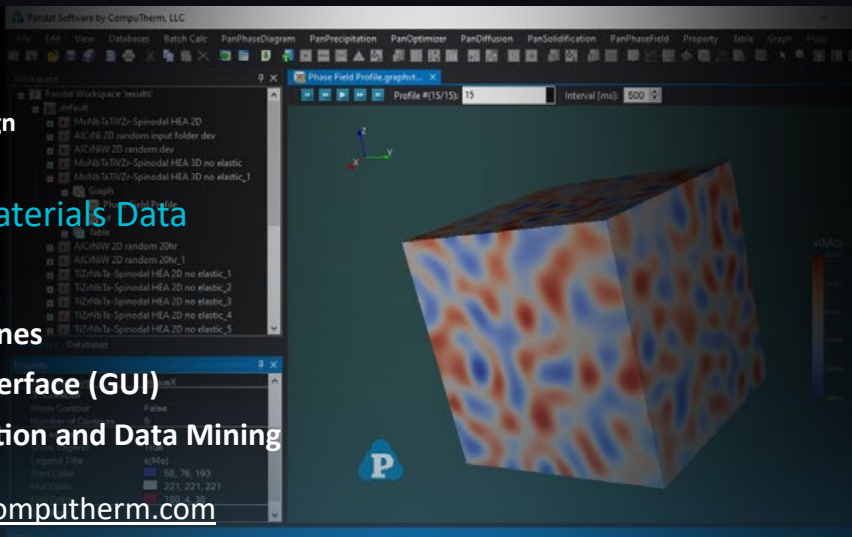
MiNES 2021 Organizers Share Lessons Learned

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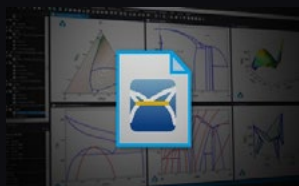


ICME & MGI
Applications

Al – based alloys
Co – based alloys
Cu – based alloys
Fe – based alloys
Mg – based alloys
Ni – based alloys
Ti – based alloys
TiAl – based alloys
Refractory alloys
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PanPhaseDiagram

- stable and meta-stable diagrams
- property contour diagrams
- thermodynamic properties
- chemical driving force



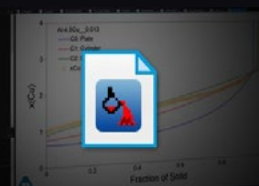
PanPrecipitation

- concurrent nucleation, growth and coarsening
- particle size and size distribution
- multi-phase co-precipitation



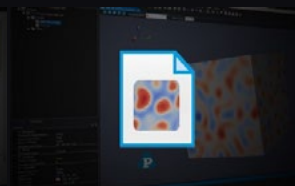
PanDiffusion

- diffusion couple
- homogenization
- carburization and decarburization
- particle dissolution



PanSolidification

- solidification path
- back-diffusion in the solid
- dendrite arm coarsening
- micro-segregation



PanPhaseField

- direct coupling with CALPHAD
- feasible for multi-component alloys
- open architecture for user's model plugin

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ABOUT THE COVER



Jud Ready, 2022 TMS President, is featured on this month's cover with a background of microscopic GTs, in honor of his extensive educational and professional background with the Georgia Institute of Technology (also known as Georgia Tech or GT). In this issue's "2022 TMS President Jud Ready: TMS is a Place for Firsts," you'll find an article based on the speech Ready delivered at the TMS 2022 Annual Meeting & Exhibition when he was installed as 2022 president.



Access Technical Journal Articles

TMS members receive free electronic access to the full library of TMS journals, including JOM. Technical articles published in JOM: The Journal are available on the Springer website. TMS members should log in at www.tms.org/Journals to ensure free access.

About JOM: The Magazine:

This print publication is excerpted from the publication of record, *JOM*, which includes both The Magazine and The Journal sections. *JOM: The Magazine* includes news and insights about TMS, its members, and the professions it serves. To access the publication of record, visit www.tms.org/JOM.

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. Learn more at www.tms.org.

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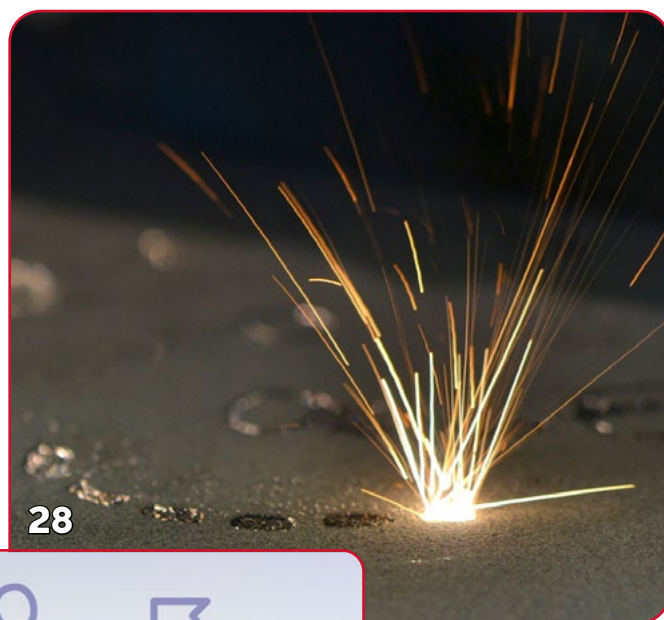
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IN THE FINAL ANALYSIS

"You must be shapeless, formless, like water. When you pour water in a cup, it becomes the cup. When you pour water in a bottle, it becomes the bottle. When you pour water in a teapot, it becomes the teapot. Water can drip and it can crash. Become like water my friend."

—Bruce Lee

I am of the generation that grew up thinking of actor and martial artist Bruce Lee as the coolest person on Planet Earth. While I was in grade school, he was electrifying playing Kato on the television show, *The Green Hornet*. Kato was technically the chauffeur/sidekick to the Green Hornet (with a literal accent on "kick"), but he was the most watchable of all the cast and characters, even when Batman and Robin made a guest appearance. When I was in junior high school, action movies were revolutionized thanks to Lee's starring vehicle, *Enter the Dragon*, where he was the charismatic, assured, and unbeatable centerpiece of many dazzling martial arts sequences. Alas, Lee died soon after filming, graduating to mythical stature.

Like the nameless extras in a Bruce Lee melee, we've all acquired many bruises through two years of the pandemic. With so many obstacles put in our paths, I think that we can all appreciate the virtues of being more analogous to water—maintaining our core essence while blithely flowing around each challenge. Still, becoming like water is so much easier said than done.

I reflect on the virtue of fluidity as I've just completed writing a summary report for the TMS Board of Directors on TMS highlights and challenges for the period spanning TMS2021 Virtual and TMS2022. During this stretch, TMS was poured into multitudinous difficult and uncomfortable shapes. Like water, we endured.

We were unable to conduct in-person meetings for most of 2021. So, we continued to pivot toward "virtualizing" one event after another. This meant trying to negotiate out of hefty penalties for failing to satisfy contractual obligations for meetings booked years earlier while simultaneously adding new contracts to provide the infrastructure necessary to conduct virtual events. Both factors translated into unplanned expense. Considering that people and exhibitors don't yet embrace virtual events with as much vigor as they do in-person ones, we experienced significant drops in our budgeted events revenue. More expense + less revenue = a failing grade in Business 101. Compensating, we took the helping hands available to us and leveraged two critical resources: business-relief funds provided by the U.S. government and our own TMS operating reserves, also known as our rainy-day fund. Getting government dollars and syphoning reserves are effective short-term solutions to keep one's head above water but are not the stuff of sustainable business longevity. Still, they helped bridge us from where we were to where we needed to be.

By the final quarter of 2021, many in the TMS community gave signs of being eager and willing to travel to events once again. Staging a face-to-face meeting in this transitional era would require retooling the TMS events machine, including (1) identifying and implementing appropriate health and safety protocols to be used at the venues; (2) working with our volunteer organizers to rework our programs for in-person and virtual elements; (3) reconceptualizing our work flow for how to manage events; and (4) crossing our fingers that another variant would not shatter the fragility of our event plans and expose attendees and the Society to more risk. The transition period has presented a still rocky business model, but we are advancing the mission and bringing the community together.

Where to next? I believe that future TMS events will be poured into one of three shapes. The first will be traditional in-person events with no virtual component. The second will be virtual-only events with no in-person component. The third will be a blend of the two.

If we are like water, this will be not a challenge but just the new way of getting things done.

Volume 74

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James J. Robinson
Executive Director

 @JJRofTMS

"By the final quarter of 2021, many in the TMS community gave signs of being eager and willing to travel to events once again."

JOM: The Journal publishes peer-reviewed technical articles covering the full range of minerals, metals, and materials. TMS members receive free electronic access to the full library of TMS journals, including *JOM*. For the full *JOM* Editorial Calendar, visit www.tms.org/EditorialCalendar.

Review the technical topics included in the current issue of *JOM*: The Journal here, and then go to www.tms.org/JOM to log in and access technical journal articles on the Springer website.

APRIL 2022

Advances in Processing, Manufacturing, and Applications of Magnetic Materials

Scope: This topic features papers on advances for synthesizing, processing, and characterization of magnetic materials including permanent and soft magnets, energy conversion, and multiferroic materials (such as magnetocaloric, magnetoelastic, magnetoelectric and magnetoresistive materials). Applications of interest include biological applications of magnetism, sensors and actuators, energy harvesting, motor-generators, transformers and inductors, and memory applications.

Editors: Scott McCall, Lawrence Livermore National Laboratory, and Ikenna Nlebedim, Ames Laboratory

Sponsor: Magnetic Materials Committee

Characterization of Waste-Derived Materials

Scope: Papers in this topic focus on the latest achievements in exploration of novel value-added materials derived from various wastes. In particular, papers on characterization and modification for those originated from mineral/metallurgical/material processing are welcome. Of interest are multifunctional slag/tailing-based materials with unique combinations of desirable thermo-mechanical-chemical performance for sustainable industrial and municipal applications.

Editors: Zhiwei Peng, Central South University; Yunus Eren Kalay, Middle East Technical University; Rajiv Soman, Eurofins Scientific; and Jian Li, CanmetMATERIALS

Sponsor: Materials Characterization Committee

Computational Design of Alloys for Energy Technologies

Scope: This special topic covers design, development, and lifetime modeling of materials for extreme operating conditions in energy technologies. Advanced materials that resist elevated temperatures, corrosive environments, and a range of static and dynamic stresses are needed to improve the efficiency and reduce the environmental impact of

energy technologies. Articles will cover the use of computational modeling using techniques including machine learning and experiments to close the design loop and accelerate materials discovery and advanced manufacturing.

Editors: Ram Devanathan, Pacific Northwest National Laboratory, and Laurent Capolungo, Los Alamos National Laboratory

Sponsor: Integrated Computational Materials Engineering Committee

Computational Modeling of Metallurgical Furnaces

Scope: Computational modeling continues to play an increasingly important role for evaluating and improving metallurgical furnace design and operation. Metallurgical furnaces typically involve complex transport phenomena, multi-phase chemical reactions and phase transformations, which make modeling efforts challenging. This special topic invited original research aimed at developing techniques for high-fidelity simulations of industrial metallurgical furnaces. Manuscripts that address gas, liquid, and solid phase interactions were particularly encouraged.

Editors: Alexandra Anderson, Gopher Resource; Fiseha Tesfaye, Åbo Akademi University; Chukwunwike Iloeje, Argonne National Laboratory; and Stuart Nicol, Glencore Technology

Sponsor: Process Technology and Modeling Committee and Pyrometallurgy Committee

Environmental Degradation of Additively Manufactured Alloys

Scope: Additive manufacturing has grown and expanded throughout different areas of applications. Given the significantly different microstructures of additively produced materials as compared with traditional materials, evaluation of their environmental degradation is essential for the prediction of performance and life in harsh environments. This special topic presents contributions that will foster discussion on how additively produced materials degrade in: (i) corrosive environments; (ii) high-temperature, oxidizing environments; (iii) harsh

environments while under mechanical stress; and (iv) high-radiation environments.

Editors: Kinga Unocic, Oak Ridge National Laboratory; Bai Cui, University of Nebraska–Lincoln; and Wenjun Cai, Virginia Polytechnic Institute and State University
Sponsor: Corrosion and Environmental Effects Committee

Low-temperature Technology for Electronic Packaging and Interconnects

Scope: This special topic focuses on low-temperature technology for electronic packaging and interconnects.
Editors: Albert T. Wu, National Central University, and Babak Arfaei, Binghamton University
Sponsor: Electronic Packaging and Interconnection Materials Committee

/// MAY 2022

Advances in Characterization of Functional Composite Materials

Scope: This topic focuses on the latest developments and applications of functional composite materials with advanced engineering uses, from initial conception to obsolescence. Of particular interest are original papers and reviews focusing on characterization and non-destructive evaluation of metal-matrix composites, ceramic-matrix composites, polymer-matrix composites, and coatings at the nano- and micro-scales.
Editors: Zhiwei Peng, Central South University; Rajiv Soman, Eurofins Scientific; Yunus Eren Kalay, Middle East Technical University; and Ramasis Goswami, Naval Research Laboratory
Sponsor: Materials Characterization Committee

Energy Efficiency and Low Carbon Footprint in Metals Processing

Scope: Metal production technologies are carbon and energy intensive, but it can be argued that the bulk of carbon footprint of metal processes comes from energy sources and reductants. In this case, decarbonizing is closely intertwined with energy consumption of processes. This special topic covers energy efficiency in relation to decarbonization of metal production. Manuscripts should address energy efficiency, carbon capture and reducing the carbon footprint of metals processing, as well as life cycle assessment.
Editors: Joseph Hamuyuni, Metso Outotec; Fiseha Tesfaye, Åbo Akademi University; Chukwunwike Iloeje, Argonne National Laboratory; and Alexandra Anderson, Gopher Resource
Sponsor: Energy Committee, Recycling and Environmental Technologies Committee, and Process Technology and Modeling Committee

Micro-architected Materials by Additive Manufacturing

Scope: This topic presents the latest developments and applications related to micro-architected materials by additive manufacturing. Original research and review papers are welcome that address topics such as design, microstructures, mechanical properties, post-processing, modelling and simulation, failure mechanisms, and characterization techniques of micro-architected materials by additive manufacturing.
Editors: Ma Qian, RMIT University, and Jonathan Tran, RMIT University
Sponsor: Invited

Phenomena and Scales Influencing Alloy Solidification Microstructures

Scope: This topic focuses on numerical predictions and experimental observations of the coupling/interaction of processes that occur across varying length and time scales simultaneously during solidification. Examples include microstructure simulations to characterize macroscopic properties such as permeability or experiments such as bulk stirring that have a direct influence on microstructure solidification.
Editor: Andrew Kao, University of Greenwich
Sponsor: Solidification Committee

Progress on Recovery of Critical Raw Materials

Scope: This special topic focuses on original research aimed at developing techniques for high-fidelity simulations of industrial metallurgical furnaces. Manuscripts that address gas, liquid, and solid phase interactions were particularly encouraged.
Editors: Hong Peng, University of Queensland, and Kerstin Forsberg, KTH Royal Institute of Technology
Sponsors: Hydrometallurgy and Electrometallurgy Committee and Recycling and Environmental Technologies Committee

Sustainable Composite Materials

Scope: This special topic covers composite materials that are derived from renewable sources and/or can be used in renewable energy-based applications such as wind energy, and solar, among others. Fundamental and applied research in this area is welcome.
Editors: Simona Hunyadi Murph, Savannah River National Laboratory, and Surojit Gupta, University of North Dakota
Sponsors: Composite Materials Committee and Energy Conversion and Storage Committee

TMS MEMBER NEWS

Share the Good News!

Contact Kaitlin Calva, *JOM: The Magazine* Principal Editor, at kcalva@tms.org to share your professional accomplishments. Please note that only news submitted by current TMS members will be considered.

TMS Members Elected to National Academy of Engineering

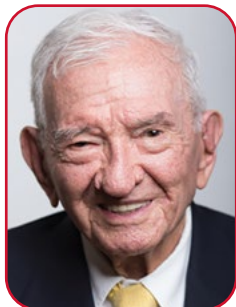


In February 2022, the National Academy of Engineering (NAE) announced the election of 111 new members and 22 international members. Election to NAE is one of the highest professional distinctions

awarded to engineers. This honor is bestowed on those who have made outstanding contributions to engineering, research, practice, education, and more; are pioneers in new and developing fields; have made major advancements in traditional fields of engineering; or are developing innovative approaches in engineering education. The newly elected class will be formally inducted during the NAE's annual meeting in October 2022.

Congratulations to the following TMS members who were elected to NAE in 2022:

Leonard Harris, president (retired), B&H Mine Services, has been a TMS member since 1983, Harris



studied metallurgy at Mount Morgan Technical College in Queensland, Australia, graduating in 1949. In 1992, Harris was named general manager of the Minera Yanacocha Company which operated the Yanacocha gold property in Peru. While in this position, he was instrumental in organizing and establishing

humanitarian aid to the communities near the mine, including access to medical care, installing portable water plants and latrines, and nutritional education and resources. He has served on the TMS Precious Metals Committee and is a recipient of the 1996 American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) William Lawrence Saunders Gold Medal and the 2016 AIME Hoover Medal. Learn more about Harris' career and history in his AIME Oral History at <https://aimehq.org/what-we-do/oral-histories/>.

Citation: *For contributions to the development of mineral resources in Peru and advancing humanitarian programs in associated communities.*

Michele V. Manuel, department chair and Rolf E. Hummel Professor, Department of Materials Science



and Engineering, University of Florida, has been a member of TMS since 2001. She received her B.S. in materials science and engineering from the University of Florida and her Ph.D. in materials science and engineering from Northwestern University.

Manuel is recipient of the TMS Early Career Faculty Fellow Award, a TMS Young Leaders Professional Development Award, and the TMS/Japan Institute of Metals and Materials (JIM) International Scholar Award. She has served on a variety of TMS functional and technical committees, and has been both a symposium organizer and presenter. Manuel was also a member of the TMS Board of Directors from 2017-2020.

Citation: *For contributions to research, implementation, and teaching of computational materials design of biomimetic self-healing metals and high-performance lightweight alloys.*

Julie M. Schoenung, department chair and professor, Materials Science and Engineering, University of California, Irvine, has been a member



of TMS since 2005. She earned her B.S. in ceramic engineering from the University of Illinois, Urbana-Champaign and an M.S. and a Ph.D. in materials engineering from the Massachusetts Institute of Technology (MIT). Schoenung was a recipient of the 2020 LMD/EPD Subject Award – Recycling.

She has served as editor-in-chief for the *Journal of Sustainable Metallurgy* and served as a key reader for *Metallurgical and Materials Transactions A*.

Citation: *For innovative and interdisciplinary applications of materials engineering in trimodal composites, coatings, additive manufacturing, and green engineering.*

James A. Yurko, senior distinguished engineer, Materials Engineering, Apple Inc., has been a member of TMS since 1995.



Yurko earned a B.S.E. from the University of Michigan and a Ph.D. from MIT, both in materials science and engineering. He has served on a variety of TMS functional and technical committees, including the Energy Committee, the

Young Leaders Committee, and the Nominating Committee. Yurko has also served as a member of the Extraction & Processing Division (EPD) and Materials

Processing & Manufacturing Division (MPMD) Councils. He was a recipient of the 2010 EPD Young Leaders Professional Development Award, a 2016 Brimacombe Medalist, and was selected to participate in the 2016 Emerging Leaders Alliance Program. Along with Antoine Allanore, MIT, Yurko was the 2012 recipient of the Vittorio de Nora Prize for Environmental Improvements in Metallurgical Industries. Most recently, he was the All-Conference Plenary speaker at the TMS2022 Annual Meeting and Exhibition, with his talk, "Alloy Design at Apple."

Citation: *For innovation, leadership, and the accelerated development of materials applied to consumer electronic products.*

Material Advantage 2021 Fall Membership Challenge Winners



Each year, during the fall semester, Material Advantage chapters are challenged to compete against each other in the Fall Membership Challenge. This contest encourages chapters to recruit new Material Advantage student members and winners receive monetary prizes for the most creative recruitment strategies and the highest percentage increase in chapter membership.

The 2021 chapter with the most creative recruitment strategies was the **Indian Institute of Technology, Kanpur** (IIT Kanpur). IIT Kanpur utilized a variety of virtual events, a new recruitment landing page on their website, and other creative strategies to encourage new members to join their chapter. To be considered for this award chapters must submit

a record of the recruitment activities and programs used as well as photographs that showcase chapter spirit, recruitment activities, and/or new members. As the winning chapter, IIT Kanpur received \$500 and a digital certificate.

With a 90% increase in membership, the **University of Puerto Rico-Mayaguez** was the 2021 chapter with the most students recruited. The chapter was awarded \$1,000 and a digital certificate.

Is your chapter interested in competing in the 2022 Fall Membership Challenge? This year's contest will occur from September 12, 2022, to October 16, 2022. Participating chapters must fill out and submit the Membership Challenge Application no later than 11:59 p.m. U.S. EST on October 19, 2022. For more information on the Fall Membership Challenge, instructions on how to submit your application, or more information on the 2021 winners, visit www.materialadvantage.org/membership/membership-challenge.



Members of the IIT, Kanpur, Material Advantage Chapter, winners of the Fall 2021 Most Creative Recruitment Strategies Challenge.

Welcome to Our New Material Advantage Chapters

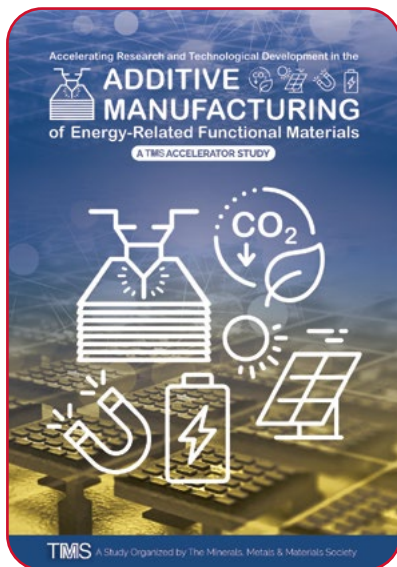
The TMS Board of Directors has approved new Material Advantage chapter charters for the following universities:

The University of Virginia,
Karnataka, India;
Government Polytechnic,
Maharashtra, India;
and **Anna University,**
Tamil Nadu, India.

Welcome to the Material Advantage and TMS family!

New Research: Additive Manufacturing of Energy-Related Functional Materials

Additive manufacturing (AM) offers the potential to accelerate innovation and reduce costs associated



with the development and implementation of advanced functional materials systems and manufacturing processes. Until recently, the majority of R&D placed a focus on structural materials. An expert study team is leading a 17-month initiative, from September

2021 to October 2022, to examine the domain as it relates to functional materials, with a specific focus on energy. The final report will be released at the Materials Science & Technology Technical Meeting and Exhibition (MS&T22).

"Accelerating Research and Technological Development in the Additive Manufacturing of Energy-Related Functional Materials," is a TMS science and technology accelerator study that

was undertaken on behalf of Oak Ridge National Laboratory and the U.S. Department of Energy Office of Energy Efficiency & Renewable Energy's Advanced Manufacturing Office.

The plans for this accelerator study include the following milestones:

- Scope and prioritize the areas of most promise for energy-related domains.
- Take a deep dive to identify and explore in-depth the key gaps, barriers, needs and enablers of the next state of additive manufacturing of functional materials in select areas deemed to have the greatest potential for the most immediate and substantive energy-related impact, particularly with consideration to decarbonization.
- Provide concrete recommendations on key milestones, detailed action plans, and implementation pathways needed to help provide a foundation for ultimately transitioning from fundamental concepts to manufactured components.

To receive any news related to this study and be notified when the free report is published, go to www.tms.org/AMstudy to complete a brief form to sign up for updates.

New AIME Oral Histories from TMS Members

The American Institute of Mining and Petroleum Engineers (AIME) has released new videos as part of their Oral History project. This project strives to support part of the Institute's mission, by preserving and promoting achievements in the fields and sharing prominent member stories with future generations.

Three new TMS members' histories have been added to the existing collection:

- **Harry Bhadeshia**, *Emeritus Tata Steel Professor of Metallurgy, University of Cambridge; Professor of Metallurgy, Queen Mary University of London*

Title: Harry Bhadeshia: An Awe-Inspiring Steel Innovator

- **Enrique Lavernia**, *Provost and Executive Vice Chancellor and Distinguished Professor of Materials Science and Engineering, University of California, Irvine*

Title: Enrique Lavernia: The Super Dean with a Passion for Research

- **Lee Semiatin**, *Senior Scientist, Emeritus, U.S. Air Force Research Laboratory*

Title: Lee Semiatin: Becoming a Journeyman Metallurgist



Visit the AIME Oral Histories web page at <https://aimehq.org/what-we-do/oral-histories> to learn the story of your profession in the words of those who have lived it. Check the AIME Oral Histories page regularly for announcements when new TMS member interviews are available, or to submit a candidate for AIME's Oral History capture.



Harry Bhadeshia



Enrique Lavernia



Lee Semiatin

In Memoriam

TMS offers condolences to the friends, family, and colleagues of the following members:

Francis "Sam" H. Froes passed away in May 2021. A



TMS member since 1984, Froes was involved in the titanium field for more than 40 years, authoring more than 100 papers in *JOM*, with the majority having titanium as the focus. He served as a member and as the *JOM* advisor from the TMS Titanium Committee for several years and co-sponsored four TMS symposia on Cost Effective

Titanium, featuring numerous papers on powder metallurgy. He served as director and department head of the Materials Science and Engineering Department at the University of Idaho. Throughout his career, he also worked for the Crucible Steel Company and the U.S. Air Force Materials Laboratory.

Dieter Herlach, a TMS member since 1997, passed away in January 2022. Herlach was the recipient



of the 2019 Bruce Chalmers Award. He graduated from RWTH Aachen in 1975, and again in 1981, with his Ph.D. Herlach began his career as a scientific employee at II Physical Institute of RWTH Aachen in 1976. He then went on to be a scientific assistant at the University of Duisburg's Laboratory of Low Temperature

Physics for six years. From 1983–2014, he was a lead scientist at the Institute of Material Physics in Space (formerly Institute of Space Simulation) at the German Aerospace Center. During his time at the Institute, he also served as a lecturer in physics, professor in physics, and a full professor in physics at Ruhr-University Bochum, becoming professor emeritus in 2014. Herlach was a prolific researcher and published many papers throughout his career.

Michael H. Loretto passed away in January 2021. A TMS member since 1993, and the 2015 recipient of the Cyril Stanley Smith Award.



Loretto was an alumnus of Sheffield University and had an international career, working at CSIRO, Melbourne, Australia; Battelle Memorial Institute, Columbus, OH, USA; Cavendish Laboratory, Cambridge, UK; and the University of Birmingham, Birmingham, UK. In 2001, he retired from his position as

director of the Interdisciplinary Research Centre in Materials for High-Performance Applications at the

University of Birmingham. During his time as director, Loretto established the Net Shape Laboratory, introducing additive manufacturing and net shape hot isostatic pressing to the university.

Amiya Kumar Mukherjee, who passed away in September 2021, was a TMS member since 1965.



Mukherjee received a B.S. in geology and physics from the University of Calcutta, a M.S. in physical metallurgy from the University of Sheffield, and a Ph.D. from the University of Oxford. He joined the University of California, Davis Department of Mechanical Engineering in 1966 and helped start a new materials science program.

Mukherjee retired in 2007 but continued to conduct research and publish. He was a member of the Mechanical Behavior of Materials and the Chemistry and Physics of Materials Committees.

Gordon M. Ritcey, a TMS member since 1970, passed away in February 2021. He studied chemistry



at Dalhousie University, where he was introduced to the field of applied research in solvent extraction. Following his studies, Ritcey went on to serve as the chief chemist at the uranium mine in the Port Radium settlement on Great Bear Lake, Northwest Territories, Canada. In 1957, he went on to work as a research scientist for

Eldorado Mining & Refining Limited and then as a senior research scientist and head of hydrometallurgy for the Canadian government. Ritcey became one of the world's authorities on solvent extraction and served as the founding editor of the *Journal of Hydrometallurgy*.

TMS also offers condolences to the friends, family, and colleagues of the following members who passed away:

Ronald Bachowski

Edward N.C. Dalder

James H. Downing

Douglas C. Haag

John R. Jose

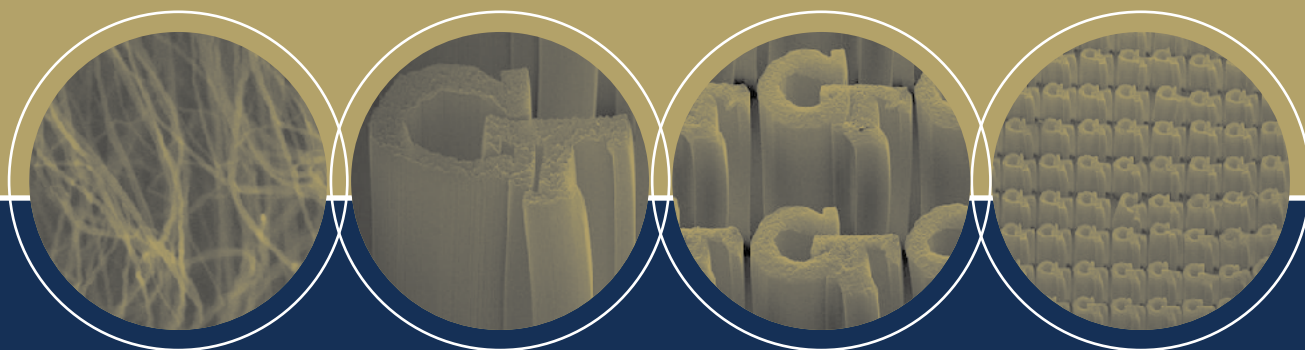
Arnold P. Litman

John N. Mundy

James A. Salsgiver

2022 TMS PRESIDENT JUD READY: TMS IS A PLACE FOR FIRSTS

W. Jud Ready



My fellow TMS members, please allow me to introduce myself. My name is Jud Ready, and I am honored to serve as the 2022 president of The Minerals, Metals & Materials Society.

With AIME (the American Institute of Mining, Metallurgical, and Petroleum Engineers), we celebrated our 150th anniversary at the TMS 2022 Annual Meeting & Exhibition (TMS2022) in Anaheim, California—home of the world's first Disney theme park.

Take a brief moment to think about the uncertainty involved in that venture.



Like Walter Elias Disney achieved in 1955, each of us as scientists and engineers are constantly in pursuit of firsts. And for me, TMS has been a place of firsts throughout my career, and I'd be willing to bet it has been—and will continue to be—a place of firsts for you too.

TMS is THE place where I first stood up in front of a distinguished audience and presented my research, in utter terror the whole time. I was delivering my presentation to a group of my advisor's peers. These were the authors of my textbooks! To those who are considering presenting their work at the next TMS annual meeting for the first time, no need to be scared like me. It's a welcoming place.

TMS is THE place where I first served on, and ultimately led, a professional committee. To all those members who have joined or are chairing a committee for the first time, welcome and thank you for volunteering.

TMS is THE place where I first organized a symposium. To all those members who organized a symposium for the first time at TMS2022 or are planning to do so for TMS2023, thank you for taking the next step as a TMS volunteer.

TMS is THE place where I received my first professional award. To all those members who received their first professional award in 2022, congratulations and keep up the good work.

TMS is THE place where I first served as a board-level director. To all those members who are serving their first terms on the TMS Board of Directors, congratulations and thank you for your dedication as a volunteer.

READY'S GT BACKGROUND

Jud Ready is the deputy director, Innovation Initiatives, for the Georgia Institute of Technology (Georgia Tech or GT) Institute for Materials. He has also been an adjunct professor in the School of Materials Science & Engineering at Georgia Tech and a principal research engineer on the research faculty of Georgia Tech Research Institute (GTRI) for 19 years. He earned three degrees, including his Ph.D., from Georgia Tech, as well.

Given his extensive educational and professional background with Georgia Tech, it is only fitting that the background image on the previous page is a collection of microscopic GTs made from carbon nanotubes, which Ready and his team grow regularly for use in energy capture (solar cells), storage (supercapacitors), and delivery (cold cathodes).

"FOR ME, TMS HAS BEEN A PLACE OF FIRSTS THROUGHOUT MY CAREER, AND I'D BE WILLING TO BET IT HAS BEEN—AND WILL CONTINUE TO BE—A PLACE OF FIRSTS FOR YOU TOO."

TMS is THE place where my professional career has happened. TMS is the place where your professional career happens too. TMS is THE professional location for so many of us.

There's an old saying in real estate: location, location, location. And believe it or not, the same saying holds true for a sesquicentennial professional society like TMS.

Consider first the **scientific location** of TMS. The expertise within TMS covers the full scientific spectrum of materials research, from theoretical/fundamental/curiosity-driven basic research, through innovative application-oriented R&D, all the way into heavily industrialized extraction and processing technologies.

For me, TMS has expanded my scientific knowledge in numerous diverse areas, including electronic packaging, nanotechnology, microgravity materials science, materials characterization, and so much more. I do not know where my scientific curiosity will lead me next, but I do know that no matter where that topic falls on the materials science spectrum, TMS has the resources and diverse expertise available to support me—and all TMS members—in our scientific and professional explorations

Consider next the **temporal location** of TMS within your lifetime. TMS will help you every year of your scientific career. For me, it began as a wide-eyed undergraduate attending my first TMS conference in 1992, long before that terrifying first presentation here as a grad student.

"THE NEEDS OF EVERY INDIVIDUAL MEMBER ARE VERY DIFFERENT AT EVERY STAGE OF THEIR INDIVIDUAL CAREERS, BUT REGARDLESS OF WHERE YOU ARE LOCATED IN YOUR PROFESSIONAL CAREER, TMS WILL BE THERE, AS WE HAVE BEEN FOR OUR MEMBERS FOR THE PAST 150 YEARS."

TMS continued to support me as a slowly maturing grad student, and then as a young professional. Now, as my career extends into my comfortable mid-career years, I have the opportunity to expose the next generation of wide-eyed undergraduate students to the importance of TMS in every year of their future careers. The needs of every single TMS member differ every single year, but TMS must be there for each individual member every single year, as it has for all members for the past 150 years.

Consider also the **professional location** of TMS within your career. TMS has been with me for every step in my career and will continue to be with me in those years still to come. It is and will be the same for you. Whether as a student or in your first job or in your current job or in retirement—and especially during those anxious periods of unemployment,

whether that employment separation is by your own choice or by someone else's choice—TMS is there to help you in your professional career. No matter if the TMS member is a gray-bearded Life Member like me, or a first-time conference attendee, first-time speaker, first-time organizer, first-time committee member, or first-time award recipient, TMS is there for you. The needs of every individual member are very different at every stage of their individual careers, but regardless of where you are located in your professional career, TMS will be there, as we have been for our members for the past 150 years.

And, of course, consider the **geographic location** of TMS. Our headquarters is in Pittsburgh, Pennsylvania, and our conferences are held in a variety of constantly rotating, geographically diverse, popular, and accessible destinations like San Diego in 2023 and 2026, Orlando in 2024 and 2027, and Las Vegas in between it all in 2025. For TMS2022 in Anaheim, we had representatives from 51 countries in attendance. Let all those 51 locations sink in. Despite the challenging and problematic travel conditions, an impressive number of attendees made the trek to join their colleagues at TMS2022.

TMS2022, and our many other high-impact events, span the full geographic length and breadth of the Americas, Asia, and Europe. In the two years preceding COVID, TMS sponsored conferences in over a dozen different countries around the globe. Much to the chagrin of all of us, COVID made us take last year's conference exclusively on-line, and we rose to the task and quickly adopted—and adapted—innovative technologies to bring that famous TMS meeting content to our members while keeping a safe geographic separation between them all.

And even now, as we move beyond COVID, TMS must continue to expand upon those innovative digital content delivery methods to benefit the member. But, I think we all realize what we missed last year. And so, we must continue to enhance our in-person activities to faithfully preserve the critically important face-to-face interactions that have brought together members in the meeting rooms, at the coffee breaks, and in the exhibitions starting in Wilkes-Barre, Pennsylvania, in 1871 and continuing to our meeting in Anaheim 150 years later.

But wherever your personal and professional location is in geographic, temporal, or scientific space—whether on-line or in real life—TMS is THE place, THE location where your professional career will grow.

Editor's Note: This article is based on the speech Ready delivered at the TMS 2022 Annual Meeting & Exhibition when he was installed as the 2022 TMS President.

**“WHEREVER
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AND PROFESSIONAL
LOCATION IS IN
GEOGRAPHIC, TEMPORAL,
OR SCIENTIFIC SPACE—
WHETHER ON-LINE OR
IN REAL LIFE—TMS
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YOUR PROFESSIONAL
CAREER WILL
GROW.”**

2022 TMS BOARD OF DIRECTORS

W. Jud Ready was officially installed as the 2022 TMS President at the TMS 2022 Annual Meeting & Exhibition (TMS2022), held February 27-March 3, 2022, in Anaheim, California. The following individuals join him on the TMS Board of Directors to lead the Society in the coming year.

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*Principal Research Engineer,
Georgia Institute of
Technology*

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*Division Leader, Los Alamos
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the Technical Staff, Sandia
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*President, Thermo-Calc
Software Inc*

Structural Materials Division Director/Chair

Suveen Mathaudhu
*Professor, Colorado School of
Mines*

Planning a Meeting during a Pandemic: Lessons Learned from MiNES 2021



Ann Ritchie



MINES 2021 INTERVIEWEES



Todd Allen (TA), the Glenn F. and Gladys H. Knoll Department Chair of Nuclear Engineering and Radiological Sciences at University of Michigan, served as general chair.



Clarissa Yablinsky (CY), a scientist at Los Alamos National Laboratory, served as technical chair.



Anne Campbell (AC), a research associate at Oak Ridge National Laboratory, served as assistant technical chair.

The Materials in Energy Systems conference (MiNES 2021) succeeded as the first in-person TMS specialty meeting since the COVID-19 pandemic necessitated virtual events. A committee of pioneering volunteers took the brave first steps to convene researchers, practitioners, and students, at long last. They shared the setbacks, strategies, and successes.

With the advent of the COVID-19 vaccine, the MiNES 2021 organizing committee saw an opportunity to plan an in-person meeting, but they faced new challenges. Some ordinances limited the size of gatherings, while some organizations restricted travel, including U.S. national laboratories.

Hoping for the best, the committee postponed the event by two months, and MiNES 2021 met on November 8–11, 2021, at the Omni William Penn Hotel in Pittsburgh, Pennsylvania. 129 attendees gathered and reignited the spirit of the meeting.

1. THE SETBACKS: What were the challenges?

CY: "It was a tough choice to decide to stick to an all in-person meeting. We knew that some people would be excluded, but the ability to collaborate in person seemed to be what most people were missing. Thus, we felt staying with an all in-person meeting had greater benefits than a hybrid model. It was unfortunate that the whole community was still unable to meet."

TA: "The uncertainty in the conference dates and the allowed attendance limited the opportunity for sponsorships."

AC: The uncertainty about the conference dates and continuing travel restrictions made planning travel difficult. The inability of the majority of the national laboratory staff to travel, including myself, reduced both the number of talks and attendees. At the last minute, the U.S. allowed travel from Europe. All of these changes combined to require multiple iterations of the conference schedule."

2. THE STRATEGIES: What was important to consider?

TA: "Important considerations for the programming included starting with a well-structured and balanced program that could be modified as we learned which researchers would be able to attend. Clarissa and Anne deserve a ton of credit for their wisdom, insights, and perseverance."

CY: "The largest challenge was keeping the program cohesive, without large gaps, but still being mindful of the flow of talks within a session, to the best of our ability. Building a cohesive schedule had challenges this year, so we had to wait until very close to the conference to release the final technical program to minimize gaps."

AC: "Keeping talk times consistent across tracks, as well as having invited talks as twice the length of contributed talks, allowed for more flexibility for schedule adjustments. Attendees indicated a higher degree of satisfaction with this, as well, so different tracks didn't have talks ending at different times."

Having the flexibility in the schedule and presenter list is key when planning conferences, but this will be a bigger focus for future conferences post-COVID."

3. THE SUCCESSES: What worked?

TA: "It was the first time in a year-and-a-half that the nuclear materials community could share results in person. We had a good venue, good support from TMS, and two excellent speakers for the plenary and the banquet talks, Eben Mulder from X-energy and Rita Baranwal from EPRI. All activities took place at the Omni, which followed health and safety protocols."

CY: "MiNES 2021 attendees showed enthusiasm for meeting in person and being able to collaborate in such an excellent venue."

AC: "All feedback from people who attended was positive, despite all the challenges and uncertainty from the pandemic. We had good attendance despite the limitations due to the pandemic. There was still a significant number of presentations from academia that showed the continued development of future nuclear materials researchers."

TA: "Having a new set of graduate students able to join the conversations around nuclear materials was an important outcome."

AC: "Also, knowing the resiliency of this community, even in the face of the unknowns, to still have a great meeting."

CY: "It was great to be back at a small specialty conference and be able to meet with colleagues. While planning was difficult, the conference was successful, and I was thankful to be able to help provide the community with an opportunity to gather and discuss new work."

THE WOMEN LEADERS OF NUCLEAR MATERIALS

After MiNES 2021, the organizing committee elected its leadership for MiNES 2023, newly appointing Maria Okuniewski to form an all-women team for the first time.



Janelle Wharry, an associate professor at Purdue University, co-founded MiNES, served as the MiNES 2019 general chair, and continues to be an active member of the organizing committee.

TMS has been co-sponsoring MiNES with the American Nuclear Society (ANS) since 2019. The conference is held every two years and was started through the TMS Nuclear Materials Committee. MiNES has created a home for a close-knit community of radiation materials scientists to immerse themselves into their core research passion and build richer connections with one another.

"MiNES has had an overwhelming influence on me. While I was getting the first MiNES off the ground, I was also navigating career challenges associated with gender diversity. Seeing MiNES succeed gave me a sense of accomplishment and confidence that enabled me to overcome this difficult time in my career. Since then, I have viewed MiNES as an opportunity for individuals from underrepresented groups to grow and show the materials profession what we're capable of doing.

For people from underrepresented groups, a scientific career path is often full of hurdles that prevent some of the most promising individuals from reaching their full potential. This hurts not only the individuals, but also holds back the research field. The MiNES leadership team wants to ensure that the conference sets a tone for our research field, by removing hurdles and empowering high performers who happen to be from diverse backgrounds, to make valuable contributions and collectively advance our field. I hope this sets a precedent for the broader minerals, metals, and materials community."

INTRODUCING THE MINES 2023 LEADERS



MiNES 2023
General Chair
Clarissa Yablinsky,
Los Alamos
National Laboratory

Clarissa Yablinsky has worked for Los Alamos National Laboratory for nine years, first as a postdoctoral research associate and then as a scientist. She also completed post-baccalaureate research there and has held research positions at the University of Wisconsin-Madison and The Ohio State University. She first joined TMS as an undergraduate student in 2002 and currently contributes to the TMS Diversity, Equity, and Inclusion Committee, Financial Planning Committee, Mechanical Behavior of Materials (SMD) Committee, and Nuclear Materials (SMD) Committee. She has a B.S. from Carnegie Mellon University and an M.S. and a Ph.D. from The Ohio State University, all in materials science and engineering.



MiNES 2023
Technical Chair
(2025 General Chair)
Anne Campbell,
Oak Ridge National
Laboratory

Anne Campbell is a research associate of graphite materials for nuclear applications in the Materials Science and Technology Division at Oak Ridge National Laboratory. She first joined as a postdoctoral research associate in 2014. Her TMS membership spans 15 years and includes participation on the Nuclear Materials (SMD) Committee and serving as the lead organizer for the Composite Materials for Nuclear Applications symposium at the 2021 TMS Annual Meeting & Exhibition. She completed a B.S.E. in nuclear engineering at Purdue University and earned an M.S.E. and Ph.D., both in nuclear engineering and radiological sciences, from the University of Michigan.



MiNES 2023
Assistant Technical
Program Chair (2025
Technical Chair,
2027 General Chair)
Maria Okuniewski,
Purdue University

Maria Okuniewski is an assistant professor of materials engineering, with a courtesy appointment in nuclear engineering, at Purdue University, where her research focuses on understanding the connections between the microstructure of nuclear materials and fuels and their mechanical properties. Previously, she was a scientist and nuclear engineer in fuel performance and design at Idaho National Laboratory. She joined TMS in 2005 and participates on the Nuclear Materials (SMD) Committee and as the TMS/MiNES liaison. She has a B.S. in biology and marine science from the University of Tampa and an M.S. and Ph.D. in nuclear engineering from the University of Illinois at Urbana-Champaign.

HONORING THE 2022 TMS YOUNG LEADERS

Megan Enright



The TMS Young Leaders Professional Development Awards honor the exceptional futures, both in TMS and as materials science and engineering professionals, of their recipients. These special honors for early career members are conferred by each of the five technical divisions of TMS. This program provides financial assistance to attend the TMS annual meeting, where recipients have access to a variety of leadership development opportunities. Recipients can participate in division council meetings, luncheon lectures, a TMS Board of Directors meeting, and more.

These experiences offer networking opportunities with professionals at all stages of their careers and prepare the Young Leaders Award recipients for future leadership roles within the Society.

Each of the 2022 Young Leaders introduced on the following pages received their awards at the TMS 2022 Annual Meeting & Exhibition (TMS2022), February 27–March 3, 2022, in Anaheim, CA. Although TMS2022 has concluded, be sure to add these young professionals to your network and your professional community.



INVEST IN THE FUTURE

Without the TMS Foundation, the opportunities highlighted by the early career professionals in this article would not be available. The TMS Foundation is dedicated to the development of the next generation of minerals, metals, and materials scientists and engineers. Visit www.TMSFoundation.org to learn more about the Foundation and aid in continuing its important work through an online donation. For questions or to talk to TMS Foundation staff, contact TMSFoundation@tms.org or call 1-724-776-9000.

Extraction & Processing Division (EPD)



Mohamed Elzohiery

"It is a great honor to receive the 2022 TMS EPD Young Leaders Professional Development Award. Being a member of TMS played a major role in developing my leadership skills, growing my professional experience, and keeping

me updated with new research and developments in my field," stated Mohamed Elzohiery, a process engineer at RioTinto – Kenecott Utah Copper. "I had the benefit of participating in a TMS annual meeting where I was able to publish and present my work, as well as grow my professional network by meeting experts and professors in metallurgical engineering from all over the world." Elzohiery received a B.Sc. and an M.Sc. in metallurgical engineering from Cairo University in 2011 and 2013, respectively. He received a Ph.D. Fellowship Award from the Department of Metallurgical Engineering at the University of Utah, graduating in 2018.



Stuart Nicol

"TMS has played an important role in my growth as a metallurgist. I have learned a lot through participating in conferences, meetings, and journals, both from the technical content and from other engineers I have

met through these activities," said Stuart Nicol, a metallurgist at Glencore Technology. "I greatly appreciate the honor of this award; it means a lot to be recognized by others in my industry. I look forward to being active with the TMS EPD and hope that I can give back and encourage others in our industry." Nicol has over 10 years of experience in pyrometallurgy, working in design, operations, and fundamental research. His experience spans all stages of metallurgical facility, design, operation, optimization, expansion, and decommissioning. In 2021, he received the TMS EPD Science Award for his research on oxide melt solidification.

"I look forward to being active with the TMS EPD and hope that I can give back and encourage others in our industry."

—Stuart Nicol

Functional Materials Division (FMD)



Huanyu (Larry) Cheng

"I'm humbled to be selected as a recipient of the 2022 FMD Young Leaders Professional Development Award, with opportunities to enhance the professional development of young, dynamic, and committed members

through leadership opportunities and networking," reflected Huanyu (Larry) Cheng, Dorothy Quiggle Assistant Professor, Pennsylvania State University. "I'm also eager to play a more active role in TMS and volunteer leadership positions in the Society in the future. Prepared to broaden the technological profile of TMS in nanomaterials, I look forward to engaging more TMS members in Functional Materials and other divisions." Cheng's research group focuses on the design, fabrication, and application of stretchable and dissolvable multimodal sensors for biomedicine. He is a recipient of 2021 Frontiers of Materials Award.

"I'm also eager to play a more active role in TMS and volunteer leadership positions in the Society in the future."

—Huanyu (Larry) Cheng



Wenzhuo Wu

"I am grateful and honored to receive the 2022 TMS FMD Young Leaders Professional Development Award! This award will not only provide valuable opportunities for me to get more engaged with TMS, but also inspire

me to strive towards my long-term career goals," said Wenzhuo Wu, Ravi and Eleanor Talwar Rising Star Associate Professor at Purdue University. "I sincerely appreciate this acknowledgment and generous support from TMS. I look forward to contributing back to the TMS community through increased engagement in technical committees, the FMD division, and the Society." Wu received his B.S. in electronic information science and technology from the University of Science and Technology of China, Hefei, and his M.E. in electrical and computer engineering from the National University of Singapore. In 2013, he earned his Ph.D. from Georgia Institute of Technology in materials science and engineering.

Light Metals Division (LMD)



Matt Pharr

"I am honored to receive this award. More importantly, I am excited to become more involved in TMS leadership activities, so as to play an active role in advancing the ever-evolving field of materials science," stated Matt Pharr, an assistant professor

at Texas A&M University. Pharr received his Ph.D. from Harvard University and performed postdoctoral research at the University of Illinois at Urbana-Champaign. His research focuses on the mechanics of materials in areas including energy storage and conversion, soft materials, irradiated materials, stretchable electronics, coupled electro-chemo-mechanics, and materials for neuromorphic computing.

"I am excited to become more involved in TMS leadership activities, so as to play an active role in advancing the ever-evolving field of materials science."

—Matt Pharr

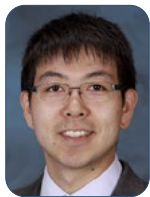


Derek Santangelo

"I am proud to be a member of a Society that can bring together the world's collective thoughts for the sake of improving our knowledge and understanding. Even more proud to be recognized as a contributing member

of this cause, both now, and for a long time to come," commented Derek Santangelo, Global Carbon Practice Lead, Center of Excellence for Aluminium, Hatch Canada. Santangelo received his bachelor's degree in mechanical engineering from McGill University in 2005. While his expertise primarily lies within the carbon area, he has also worked in reduction, potlining, material handling, gas treatment, and casting. Santangelo has been a member of the TMS Aluminum Committee since 2019.

Materials Processing & Manufacturing Division (MPMD)



Yue Fan

"I am very grateful for the precious recognition. I have long regarded TMS as my home conference ever since I first attended in 2015, because TMS has provided such a great platform (especially for young professionals) to

interact and collaborate with people with diverse backgrounds," said Yue Fan, an assistant professor at the University of Michigan. "Along the path, my journey at TMS has also become more enriched, from simply giving presentations to organizing symposia,

editing *JOM* issues, and serving on both technical and diversity committees. I look forward to continuing to serve and contribute to the TMS community and passing such pride to my students and the next STEM generation." Fan received his Ph.D. from the Massachusetts Institute of Technology in 2013. His primary research interest is providing substantive knowledge on mechanics and microstructural evolution in complex systems via predictive modeling.

"TMS has provided such a great platform (especially for young professionals) to interact and collaborate with people with diverse backgrounds."

—Yue Fan



Arun Devaraj

"Since 2008, TMS meetings have been my main avenue to get updated on the latest and greatest in materials research, organize symposiums, attend technical committee meetings, and meet friends and colleagues from across the world in

the material science research community," noted Arun Devaraj, senior research scientist at the Pacific Northwest National Laboratory. "I am honored to receive the 2022 MPMD Young Leaders Professional Development Award and through this unique opportunity, I am looking forward to contributing more to the long-term growth of the MPMD and the TMS community." Devaraj's research focuses on physical metallurgy, primarily on revealing the behavior of materials under far-from-equilibrium conditions imposed through, deformation, corrosion, irradiation, thermal treatments, or a combination of these factors. Devaraj is the secretary of the TMS Shaping and Forming Committee and has been a symposium organizer for TMS conferences.

Structural Materials Division (SMD)



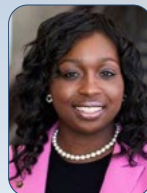
Assel Aitkaliyeva

"TMS has played a big role in my scientific career. Attending TMS meetings has always provided me with opportunities to network, learn more about progress made in the field, develop successful collaborations,

and share my research, while serving on various committees helped me find my voice and identify the topics I am most passionate about," recalled Assel Aitkaliyeva, an assistant professor at the University of Florida. "I look forward to contributing to the TMS mission in the future and sharing my experience with my students." Aitkaliyeva received a B.S. in physics from Kazakh National University. She also earned an M.S. in nuclear engineering and a Ph.D. in materials science and engineering from Texas A&M University.

"Attending TMS meetings has always provided me with opportunities to network, learn more about progress made in the field, develop successful collaborations, and share my research, while serving on various committees helped me find my voice and identify the topics I am most passionate about."

—Assel Aitkaliyeva



Clinique Brundidge

"The TMS Foundation has been an important resource for my educational and career advancement since 2007. I'm honored to have opportunities to participate and contribute to such a long-standing, prominent international

organization," stated Clinique Brundidge a lead materials scientist. "I'm esteemed to receive the highly competitive SMD Young Leaders Professional Development Award and look forward to pursuing more TMS leadership roles." Brundidge was a post-doctoral research fellow at University of California, Santa Barbara and earned her Ph.D. at the University of Michigan–Ann Arbor.

In addition to the TMS Young Leaders Professional Development Awards, TMS has several honors that recognize young members. TMS supports its early career members in their professional growth and leadership development through awards intended to facilitate networking and advancement within the Society. Join us in congratulating the following recipients and be sure to add these young professionals to your network and your professional community as well.

Young Innovator in the Materials Science of Additive Manufacturing Award

This award seeks to recognize an outstanding, early career individual who is performing innovative research in the area of the materials science of additive manufacturing.



Tao Sun Associate Professor, University of Virginia

"I am truly honored to receive this award from TMS! As an X-ray scientist, I had very limited knowledge on additive manufacturing back in 2015, when I initiated this research

program at the Advanced Photon Source. My whole team then started to attend TMS sponsored meetings and learn from experienced researchers in this field. The TMS Annual Meeting & Exhibition offers the best venue for researchers in academia, government labs, and industry to communicate recent advancements in metal additive manufacturing. Now I consider TMS my home professional society and highly value my interactions with colleagues and friends at the annual meeting and via other TMS activities. I appreciate the community's recognition of our work which was accomplished by the collective efforts of my talented dedicated determined team members and collaborators."

Lecture: "The Critical Roles of Keyhole in Laser Powder Bed Fusion"

Frontiers of Materials Award

This award is given competitively to top-performing early career professionals capable of organizing a Frontiers of Materials event comprising a hot or emergent technical topic at the TMS Annual Meeting & Exhibition.



Andrea Koerdt Federal Institute for Materials Research and Testing

"I am deeply honored to receive this award and the resulting boost to my career. There are incredible opportunities through the TMS

Frontiers Materials Award and participation in the conference. The biggest challenge in studying Microbiologically Influenced Corrosion (MIC) is making key stakeholders and other disciplines aware of this subject. This award enables me to make new contacts, exchange knowledge and experience with scientists and experts from other disciplines, learn about other points of view, and initiate new collaborations. An outstanding success for me and for MIC research is the networking potential between scientists, stakeholders, and experts from Europe and the USA."



Yu-chen Karen Chen-Wiegart
Assistant Professor, Stony Brook University/Brookhaven National Laboratory

"The award enabled organizing a special symposium session at the TMS annual meeting – it drives us to

further the understanding of nano-architected materials with novel characterization methods, such as advanced microscopy and synchrotron X-ray techniques, that are augmented by data science and machine learning algorithms. Honored and humbled by the opportunity to receive this meaningful award, I am truly grateful to TMS, the award committees, the Nanomaterials Committee, and wonderful symposium co-organizers for their trust and great support. While this award marks an incredible step for my own professional career, I am even more excited to have the opportunity to serve the community by bringing people with a wide range of technical backgrounds and research interests together, in exploring one of the most exciting areas in materials science and engineering in our times!"



Mostafa Bedewy
Assistant Professor, University of Pittsburgh

"TMS is the flagship professional society for a large community of materials scientists and engineers, and I view this award as a perfect opportunity to

increase my involvement in TMS activities, especially during the TMS Annual Meeting & Exhibition. I am grateful for the recognition of my research on nanocarbons through such a competitive award, and I am looking forward to presenting my work at future TMS conferences, starting with organizing a symposium at TMS2022. This award also highlights TMS' support for emerging areas of scientific research in materials science and engineering, especially those relating to the integration of graphene and related materials in flexible device manufacturing. Indeed, TMS and the broader materials community have always valued and celebrated the diversity of topics and backgrounds under its umbrella."

Young Leaders International Scholar Award - JIM

This award, jointly administered by TMS and the Japan Institute of Metals and Materials (JIM), promotes young member activities and strengthens the collaborations between these two international societies. Recipients travel to the JIM annual meeting where they can present papers at international sessions.



Victoria Miller
Assistant Professor, University of Florida

"Being a part of TMS has shaped and helped to facilitate every stage of my career. As a student, I ran around watching talks and networking, which set me up for my post-doc and faculty position. Now that I am on the tenure-track, TMS Young Leader activities and the International Scholar Award are helping me to broaden my horizons even further—taking me to Japan for the first time!"

JIM Young Leader

As part of this Young Leader's International Scholar Award, a representative from the Japan Institute of Metals and Materials (JIM) travels to the TMS Annual Meeting & Exhibition where they can present their paper at an international session.



Daixiu Wei
Assistant Professor, Tohoku University, Institute for Materials Research

ARE YOU A 2023 YOUNG LEADER?

TMS Young Leaders Professional Development Award recipients are innovative individuals who represent the future of the minerals, metals, and materials community. A common thread amongst these individuals is their dedication to advancing their professional careers and leadership skills, including being active as TMS volunteers and aiding in the facilitation of TMS' strategic initiatives.

Do you, or someone you know, fit these criteria? Visit the TMS Honors and Awards website at www.tms.org/awards to learn more and apply. Applicants must be TMS members in good standing who are age 40 or younger. Awardees must also demonstrate a desire to play an active role in TMS and the potential to advance to volunteer leadership roles with the Society.

The deadline to submit applications for the 2023 Young Leaders Awards is August 15, 2022.

THE TMS FOUNDATION: *INSPIRATION DURING TOUGH TIMES*

Ann Ritchie



The TMS Foundation celebrated notable gifts, an increase in donors, and growth in the total donations in 2021, having persevered through global economic challenges in 2020. Outgoing chair Garry W. Warren, University of Alabama, demonstrated impressive leadership during two unprecedented years of service, and is transitioning the leadership role to incoming chair Carl M. Cady, Los Alamos National Laboratory.

"I am wistful yet excited by this transition as I cannot think of the TMS Foundation without thinking immediately of both Garry Warren and Carl Cady, who have been so generous of time, energy, enthusiasm, leadership, and finances in advancing our goals over the last decade," said James Robinson, TMS executive director.

The Battelle Memorial Institute and its former chief executive officer and president, Jeffrey Wadsworth, each donated \$15,000 to the TMS Foundation to ensure our two diversity-focused awards, the Ellen Swallow Richards Diversity Award and the Frank Crossley Diversity Award, recognize recipients consistently. These gifts added a \$1,500 cash prize to the Swallow Richards Award and a \$500 travel stipend to the Crossley Award. These awards recognize individuals who have helped or inspired others to overcome personal, professional, educational,

cultural, or institutional adversity to pursue a career in minerals, metals, and/or materials. Wadsworth was instrumental in the creation of these two awards for the TMS Foundation, starting with the establishment of the Swallow Richards Award in 2013.

The generosity of donors was particularly strong in their support of the TMS technical division scholarships and Young Leaders Professional Development awards. Unrestricted donations also increased since the previous year.

Sixty individuals gave their first donation in 2021. Overall, 348 individuals gave gifts, representing an increase of 56 donors. The TMS Foundation ran its year-end appeal campaign from October through December and raised \$79,924. In total, the funds raised over the course of the year totaled \$168,048.

The TMS Foundation thanks the TMS members and friends for their support in 2021 with the Annual Giving Honor Roll and Lifetime Giving Honorable Societies on the pages that follow, also available at www.TMSFoundation.org/HonorRolls

To earn a spot on the 2022 Honor Roll, you can make a donation at www.TMSFoundation.org/Contribute. For details about donation options or to discuss your donation personally, please contact Kim Cannon at TMSFoundation@tms.org or 1-724-776-9000.

Continuing the Legacy: Meet the New Chair



Garry W. Warren
2016–2022 Chair,
TMS Foundation
Board of Trustees;
2011 TMS President;
and Professor Emeritus,
University of Alabama

Chaired by Garry W. Warren from 2016–2022, the TMS Foundation made great strides in recent years. Warren identified areas of focus, developed strategies, and motivated Society members to support growth and development. In 2021, the TMS Foundation focused its fundraising on three initiatives: increasing the number of Young Leaders Awards, increasing the number of Family Care Grants, and reestablishing the Presidential Scholarship. Carl M. Cady became the new chair in March 2022, having been a trustee since 2018.

"I have very much appreciated the years of service Garry Warren dedicated to TMS. He was 2011 TMS President when I served on the board of directors. We have been on the TMS Foundation board together for my entire time in service, as well," Cady said. "Garry is a person that you want to follow because he is a lead-by-example kind of person, an excellent motivator, and recruiter of talent. He has a way of putting people at ease and inviting people to be part of the mission. Our Society could not have had a better leader for any of the positions in which he has served. Importantly, leadership in bringing diversity and inclusiveness to our Society is one of the things I believe will be a lasting legacy Garry has given to TMS."



Carl M. Cady
2022–2025 Chair,
TMS Foundation
Board of Trustees; and
Technical Staff Member,
Los Alamos National
Laboratory

Cady was serving on the board of directors with Diran Apelian when Rob Wagoner led the effort to revitalize the TMS Foundation. He witnessed the work to set goals and put forth the effort to make it sustainable.

"I became interested in doing as much as I could to support the TMS Foundation and have been a champion and supporter since that time," Cady said.

Going forward, the TMS Foundation will continue soliciting support for awards and scholarships. Cady hopes to see the return of some awards that the TMS Foundation has had to restrict until they were sustainable. The short-term goal is to build up the portfolio, and then in the longer term, develop plans to start using the saved funds without spending down the principle.

"Many of the Foundation's tasks help to bring recognition to the Society. The Society awards we support or review, the initiatives that help bring members to the meetings, the meetings we help bring to fruition: all are rewarding," Cady said. "Helping to make our Society 'the' place where people want to bring their research and ideas in a collaborative way are the motivations that I have to be part of the board of trustees."





Thank You to Our 2021 Donors



1871 Legacy Circle

Lucinda and Martin Glicksman
Garry W. Warren and
Larry Goldman*

Lifetime Giving Honorific Societies



Diamond Society (\$100,000 or more)

Lucinda and Martin Glicksman
Geraldine McCulley Wadsworth
and Jeffrey Wadsworth
Robyn and Rob Wagoner



Platinum Society (\$50,000 to \$99,999)

Future Members to Come



Gold Society (\$20,000 to \$49,999)

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2021 Annual Giving Honor Roll

(List updated annually)

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Frank E. Wagstaff
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Robyn and Rob Wagoner
Joan and James Yurko

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	Ernest J. Sirois	

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DON'T MISS THE 2022 ADDITIVE MANUFACTURING BENCHMARK TEST SERIES AND CONFERENCE



Brandon M. Lane,
Brian J. Simonds,
Jonathan E. Seppala,
and Lyle E. Levine

BE PART OF THE CONVERSATIONS

Everyone in AM modelling, simulation, and supporting measures is encouraged to attend, even if you are not involved in the benchmark challenges!



August 15–18, 2022

Hyatt Regency Bethesda^a, Bethesda,
Maryland, USA

Register for the meeting and reserve a hotel room on the TMS meeting website at www.tms.org/AMBench2022

Access the benchmark challenges on the NIST AM-Bench website at www.nist.gov/ambench

a. Certain commercial products or locations are identified in this article. Such identification is not intended to imply recommendation or endorsement by NIST.



The explosive growth of additive manufacturing (AM) is matched by an equally strong push in research and development to support those applications. The relative complexity of these manufacturing processes and the materials they generate still elicit a great need for better understanding of the interactions between the fabrication parameters (e.g., material deposition rate, applied thermal energy, etc.) and the material development and evolution. Complex problems require complex tools, and with the boom in AM, the development of computational models and simulations to predict all aspects of these processes has grown in parallel. Incredible diversity exists in the types of models, the level of physical or computational complexity, the range of materials, and applications. But all require something similar: input of or reference to relevant physical values achieved through accurate measurements. Measurements are essential, not just in the development of AM models, but in the testing and validation of their predictions.

To address this gap, the National Institute of Standards and Technology (NIST) initiated the Additive Manufacturing Benchmark Test Series (AM-Bench), where AM modelers and metrologists compare computational predictions to an array of measurements designed and dedicated to advancing AM modelling. The inaugural AM-Bench conference in 2018 was a landmark in AM model development, where modelling challenges were first described, high-quality data were provided to compare to models, and, importantly, the community came together to discuss what worked, what didn't, and how we could improve the quality, trustworthiness, and value of AM models and simulations.

A SUCCESSFUL 2018 CONFERENCE

The 2018 AM-Bench test series and conference were widely successful, with more than 40 scientists from national laboratories, universities, and private industry participating in the measurements, over 45 submissions to the modelling challenges, and over 160 attendees at the conference held the week of June 18, 2018, at NIST in Gaithersburg, Maryland. A published collection summarizes the measurements and challenges¹. Apart from stellar presentations from both metrologists and modelers, plenary discussion sessions sparked lively conversations about the state of AM modelling and how AM-Bench can continue to accelerate model development, application, and trust. A major objective of AM-Bench is not just to generate measurement data, but also discourse. This input, along with valuable advice from the AM-Bench scientific committee and stakeholders, helped to guide the planning for AM-Bench 2022.

THE 2022 AM-BENCH MEASUREMENTS

The COVID-19 pandemic prevented key measurements from being conducted and caused a postponement of the meeting from 2021 to 2022. However, it also allowed for more comprehensive planning, with vast improvements and additions to the measurement systems, analysis methods, and data management compared with 2018.

As in 2018, a large focus will be on the connection between processing and microstructure for metals-based laser powder bed fusion (LPBF). A hierarchy of experiments will include feedstock characterization, *in-situ* measurements during the build, post-build characterization of part deflection and location-dependent residual stress and microstructure, and measurements of microstructure evolution during post-build thermal processing. While the 2018 tests were conducted on both commercial and research AM machines, almost all 2022 *in-situ* LPBF measurements and fabrication are done on the NIST Additive Manufacturing Metrology Testbed (AMMT), shown in Figure 1, using the same environment, instruments, and calibrations from the small-scale, individual laser scans to full 3D builds.

The similarities to 2018 mostly end there. AM-Bench 2022 will extend the 2018 focus to include local mechanical behavior, along with greatly improved studies of the fundamental laser-sample interactions. Other extensions include a much wider array of machine performance characterization tests (i.e., calibrations), completely redesigned and vastly improved thermographic system performance, and completely new measurements, such as laser energy absorption and 3D microstructure characterization.



Figure 1: The outside view of the NIST Additive Manufacturing Metrology Testbed (AMMT), used for the metal 3D builds and in-situ measurements (top). A new high speed, high magnification thermographic camera setup (lower left). The in-situ characterization of laser beam energy profile and dynamic performance (lower right).

AM-Bench 2018 included a large set of measurements on polymer AM, and the lessons learned are being applied to AM-Bench 2022. In 2018, the main focus was on macroscale properties such as part thickness, mass, tensile properties, void distribution, and local anisotropy for samples produced using selective laser sintering (SLS) and material extrusion (MatEx). The corresponding challenge problems did not produce the broad community response engendered by the metal AM challenges and subsequent discussions with stakeholders led to a new focus on the fundamental processes of MatEx, SLS, and stereolithography (SLA).

Another major addition to AM-Bench 2022 is “asynchronous benchmarks” that are not tied to the nominal three-year benchmark cycle to provide increased agility in addressing the needs of our stakeholders. Asynchronous benchmarks are relatively small, stand-alone sets of measurements that address a specific need of the modelling community. The challenge problems for the first asynchronous benchmark were released in January 2022, and the measurements use a combination of high-speed synchrotron radiography and time-resolved, calibrated laser-energy coupling to explore the *in-situ* dynamics of the laser-metal interaction, shown in Figure 2². The AM-Bench 2022 conference will include this asynchronous benchmark in addition to the regular 2022 benchmarks.

An exciting development is improvement to the data management systems. AM-Bench embraces the FAIR data principles of Findability, Accessibility, Interoperability, and Reusability³. A broad team of data scientists is developing a combination of robust data and metadata repositories, data and sample tracking systems, Extensible Markup Language (XML)-based schema, and server-side data analysis systems to provide users a free and accessible data management system for exploring, downloading, and analyzing the extensive AM-Bench data sets. Ultimately, it is planned to include vetted analysis codes and measurement data sets submitted by outside participants.

LOOKING FORWARD TO AUGUST 2022

The asynchronous benchmark descriptions and challenge problems were released in January 2022, with challenge problem submissions due in April. The main benchmark test descriptions and details about the corresponding modelling challenges will be released in April 2022 on the NIST AM-Bench website at <https://www.nist.gov/ambench>. Modelers who wish to participate in the AM-Bench challenges should expect to submit their results in July 2022 and the measurement results will be disseminated shortly after.

ABOUT THE AUTHORS

Brandon M. Lane is the leader of the NIST Engineering Laboratory (EL) Metrology for Real-time Monitoring and Control of AM Project, and co-chair of the AM-Bench Organizing Committee. **Brian J. Simonds** is an applied physicist with the NIST Physical Measurement Laboratory (PML) studying high-power laser metrology and applications. **Jonathan E. Seppala** is the leader of the NIST Materials Measurement Laboratory (MML) Polymer Additive Manufacturing and Rheology Project. **Lyle E. Levine** is the leader of the NIST MML Additive Manufacturing of Metals Project, is the founder of AM-Bench, and serves as chair of the AM-Bench Steering Committee and co-chair of the AM-Bench Organizing Committee.

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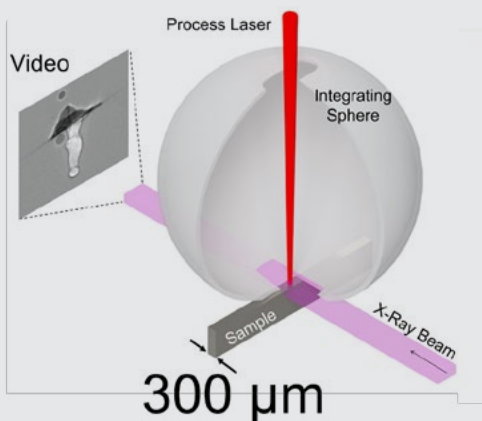
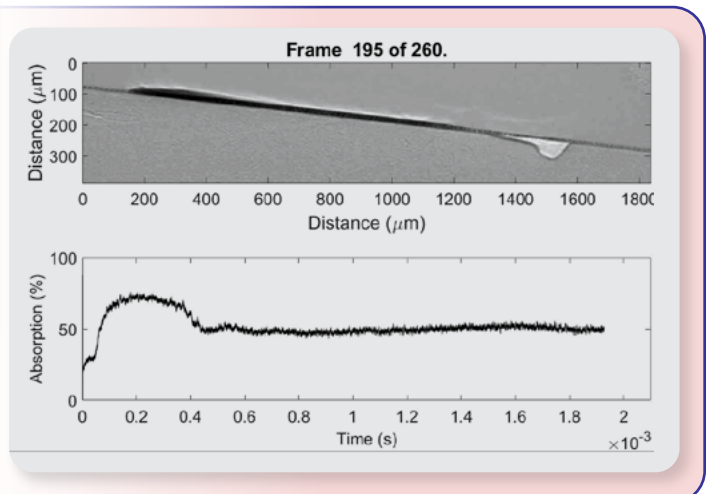


Figure 2: A schematic of the high-speed synchrotron radiography and laser absorption setup at Argonne Advanced Photon Source (left). A synchronized radiographic cross-section of the melt pool and dynamic laser absorption (right).



In Case You Missed It:

BUSINESS NEWS FROM THE FIELD



Big Bay, Michigan, USA: (Photo above) The German automaker Dr.-Ing. h.c. F. Porsche AG announced that a Taycan Cross Turismo entered the Guinness World Record books by achieving the greatest altitude change ever by an electric car. The journey began underground at Eagle Mine in Michigan. A team drove the car to the record-breaking ascension of 15,889 feet at its final destination of Pikes Peak in Colorado. (Photo Credit: Porsche AG)

Fast Radius Opens New Manufacturing Facility

Chicago, Illinois, USA: Fast Radius, Inc. opened a manufacturing technology campus on Goose Island in Chicago, including a microfactory and software technology center. The microfactory will produce component parts for companies across industries, including automotive, electric vehicles, medical and healthcare devices, and consumer goods. The company's software and services center will help customers to design component parts, optimize them for production, make them when and where they're needed, while also providing transparency through the production lifecycle and supply chain.

Bear Creek Acquires Mercedes Mine

Vancouver, Canada: Bear Creek Mining Corporation agreed with Equinox Gold Corporation to acquire a 100% interest in the Mercedes gold-silver mine in Sonora, Mexico. The acquisition will move Bear Creek from a development stage company to a precious metal producer. Equinox will receive a cash payment of \$75 million and issuance of 24,730,000 Bear Creek common shares, a deferred cash payment of \$25 million due within six months, and a 2% net smelter return (NSR) payable on metal production from the Mercedes mining concessions.

Do you have business or industry news of interest to the minerals, metals, and materials community?

JOM
THE MAGAZINE

Submit your announcement or press release to Kaitlin Calva, *JOM: The Magazine* Principal Editor, at kcalva@tms.org for consideration.



Lemhi County, Idaho, USA:

(Photo left) Jervois Global Limited began underground construction of its 100%-owned Idaho Cobalt Operations in Idaho. This marks the first time in decades that the United States will have a primary cobalt mine within its borders. Commissioning and first production of cobalt concentrate is expected in mid-2022.

(Photo Credit: Jervois Global)

POSCO and HBIS Accelerate in Automotive Sheets

Beijing, China: An auto sheet joint venture between Chinese steel producer HBIS Group and South Korea's POSCO, with an investment of 4.125 billion yuan (\$647 million), started construction in Hebei, China. The venture, split equally between the two steel giants, involves two production lines in the northern Hebei province and an existing line in Guangdong. Steel plates produced at the plant will be supplied to major automakers including Toyota, Honda, Nissan, Hyundai, BMW, and Volkswagen. Total capacity is expected to reach 1.35 million tonnes every year when the project is put into production in 2023.

U.S. Steel Selects Site for Advanced Mill

Pittsburgh, Pennsylvania, USA: United States Steel Corporation announced that a new \$3 billion steel mill will be located in Osceola, Arkansas, close to the company's Big River Steel plant. The technologically advanced facility features two electric arc furnaces (EAFs) with 3 million tons per year of advanced steelmaking capability, a state-of-the-art endless casting and rolling line, and advanced finishing capabilities. It is the first use of endless casting and rolling technology in the U.S. The facility, creating approximately 900 jobs, will be completed in 2024.

TMS MEETING HEADLINES

Meeting dates and locations are current as of February 21, 2022.

For the most recent updates on TMS-sponsored events, visit www.tms.org/Meetings.



6th World Congress on Integrated Computational Materials Engineering (ICME 2022)

April 24–28, 2022

Lake Tahoe, Nevada, USA

Register Now

ICME 2022 convenes leading researchers and practitioners to share the latest knowledge and advances in the discipline. This congress is the recognized 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.

www.tms.org/ICME2022



6th International Congress on 3D Materials Science (3DMS 2022)

June 26–29, 2022

Washington, D.C., USA

Discount Registration Deadline: May 13, 2022

3DMS 2022 showcases work advancing the three-dimensional characterization, visualization, quantitative analysis, modeling, and development of structure–property relationships of materials, as well as associated big data and machine learning issues.

www.tms.org/3DMS2022



Additive Manufacturing Benchmarks (AM-Bench) 2022

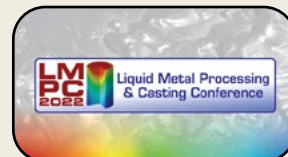
August 15–18, 2022

Bethesda, Maryland, USA

Register Now

AM-Bench 2022 continues a series of controlled benchmark measurements, in conjunction with a conference, enabling modelers to test their simulations against rigorous, highly controlled additive manufacturing benchmark test data.

www.tms.org/AMBench2022



2022 Liquid Metal Processing & Casting Conference (LMPC 2022)

September 18–21, 2022

Philadelphia, Pennsylvania, USA

Discount Registration Deadline: August 8, 2022

LMPC 2022 is a unique event that convenes experts from both industry and academia to showcase the latest technological and scientific advances related to those industrial processes used to cast large ingots of highly alloyed metals.

www.tms.org/LMPC2022

Other Meetings of Note



Materials Science & Technology

October 9–13, 2022

Pittsburgh, Pennsylvania, USA

www.matscitech.org/MST22



TMS 2023 Annual Meeting & Exhibition

March 19–23, 2023

San Diego, California, USA

www.tms.org/TMS2023



Superalloy 718 and Derivatives

May 14–17, 2023

Pittsburgh, Pennsylvania, USA

www.tms.org/Superalloy718-2023



TMS 2024 Annual Meeting & Exhibition

March 3–7, 2024

Orlando, Florida, USA

www.tms.org/TMS2024

Co-Sponsored Meetings

Offshore Technology Conference (OTC) 2022

May 2–5, 2022

Houston, Texas, USA

ALTA 2022 Nickel-Cobalt-Copper, Uranium-REE, Gold-PM, In Situ Recovery, Lithium & Battery Technology Conference & Exhibition

May 20–27, 2022

Perth, Australia

8th International Conference on Solid-Solid Phase Transformations in Inorganic Materials (PTM2022)

June 27–July 1, 2022

Xi'an, China

The 12th International Conference and Workshop on Numerical Simulation of 3D Sheet Metal Forming Processes (NUMISHEET 2022)

July 10–14, 2022

Toronto, Ontario, Canada

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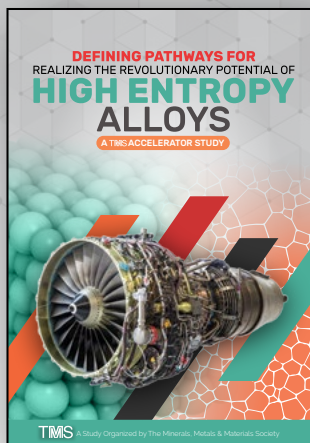
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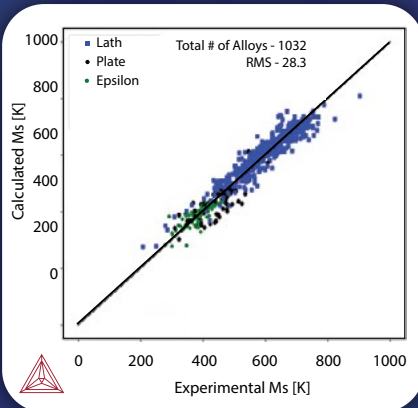
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- ✓ **Accelerate** materials development while reducing risk
- ✓ **Troubleshoot** issues during materials processing

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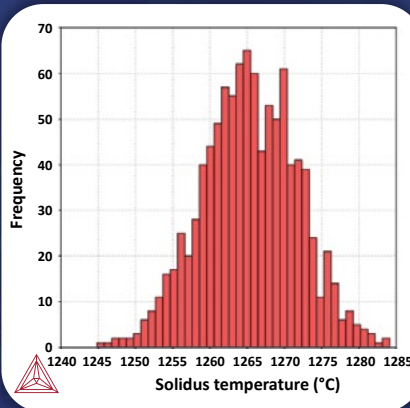
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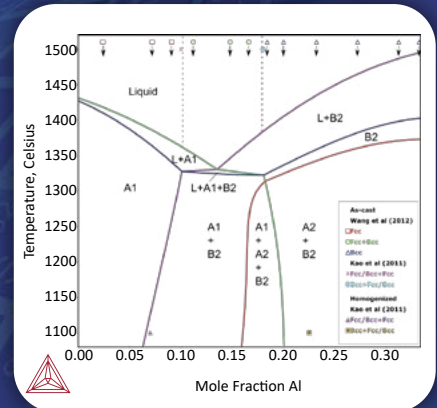
Comparison of calculated and experimental Ms temperatures for a wide range of steels

Nickel



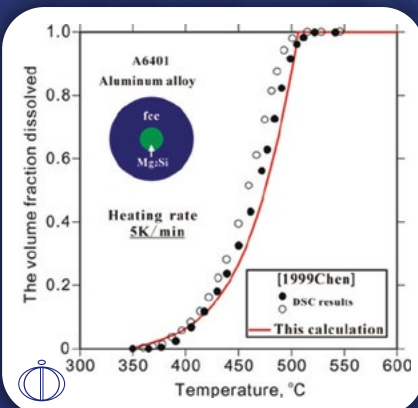
Variation in solidus temperature over 1000 compositions within alloy 718 specification

High Entropy Alloys



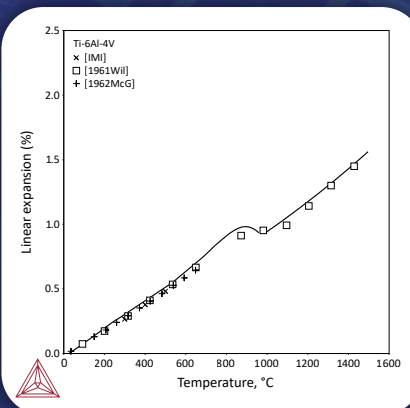
Calculated phase diagram along the composition line of CoCrFeNi-Al

Al Alloys



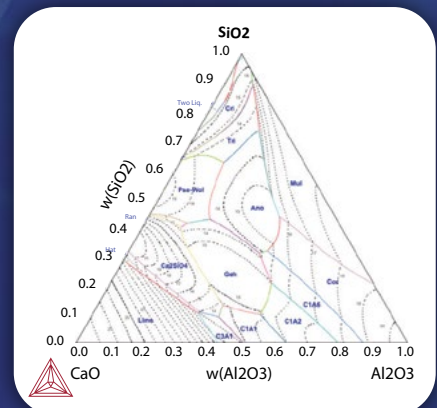
Dissolution of Mg₂Si precipitate in Alloy A6401

Ti and TiAl Alloys



Linear expansion vs Temperature for Ti-6Al-4V

Oxides



Ternary liquidus projection in oxide systems