

JOM THE MAGAZINE

SEPTEMBER 2022

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

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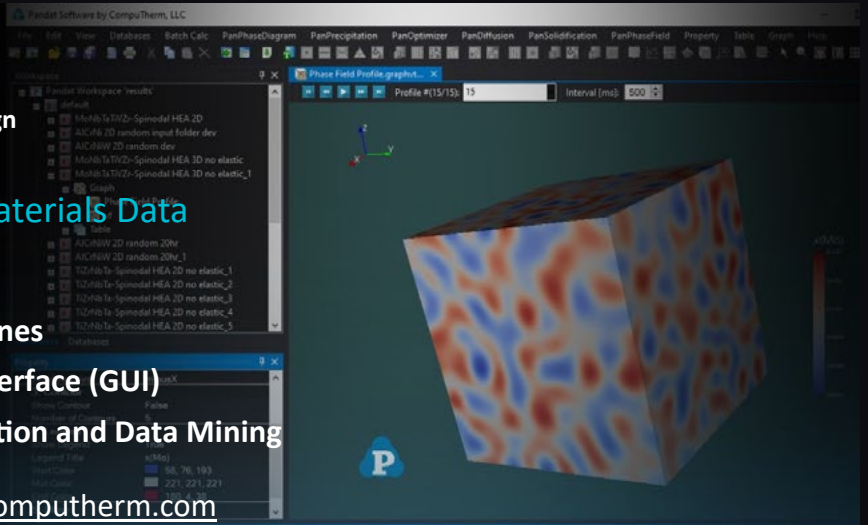
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ABOUT THE COVER



In this issue, *JOM: The Magazine* celebrates the differences that make us unique with its special topic article series by the TMS Diversity, Inclusion, and Equity (DEI) Committee. The brain and infinity symbol shown on this cover represent the theme of neurodiversity. The rainbow color scheme represents the full spectrum of these conditions and the diverse array of characteristics and ideas that neurodiverse individuals can bring to the table when we acknowledge and accept these differences to create diverse and inclusive organizations and communities. The inset image shows the Materials Science & Technology 2022 (MS&T22) meeting branding, featuring this year's location in Pittsburgh, Pennsylvania.



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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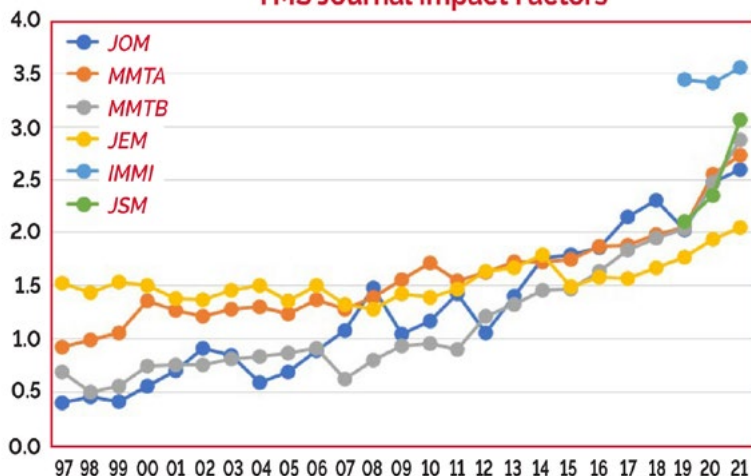


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IN THE FINAL ANALYSIS

"Never make predictions, especially about the future."

—Casey Stengel

As a Pittsburgher, I have a unique affection for Casey Stengel. Why? Because he was the manager of baseball's New York Yankees in the year that the Pittsburgh Pirates shocked Yankeedom and triumphed in the 1960 World Series. Bliss! I was only two months old at the time and played no known role in the Pirates' victory, but I am certain that the win played a big role in shaping me. I credit the decades-long emanations of pride and elation from hallowed Forbes Field as infusing me with a generally optimistic worldview and a firm belief that we can earn great things with preparedness, hard work, a no-quit attitude, and, of course, a timely home run.

What's all this got to do with TMS? Well, I posit that Team TMS brings a Pittsburgh attitude to conference organization. It's hard, worthy, and important work as events are where new developments are revealed, collaborations and networks are built, accomplishments are celebrated, and progress is made. Events are the sturdy and enduring trunk of the metaphorical tree that is TMS. So important are events to TMS that Goal 2 of the TMS Aspires Strategic Plan is "TMS aspires to be the place where global materials practitioners come together and participate in vibrant annual meetings, specialty conferences, courses, student activities, and other events."

While we put quality effort into every event that the Society conducts, we are necessarily most engaged with our version of the World Series: The TMS Annual Meeting & Exhibition. Our motto is "The World Comes Here," and we all endeavor to make that an authentic characterization of the event and not marketing pabulum. Pre-pandemic, our annual meeting was on a virtuous ascendancy, with TMS2020 in San Diego being our best-attended event to date; half of the attendees came from outside of the United States. We left our favorite southern California city with great expectations for a larger, more celebratory 150th anniversary event the following year in Orlando, Florida. Well, that splendid vision went "poof," and TMS2021 turned into a hectic switch to all virtual. TMS2022 was in person but with a virtual-only participation option, strict COVID protocols, and heavily limited international participation. That brings us to TMS2023, which will see TMS returning to San Diego in March. What will this event deliver? Let me ignore Casey Stengel's advice and make a few predictions:

- We are leaning in for an all-in-person event. No virtual option. You don't have to shake hands, but you can make eye contact, which is darn hard to do in the world of Zoom.
- We will have a much-improved app compared to previous versions. (Yes, we read and take to heart comments in attendee surveys.)
- We will have our largest or second largest technical program. Traditionally popular topics will be well represented: aluminum, additive, alloying, characterization, computation, extraction, . . . Wait, wait: It's a mistake to list topics as I'm going to run out of space and miss many favorites. Let's just go with context: 99 separate symposia collected abstracts for TMS2023.
- We will not see as many participants from China as we did in the "Before Times." Some travel is just going to be slow to open up. I'd be fine being wrong in this prediction.
- We will have a different headquarters hotel in San Diego: The Hilton Bayfront San Diego. It is most conveniently positioned for all TMS2023 activities, and I encourage you to join TMS leadership in staying there.

A final prediction? Sure: We are all ready for a return to San Diego in more ways than one. I know that's true!

Volume 74

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James J. Robinson
Executive Director

 @JJRofTMS

*"Events are the sturdy
and enduring trunk
of the metaphorical
tree that is TMS."*

JOM: The Journal includes 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 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 access technical journal articles on the Springer website.

SEPTEMBER 2022

Health, Safety, and Environmental Sustainability in Aluminum Recovery

Scope: Nowadays, both the aluminum industry and scientific research are aiming to create a low-carbon, energy-efficient, and sustainable process with high health and safety standard. This topic covers recycling of aluminum (and its alloys), with a specific focus on managing the health safety and environmental issues for secondary aluminum production.

Editors: Anne Kvithyld, SINTEF, and Hong Peng, University of Queensland, Australia

Sponsor: Aluminum Committee

High Temperature Alloys: Manufacturing, Processing, and Repair

Scope: High-temperature alloys are crucial for allowing components in power generation and propulsion systems to operate at the highest possible temperatures and in extreme environments, for maximum efficiency. This topic explores advances in manufacturing, processing, and repair of high-temperature alloys, such as Ni- and Co- based superalloys, high entropy alloys, and refractory alloys. Areas of interests include advanced processing methodologies, novel manufacturing techniques, process-microstructure-property relationships, surface modification, repair, welding, and joining techniques.

Editor: Benjamin Adam, Oregon State University

Sponsor: High Temperature Alloys Committee

Interactions Between Biomaterials and Biological Tissues and Cells

Scope: This topic investigates the physical, mechanical, biological, and biochemical interactions between engineered biomaterials and biological tissues and cells. Topics of interest include but are not limited to biointerfaces, mechanobiology, biocompatibility, tissue compatibility, inflammatory responses, biodegradation, toxicity, tissue regeneration, protein-materials interactions, cell-material interactions, and biomimetic and bioinspired surfaces.

Editors: Jing Du, Pennsylvania State University; Dinesh Katti, North Dakota State University; and Vinoy Thomas, University of Alabama at Birmingham

Sponsor: Biomaterials Committee

Machine Learning and New Paradigms in Computational Materials Research

Scope: The field of computational materials science has been applying essential concepts of machine learning such as iteratively optimizing solutions, interpolating functions in high-dimensional space, and manipulating patterns in data, effectively since its inception. Recent developments in learning theory and practice, along with the proliferation of data and cheap computing, have resulted in promising new methods and enhanced embodiments of established techniques. This topic aims to showcase and review some of these developments.

Editors: Sara Kadkhodaei, University of Illinois Chicago; Eva Zarkadoula, Oak Ridge National Laboratory; and James Morris, Ames Laboratory

Sponsor: Chemistry and Physics of Materials Committee



Contribute to JOM: The Journal

Visit www.tms.org/JOM to access author tools that will answer your questions during every step of the manuscript preparation process, from determining the appropriate technical topic for your paper to reading the final product on SpringerLink.

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

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.

Newest TMS Accelerator Study Explores Additive Manufacturing and Functional Materials

An expert TMS study team is currently conducting a 17-month initiative to examine additive manufacturing as it relates to functional materials, with a specific focus on energy. The report, *Accelerating Research and Technological Development in the Additive Manufacturing of Energy-Related Functional Materials*, will be released in October 2022 at the Materials Science & Technology 2022 Technical Meeting and Exhibition (MS&T22). The publication plans to address 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.

The 16-member study team is led by Paul Ohodnicki, associate professor in the Mechanical Engineering and Materials Science Department at the University of Pittsburgh and the Engineering Science program director. He is also the founding director of the Advanced Magnetism for Power and Energy Development (AMPED) consortium and the chief technology officer and co-founder of CorePower Magnetism. In addition, Ohodnicki currently serves as the chair of the TMS Functional Materials Division on the TMS Board of Directors.

The study team is made up of the following members:

- **Iver Anderson**, Ames Laboratory
- **Raymundo Arroyave**, Texas A&M University
- **Rajarshi Banerjee**, University of North Texas
- **Brett Conner**, PM2 Strategies
- **Ryan DeHoff**, Oak Ridge National Laboratory



- **Dana Frankel**, QuesTek Innovations LLC
- **Kyle Johnson**, Sandia National Laboratories
- **Andrew Kustas**, Sandia National Laboratories
- **Saniya LeBlanc**, George Washington University
- **Susan MacKay**, University of Maine
- **Joseph Mantese**, Raytheon Technologies
- **Simona Hunyadi Murph**, Savannah River National Laboratory
- **Mehran Tehrani**, University of Texas at Austin
- **Nihan Tuncer**, Desktop Metal
- **Emma White**, DECHEMA Forschungsinstitut/Ames Laboratory

Learn more about each of the study team members and sign up to receive updates to be among the first notified when the free report is available to download at www.tms.org/AMStudy.

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

Correction

JOM: The Magazine staff apologizes for the misspelling of **Oleg D. Sherby's** name in the July 2022 article, "Forged with Fortitude: The 2022 TMS Bladesmithing Competition." The TMS Wadsworth-Sherby Grand Prize of the TMS Bladesmithing Competition is named in honor of Sherby and his work.

FOSTERING INCLUSIVE DIVERSITY

KIYO T. FUJIMOTO AND
TASHIEMA L. ULRICH



The TMS Diversity, Equity, and Inclusion (DEI) Committee article series in the September 2022 *JOM: The Magazine* provides a collection of articles that highlights a more recent diversity concept and the work that TMS has been doing to foster a more inclusive community. It is our hope that this special section provokes thought and conversation about things we can continue to improve within our organizations to become more diverse and to ensure that all individuals are provided the support and opportunity they need to realize their full potential.

Two of the three articles in the series are focused on neurodiversity, a relatively new topic in the conversation around diversity. Neurodiversity is the term used to describe the neurological diversity of humans. The neurodiversity movement started in the late 1990s with the goal of increasing acceptance and inclusion for all people while embracing neurological differences. These two articles serve as starting point for the TMS community to begin the discussion and identify ways in which we can be accommodating for members who identify as neurodiverse.

In the first article, "Neurodiversity in Materials Science," Gee Abraham introduces the concept of neurodiversity while also sharing a first-person account of the gifts and challenges associated with those who identify as neurodivergent. Abraham has over 10 years of experiences in materials science and, while she is not a medical doctor, has done years of neuroscience and psychology research and has the ability to relate to our community given her background in materials science. In her article,

"Fostering Inclusive Diversity" serves as an introduction to a thematic group of articles in the September 2022 issue of *JOM: The Magazine*, covering diversity and inclusion topics related to neurodiversity and leadership. The article package is a feature series developed by the TMS Diversity, Equity, and Inclusion Committee. For additional information, contact Kaitlin Calva, *JOM: The Magazine* Principal Editor, at kcalva@tms.org.



Kiyo T. Fujimoto



Tashiema L. Ulrich

“...creating a culture that recognizes, embraces, and celebrates all the things that make us different comes through activities intended to create a more inclusive environment that allows everyone to feel welcome and valued.”

—Kiyo T. Fujimoto and Tashiema L. Ulrich

Abraham provides some resources that could be used as a guide to enable thoughtful approaches for incorporating accommodations for our neurodivergent members and to develop professional activities that will create a more inclusive environment for all.

The second article, “Neurodiversity: An Invisible Strength?,” is a question-and-answer piece based on the interview of neurodiversity expert Lawrence K. Fung conducted by Mitra Taheri, co-chair of the Fourth Summit on Diversity in the Minerals, Metals,

and Materials Profession (DMMM4). This article serves as a supplement to Fung's keynote presentation given at DMMM4 that was held in conjunction with the TMS 2022 Annual Meeting & Exhibition in March 2022. Fung is an assistant professor in the Department of Psychiatry and Behavioral Sciences at Stanford University and director of the Stanford Neurodiversity Project, and is also the father of a teenager on the autism spectrum. In this article, Fung explains why neurodiversity matters and how society can be benefitted from a neurodiverse individual.

The third and final article in the series illustrates what TMS is currently doing to improve diversity amongst its leadership teams. The TMS DEI Race & Ethnicity Working Group established a mentoring program in 2020 known as the Leadership Development Initiative (LDI) with the hope of increasing minority participation within the Society.

This article, “TMS LDI: Accelerating Diverse Leadership Across Every Level of the Society,” by Johnathon D. Madison and Megan J. Cordill, provides the motivation for this initiative while

detailing the impact of these efforts within TMS after three cohorts. This article highlights the progress that we are making as a Society but also brings to light that more work is needed as we strive to become an organization that is representative and accommodating of every individual.

It is our hope that the topics highlighted in this collection of articles will provide additional food for thought to provoke conversations and actions to further foster inclusive diversity. Raising awareness for all the elements that make an individual unique is a critical step towards increasing diversity. But the next step of creating a culture that recognizes, embraces, and celebrates all the things that make us different comes through activities intended to create a more inclusive environment that allows everyone to feel welcome and valued. It is through these efforts that we can empower others to be their authentic selves while also allowing us the opportunity to enhance our awareness so we can be more open-minded towards the uniqueness of others.

Kiyo T. Fujimoto is a research scientist at the Idaho National Laboratory, where she focuses her work on additive manufacturing of sensors for harsh environments. As a TMS member, she is participating in the Leadership Development Initiative, and is currently serving as the DEI JOM Co-Liaison.

Tash Ulrich is a research scientist in the Nuclear Fuel Element Performance Group at Oak Ridge National Laboratory. Her research is focused on post irradiation examination of different nuclear fuel forms. As a TMS member, she is participating in the second cohort of Leadership Development Initiative and is serving as the DEI JOM Co-Liaison.

MAKE A DIFFERENCE GET INVOLVED

Do you want to create an inclusive global community where students and professionals from all walks of life feel welcome and valued? Help TMS advance this goal in our community through the Diversity, Equity, and Inclusion (DEI) Committee.

The DEI Committee offers a number of exceptional engagement opportunities, including:

- TMS Pride Working Group
- Race and Ethnicity Working Group
- Best Practices and Policies Working Group
- Asian/Pacific Islander (API) Working Group
- Award Nomination Working Group

TMS members in good standing who are interested in joining the DEI Committee should contact **TMS staff liaison Donna Edenhart** at dedenhart@tms.org.

NEURODIVERSITY IN MATERIALS SCIENCE

GEE ABRAHAM

Like many conference attendees, I was wandering the Materials Science and Technology (MS&T) Conference to see the latest industry tools. There were specialists chatting about the resolution capabilities of a new analyzer. Competing executives talking big business. A crowd of people watching a huge saw growl through a test piece. These are the sights and sounds of an exhibition, and I was there to absorb it, to experience the materials world.

As I strolled through the exhibition hall a daze settled over me. I couldn't have been there for more than 20 minutes, but a familiar anxious feeling crept in. Soon I worried might fall into a disoriented puddle of tears in the middle of the exhibition hall. I was experiencing sensory overwhelm, and the sights and sounds had morphed into a cantankerous cacophony.

Thankfully, I made it to the exhibitor lounge, where I relaxed for several minutes, focused my

breathing, and had some water. The lounge is a helpful accommodation for people who work all day in a constant stimuli environment. Were it not for the lounge, I may have ended up in a corner, bathroom, or the aforementioned puddle.

I thought to myself: What if I didn't understand what was happening to me and how to handle being overwhelmed? What if this was my first conference and I didn't know about the exhibition lounge? Who could I have asked for help?



Gee Abraham

Making Sense of Neurodiversity

Society was designed for the typical way of thinking, called "neurotypical," because for most people it's fine. However, studies have shown that around 15% to 20% of the general population do not have a neurotypical brain [1]. People with brains that work different than most, usually associated with specific neurodevelopmental conditions (for example, attention-deficit/hyperactivity disorder [ADHD] and attention-deficit disorder [ADD]; Tourette Syndrome; autism; dyslexia; dyspraxia; dyscalculia; auditory processing disorder; and intellectual

"Neurodiversity is the idea that we have a variety of brains that can work together to achieve diversity of thought... Neurodiversity is the reality of society, so it should be the goal of organizations seeking diversity within their groups."

—Gee Abraham

is the theory of social disability. As an example, a wheelchair user is not disabled because they can move about town. However, they become more disabled when they want to enter a store with no ramp. Society in general is not friendly to disabled people, but inclusion practices can go a long way toward welcoming us.

Inclusion is the idea of helping people contribute their unique abilities to society. It is the practice of providing equal access to opportunities, outcomes, and resources. It is the welcoming of people who might otherwise be excluded or marginalized. Everyone has biases, and inclusion practices help remove those from the equation. Inclusion begets a healthier society with a diversity of ideas, raising the wellbeing of everyone, not just the newly included.

To be inclusive, think about the outcome you are trying to reach and provide the tools necessary to achieve that. Providing the same tools to everyone results in equality, where all people are treated the same and the outcomes are drastically different. Providing different tools based on peoples' needs results in equity. You wouldn't provide the same size bicycle to both a child and adult, right? Think about the outcome.

disabilities) are said to be "neurodivergent." It has been shown that neurodivergent people have more neuronal connections in the brain, resulting in higher sensitivity to environments [2]. "Sensory overwhelm" is a quite literal term, but breaking it down gets to the core of neurodiversity. "Sensory" has to do with our senses, which communicate with the brain via nerves, neurons, and synapses. "Overwhelm" means to inundate or be too strong. Understanding these, it's no surprise that a neurodivergent person might have a tough time at the exhibition.

"Neurodiversity" was coined by sociologist Judy Singer in 1998 to describe the neurological diversity of humans. She argued that differences in neurology should be respected as a social category like ethnicity, gender, sexual orientation, socioeconomic class, and others. Neurodiversity is the idea that we have a variety of brains that can work together to achieve diversity of thought. Importantly, it encompasses the full spectrum of human experiences and perceptions. Neurodiversity is the reality of society, so it should be the goal of organizations seeking diversity within their groups. It is the pinnacle of acceptance of every person as they are—true inclusivity. Without neurodiversity, humanity would never advance through adversity.

I'm Disabled and Want to Be Included

All neurodivergent conditions are types of disabilities. A disability is a physical or mental condition that limits a person's movements, senses, or activities. Society often worsens disabilities; this

Accommodations Are Used to Achieve Equity

How can equity be obtained? If the effects of a disability can be mitigated through an accommodation, then that's good! More people can participate in society. More people are included. Some examples of accommodations include sign language for deaf people, large-print books for the visually impaired, flexible schedules for people with mental health conditions, and ergonomic chairs for those with back pain.

There are laws, such as The Americans with Disabilities Act (ADA), that prohibit discrimination and require employers to provide reasonable accommodations for disabled people. But why should it be up to a law to ensure inclusion? Don't you want to welcome as many people as possible? I know that most organizations and people try to do the right thing, but they don't know exactly how.

A neurodivergent person should not need to disclose the actual condition or specifically mention the ADA or other laws to be accommodated. As an organization trying to include people, your number one goal is to center the disabled person. Ask them about their needs and focus on obtaining an equitable outcome for them. No assumptions are needed—ask what is necessary to be successful.

Neurodivergence Serves My Career Well

I'm autistic, and I realized as much when my sensory overwhelm became too...overwhelming. I

joined a group of neurodivergent authors, writing and editing articles for a blog. We eventually formed into a nonprofit organization, NeuroClastic Inc., focused on sharing voices and providing services to the neurodivergent community and I served as the first chief communications officer. I dug into neuroscience and psychology research, and now I'm co-authoring a Children's National Hospital study on the intersection of autism and gender.

Prior to that, I earned a degree in materials science and spent 12 years with a metallography supplier as lead technical writer and technical services manager. I taught metallography workshops for more than a decade, reviewed or edited for three materials journals, and I eagerly volunteer for materials societies. I'm currently a freelance writer and editor.

Neurodivergence has served me well, providing pattern recognition skills that enable great technical service and editing abilities. High-sensory sensitivity assists with high-quality sample preparation and a photographic memory works wonders with microstructural characterization! Similar to getting through a day at the exhibition hall, though, I might need an accommodation to get through a day in at the office.

I have a sensitivity to bright lights, so

perhaps I could have a desk not directly below a big fluorescent light, with my own little light that I can adjust. Maybe I could wear sunglasses at my desk when needed. These seemingly simple accommodations would get me through the day and help me produce my best work.

Next Steps for Readers

Think about how to make your professional activities more inclusive. What is needed at a conference and exhibition to help someone like me in an overwhelm situation? I recovered in the exhibitor

lounge, but could there be a sensory lounge with segmented areas and dimmable lights for attendees?

There is no need to assume every accommodation is needed; ask the potential attendees in a survey during the planning stages what they might require. Are the talks inaccessible for deaf people? Handouts, interpreters, or captions might be appropriate. In-person icebreakers can be difficult for those with social anxiety; online events are a great tool to help them still participate in professional networking activities.

Similar thinking can be applied to the laboratory and other environments. For example, if someone in your lab group has a skin allergy, you can provide a different type of protective glove. To ensure inclusion, carry this ideal to the manufacturing floor,

office, meetings, and even the hiring process. If you know the criminal justice system is biased against disabled people—and it is, since disabled people are over-represented among the incarcerated [3]—then eliminate criminal background checks for roles that don't require them.

I could keep listing examples, but I will instead point you to the Job Accommodation Network (JAN) at askjan.org, which has a filterable list of specific accommodations and disabilities. For further reading on many of the ideas presented here, I recommend the book *Neurodiversity at Work*, by Theo Smith and Amanda Kirby.

Gee Abraham is a freelance writer and editor with a background in materials science. After battling depression for years, she realized her autistic and transgender identities and helped found a nonprofit providing services to the neurodivergent community. She recently joined TMS and is looking forward to advancing diversity within the Society.

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NEURODIVERSITY: AN INVISIBLE STRENGTH?

LAWRENCE K. FUNG, TASHIEMA L. ULRICH,
KIYO T. FUJIMOTO, AND MITRA TAHERI

When we think of social justice movements, we often highlight events such as women's suffrage, the civil rights movements of the 1960s, and the fall of apartheid. More recently, LGBTQ+ rights have been at the forefront of our minds as society strives to be more inclusive of our diverse population. On the heels of these critical movements and advancements is a relatively new player: neurodiversity.

Neurodiversity was introduced at the Fourth Summit on Diversity in the Minerals, Metals, and Materials Professions (DMMM4), held in conjunction with the TMS 2022 Annual Meeting & Exhibition. The DMMM4 neurodiversity symposium provided a perfect setting for the TMS community to begin the discussion of neurodiversity, identifying the key challenges and solutions in the TMS community not only for members and colleagues who identify as neurodiverse, but also to educate and provide a place for the TMS community as a whole to understand and work in conjunction with a neurodiverse community.

What follows is an interview with DMMM4 co-chair Mitra Taheri conducted with DMMM4 keynote speaker and neurodiversity expert Lawrence K. Fung to provide his insight on neurodiversity for the entire TMS community.

Mitra Taheri: What sparked your interest in neurodiversity?

Lawrence K. Fung: I entered the field of autism about 14 years ago, when my son was diagnosed with autism. Since then, I have been studying the neurobiology, the assessment and intervention for people on the autism spectrum. It is very good to be logical in trying to understand the basis of biology, thereby advancing assessment, and intervention accordingly. But as I understand the field more and more, I appreciate that the characteristics of neurodiverse individuals can be both strengths and challenges at the same time. For example, an autistic individual can be very detail oriented and persistent in developing their deep interests. These can all be strengths when the environment allows them to use their strengths.

On the flip side, when people around autistic individuals use a deficit-based approach, the very same autistic people may be viewed as not seeing the big picture and perseverating on things that others don't care about. In the last 10 years or so, I have been trying to answer some of the following questions: How can society build neurodiversity-friendly environments? How can we use the characteristics of neurodiverse individuals to build a positive identity about themselves? Helping neurodiverse individuals find their strengths and interests and to be

employed successfully would be a very positive way of helping neurodiverse individuals to shape their identity based on their strengths and interest.

"But as I understand the field more and more, I appreciate that the characteristics of neurodiverse individuals can be both strengths and challenges at the same time."

—Lawrence K. Fung

Taheri: How do you define neurodiversity and how has the definition evolved over time?

Fung: *Neurodiversity is about acknowledging differences in brain function and behavioral traits as normal variation of the human population.* This approach of thinking about neurodiversity and neurodiverse conditions, such as autism and attention-deficit/hyperactivity disorder (ADHD), is very powerful because you will not need to use ways to extinguish characteristics of neurodiverse conditions, but rather you embrace the conditions, embrace the characteristics, and try to pivot the characteristics to what the strengths of each neurodiverse individual. As Gee Abraham also mentioned in her article, "Neurodiversity in Materials Science," sociologist Judy Singer first coined the term "neurodiversity" in 1998. In her work, she described the need to change autism from a medicalized disability to a new social movement. This coincides with the autism rights movement led by Jim Sinclair, who argued that autism is "a variation in functioning rather than a disorder to be cured." In the 1990s and early 2000s, most of the participants of the first neurodiversity movement were people on the autism spectrum, so it was perceived as a movement for people on the autism spectrum trying to focus on their abilities. Now we understand that neurodiverse conditions are more than just autism. It also includes ADHD and dyslexia, as well as other

"...neurodiverse people can have a very positive identity based on their strengths and interest instead of an identity based on their challenges or diagnoses. Furthermore, neurodiverse individuals can bring new perspectives to the world, some of which could be groundbreaking."

—Lawrence K. Fung

conditions like epilepsy and Tourette syndrome, etc. So, the scope of the work that we are doing not only needs to be designed for autistic individuals, but also for neurodiverse individuals in general. So, this is the new angle of neurodiversity: we are not focusing on autism, but rather a larger umbrella of neurodiverse conditions.

Taheri: How common are neurodiverse conditions?

Fung: Autism, as one of the neurodiverse conditions, has a prevalence of about 1 in 44 which is 2.3%. Dyslexia is much higher, between 13 to 14%; ADHD is approximately 5 to 7%. As you can see if you add all the neurodiverse conditions, the prevalence would represent the largest minority group in the world.

Taheri: Why does neurodiversity matter?

Fung: Neurodiversity matters a lot because, as I said earlier, neurodiverse people can have a very positive identity based on their strengths and interests instead of an identity based on their challenges or diagnoses. Furthermore, neurodiverse individuals can bring new perspectives to the world, some of which could be groundbreaking. For example, Alan Turing and Albert Einstein were undoubtedly neurodiverse. During World War II, Alan Turing built the first computer to crack the Enigma, the encryption machine used by the Germans to transmit coded messages. Turing's work directly contributed to stopping World War II. Albert Einstein revolutionized many concepts in theoretical physics. We know a lot more about our universe because of his work. Based on Einstein's mathematics he developed and the physics he described, physicists are now able to perform experiments that allow us to observe the phenomena he predicted.



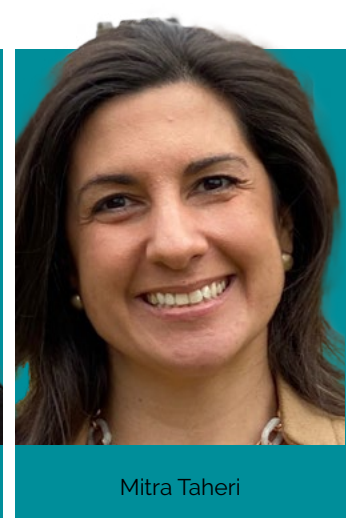
Lawrence K. Fung



Tashiema L. Ulrich



Kiyo T. Fujimoto



Mitra Taheri

Taheri: What is an example of neurodiversity at work?

Fung: Most people in the field would regard SAP as the first company that successfully started and expanded the Autism at Work Program. Their program has changed the lives of many of their employees, especially the employees on the autism spectrum. Autistic employees had the opportunities to show their capabilities and some of them are even winning major awards on innovation in the company. Within a company of 80,000 people, one of the autistic individuals won an award for his innovation. That award is usually given to a department or a large group, but this time around it was awarded to a single individual, and this individual is on the autism spectrum. This is just one of many examples.

Taheri: How can neurodiversity change the way we do research and science, and how we collaborate?

Fung: Great question. Neurodiverse individuals think differently, and because of that they bring in a lot of innovative perspectives which can be beneficial to science and research. If we can level the playing field so that neurodiverse individuals are able to utilize resources just like all others, then their potential can be maximized, and they can contribute to science and research a lot more. More importantly, if we are successful in making the educational environment more neurodiversity-friendly, more brilliant minds will pursue research and science for their careers.

Taheri: How can an organization create a space for neurodiversity?

Fung: For most places there usually are two major ingredients. One is endorsement by someone who is more senior in the organization, and the other ingredient is grassroots efforts on neurodiversity. If you have these two components, you will most likely have a good chance to start a program. It is always difficult to expand a program, but starting, I think we have seen, is very possible.

Taheri: What is your experience within your center and more broadly?

Fung: In the Stanford Neurodiversity Project, we have seen that both small and large organizations alike can build neurodiversity at work programs. To convince people that this is a good initiative is relatively easy because most people embrace diversity, equity, and inclusion (DEI) as an initiative. Expanding the DEI initiative to include neurodiversity seems to be logical for most human resource professionals. In addition to the employment-related efforts, our group has also been very active in neurodiversity education at all

levels. I teach a design thinking project-based course on neurodiversity at Stanford University. Using a similar approach, we have been teaching high school students about neurodiversity during the summer. After the neurodiversity workshop, the students returned to their high schools to initiate neurodiversity clubs and other neurodiversity advocacy initiatives. Our group also runs the Stanford Neurodiversity Summit, a virtual conference participated by neurodiverse individuals, their families, educators, employers, mental health providers, and other interested individuals. Last year, over 5,000 people attended the summit. Finally, in the past three years, we have been supporting neurodiverse students at Stanford through our Neurodiverse Student Support Program.

Next Steps

Raising awareness of neurodiversity and its importance is a great first step, but advocacy and accessibility within our own organizations are vital next steps toward creating a more inclusive and welcoming environment. This can be done by including more inclusive language in job descriptions, adapting interviewing methods and evaluation methods, and considering workspace and work schedule accommodations for neurodiverse individuals.

For TMS specifically, the highlight of neurodiversity within DMMM4 has generated significant interest in forming a working group within TMS focused on supporting and engaging TMS members with neurodiversity identification. If you or anyone you know is interested in joining this working group please contact the TMS DEI

Committee Chair Jenifer Locke at Locke.121@osu.edu.

Lawrence K. Fung is a scientist and psychiatrist specializing in autism and an assistant professor in the Department of Psychiatry and Behavior Sciences at Stanford University. He is director of the Stanford Neurodiversity Project and directs the Neurodiverse Student Support Program, Neurodiversity at Work Program, and Adult Neurodevelopment Clinic at Stanford.

Tashiema L. Ulrich and Kiyo T. Fujimoto are the DEI Committee's JOM Co-Liaisons.

Mitra Taheri is a professor of materials science and engineering and director of the Materials Characterization and Processing Facility at Johns Hopkins University. She also holds a joint appointment at the Pacific Northwest National Laboratory. At TMS, Taheri is a member of the DEI Committee and several other TMS committees.

"...if we are successful in making the educational environment more neurodiversity-friendly, more brilliant minds will pursue research and science for their careers."

—Lawrence K. Fung

TMS LDI: ACCELERATING DIVERSE LEADERSHIP ACROSS EVERY LEVEL OF THE SOCIETY

JONATHAN D. MADISON
AND MEGAN J. CORDILL

Experts report organizations possessing diverse boards are significantly associated with enacting more “equitable practices” throughout an organization. These practices include work-life benefits, LGBTQ+ policies, employing persons with disabilities, and more equitable promotions among persons of color and women [1]. Unfortunately, data also suggests this won't happen serendipitously. In private and public sectors, persons of color and women are far less likely to reside in positions of leadership and decision-making authority in comparison to white male colleagues [2-5]. Studies reveal this likelihood significantly exceeds random chance and normalization due to population differences and

in fact, increases along professional trajectories. Researchers have even shown this disparity is most

pronounced at the highest levels of organizational leadership [6-10]. Relatedly, social science has also shown that women and persons of color who do rise to levels of leadership often do so in isolated instances, undertake more delayed and “circuitous” paths, and suffer challenges uncommon to their peers [3, 6, 8, 9]. The challenge and solution are clear. If TMS is to realize the aspiration “to be a highly inclusive Society” per its strategic plan, data suggests achieving a critical mass of persons of color and women within positions of leadership—up to and including the board of directors—is not only an enabling procedure,



Figure 1: A notable increase of African Americans and Hispanic/Latinos within engaged volunteers and Society leaders within TMS from 2018 to 2021. (Please note: the information represented in this chart was generated in January 2022 and is based on 2021 TMS membership data, for U.S. members and those who have opted to share their ethnicity information.)

but it is also an imperative for realizing equitable practices throughout the organization. **(Editor's Note: for more on the Society's strategic plan, TMS Aspires, visit www.tms.org/TMSAspires.)**

Although TMS is an international society with a robust membership, underrepresentation of certain populations (e.g., African American, Hispanic/Latino) is woefully apparent. In a 2016 assessment of membership demographics, persons identifying as Hispanic/Latino composed 3%, African American composed 2%. Furthermore, between 2014 and 2016, while those identifying as Asian increased from 13 to 19%, Hispanic/Latino saw only an increase of 1% and African Americans realized no net difference. In a 2021 TMS accounting of ethnic diversity among volunteers, Society leaders and the board of directors, African Americans accounted for 5%, 8%, and 0%, respectively, while Hispanic/Latinos accounted for 4%, 4%, and 0%, respectively (see Figure 1 on previous page).

While these percentages are in themselves small, the progress in raw numbers in comparison to 2018 is notable. Given the increase is most notably apparent among engaged volunteers and Society leaders, the authors suggest a portion of this increase is directly due to the TMS Leadership Development Initiative (LDI). The LDI is a

member-driven mentoring program that engages TMS members from underrepresented populations, identifies their highest volunteerism ambition within TMS, helps them chart a course from where they currently are to that ultimate ambition, and identifies the most appropriate experiences to have along the way. Succinctly stated, the goal of the TMS LDI is to: *within seven years, notably impact the candidate pool for leadership across all levels of TMS with an infusion of high-caliber, high-potential TMS members hailing from our Society's most underrepresented populations* (i.e., African American, Hispanic, and women). To date, three cohorts have been launched in conjunction with the 2020, 2021, and 2022 TMS annual meetings, amounting to 19 TMS mentee-mentor pairs.

The impact of the program, however, is best depicted by the remarkable activity of its mentees. A majority (70%) of mentees across all three cohorts have joined at least one technical or functional committee. Several mentees have successfully proposed, organized, or chaired symposia at TMS2020, TMS2021, and/or TMS2022—and in many cases, for their very first time. No fewer than three mentees have been appointed as Divisional Representative to various functional committees, including Public & Governmental Affairs, Professional Development, and Membership & Student Development. One mentee now serves as a trustee on the TMS Foundation, and one mentee served as lead organizer for the most recent TMS Summit on Diversity in the Minerals, Metals, and Materials Professions (DMMM4) which was

co-located with TMS2022. In this year alone, five LDI mentees authored articles published in *JOM: The Magazine*, with four additional mentees going on to serve as *JOM* liaisons. While these achievements may seem commonplace for some, for anyone new to an organization the size of our professional society, the “activation energy” required to meaningfully engage and successfully identify where and how to volunteer can be extremely challenging. Furthermore, engagement is particularly difficult without guidance or tangible examples to look towards. The TMS LDI provides both. The results demonstrate the approach has both merit and potential for transformational impact with regard to attracting and involving

“While these achievements may seem commonplace for some, for anyone new to an organization the size of our professional society, the ‘activation energy’ required to meaningfully engage and successfully identify where and how to volunteer can be extremely challenging.”

—Jonathan D. Madison and Megan J. Cordill



Jonathan D. Madison



Megan J. Cordill

underrepresented populations within a rather brief period of time.

In their own words, LDI mentees have praised the strategic and focused interaction they experience with their mentors and TMS. One mentee offered, ***“the LDI has allowed me to become more active in my field. It’s been a rewarding experience, and I am so happy to be a part of this.”*** Another mentee stated, ***“It is a pleasure working with my mentor. I have a better understanding about TMS. I can’t believe that I have been a member in TMS this long and didn’t know about half of the things that we covered.”***

From reinvigorating technical engagement to supporting retention and active participation in the organization, those impacted by the program have spoken. However, an unanticipated consequence springing forth from the LDI has been the formation of new and long-lasting friendships. Given the most recent challenges of the pandemic, it was particularly impactful to receive a comment from one of the LDI mentees stating, ***“my mentor has been an outstanding source of support and makes me feel connected to TMS, despite these extreme circumstances.”***

Since its genesis with the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME), TMS has always been a gathering place for bright minds interested in the science of minerals, metals, and materials. However, TMS is largely differentiated from other professional societies, not because of our general subject matter, but due to the fact that despite a growing membership of well over 12,000 TMS still feels like family to so many. With the TMS LDI, our family just got a little more welcoming, a little more diverse, and just a little bigger.

Next Steps

Results obtained through the first three cohorts of the TMS LDI demonstrate the approach has merit and potential for transformational impact regarding diversity. However, the activity requires a non-trivial amount of effort to staff and facilitate. To make the LDI scalable and sustainable, additional infrastructure and investment will be required.

Jonathan D. Madison is program director in the Division of Materials Research at the National Science Foundation. A TMS member since 2003, Madison chaired the organizing committee for the third Summit on Diversity in the Minerals, Metals, and Materials Professions. He is currently the chair of the DEI Committee’s Race & Ethnicity Working Group.

Megan J. Cordill (she/her) is the vice director at the Erich Schmid Institute for Materials Science, Austrian Academy of Sciences. She is the past chair of the

“With the TMS LDI, our family just got a little more welcoming, a little more diverse, and just a little bigger.”

**—Jonathan D. Madison
and Megan J. Cordill**

TMS DEI Committee and was a member of the TMS Ad Hoc Committee on Potential Biases within the TMS Culture.

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MS&T22 WELCOMES NEW EXHIBITS AND PROGRAMMING

Kelly Zappas

KEY MS&T22 DATES

September 15, 2022: Advance Registration Deadline

September 15, 2022: Housing Deadline

October 9–12, 2022: Meeting Dates

Bringing together the resources and members of complementary materials science and engineering groups has long been a defining feature of the Materials Science & Technology (MS&T) conference series. In 2022, MS&T builds on that tradition by welcoming new partners who will bring fresh exhibits, symposia, and audiences to the event.

As in previous years, MS&T22 will bring together three leading materials societies—TMS, the American Ceramic Society (ACerS), and the Association for Iron & Steel Technology (AIST). To supplement this long-standing partnership, MS&T will welcome Event Partners to expand the exhibition and the Society for Biomaterials to offer additional programming.



Technical Meeting and Exhibition

MS&T22

MATERIALS SCIENCE & TECHNOLOGY

MS&T22 WELCOMES NEW PARTNERS

Event Partners, a U.K.-based commercial exhibition firm, will bring **The Advanced Materials Show USA** and **The Nanotechnology Show** to MS&T22. The Advanced Materials Show USA was previously held as a standalone event, while The Nanotechnology Show will debut at MS&T22. The two events will join with the existing MS&T22 Exhibition to offer MS&T attendees access to an enhanced exhibit experience.



On the programming side, the **Society For Biomaterials** has joined MS&T22 as a co-sponsor and will be holding three new symposia: Biological Response to Materials and Material's Response to Biological Environments; Biomaterial Applications; and Biomaterial Applications in Today's Industry: Development, Translation & Commercialization.

The Society For Biomaterials is a multidisciplinary society of academic, healthcare, governmental, and business professionals dedicated to promoting advancements in all aspects of biomaterial science, education, and professional standards to enhance human health and quality of life.

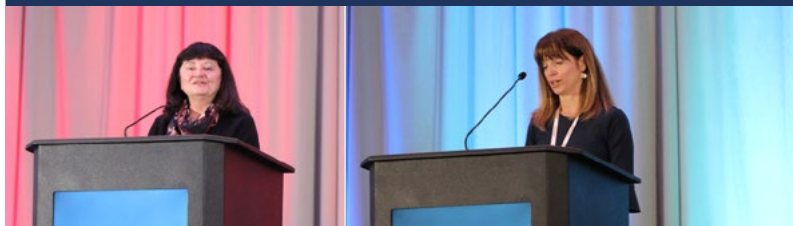


"Adding two new events to the MS&T22 Exhibition will bring new companies to our MS&T attendees, while also introducing new exhibitors to the value of the MS&T technical program," said James J. Robinson, TMS executive director. "From a programming standpoint, the addition of the Society for Biomaterials will bring fresh ideas that work well with our traditional technical programming. I think our MS&T attendees will benefit from the broader perspectives these new partners bring to the event."

"I think our MS&T attendees will benefit from the broader perspectives these new partners bring to the event."

—James J. Robinson, TMS Executive Director

TECHNICAL PROGRAM HIGHLIGHTS



Ellen Cerreta (right), 2021 TMS President, introduced Tresa Pollock (left), TMS 2021 Institute of Metals/Robert Franklin Mehl Awardee, as she delivered the TMS presentation in the MS&T21 plenary session.

The MS&T22 technical program is made up of more than 80 symposia in 15 technical tracks. Programming is developed by all three sponsoring societies and coordinated by the MS&T22 Program Coordinating Committee. **John Carpenter**, Los Alamos National Laboratory, and **Eric Lass**, University of Tennessee, Knoxville, are the TMS representatives to the 2022 Program Coordinating Committee.

The TMS Fall Meeting explores the intersections of development, synthesis, and application and features a collection of symposia in interest areas that are related to TMS and its members.

For 2022, symposia are planned in the following topic tracks:

- Additive Manufacturing
- Artificial Intelligence
- Biomaterials
- Ceramic and Glass Materials
- Education
- Fundamentals and Characterization
- Iron and Steel (Ferrous Alloys)
- Lightweight Alloys
- Materials-Environment Interactions
- Modeling
- Nanomaterials
- Nuclear Energy
- Processing and Manufacturing
- Sustainability, Energy, and the Environment
- Special Topics

For a look at the specific symposia organized and sponsored by TMS technical committees, visit the TMS Fall Meeting page on the MS&T22 website at www.matscitech.org/MST22. The TMS Fall Meeting explores the intersections of development, synthesis, and application and features a collection of symposia in interest areas that are related to TMS and its members.

ANDERSON TO DELIVER TMS PLENARY



Iver Anderson

Iver Anderson, a senior metallurgist at Iowa State University and Ames Laboratory, is the 2022 recipient of the TMS/ASM Joint Distinguished Lectureship in Materials and Society Award. As a part of this award, Anderson will present his lecture, **"Materials Research on Clean Energy: For the Sake of Our Grandchildren,"** at the MS&T22 All-Conference Plenary session on Tuesday, October 11.

"We professionals in the materials science and engineering community must make our best efforts to work on important greenhouse gas

emission challenges to make the economic leap to green technologies more pragmatic and palatable," reads Anderson's abstract for the talk.

To attack and, hopefully, to reverse greenhouse gas (GHG) growth, Anderson says, the critical but formidable goal of net-zero GHG emissions by 2050 must be reached—a goal that will require major efforts from across our society and a leap of faith by the world's economies.

"From the latest report by the Intergovernmental Panel on Climate Change (IPCC), it is becoming increasingly apparent that we must do this for the health and well-being of our own children and grandchildren, if we want to help them avoid predictable climate disasters," writes Anderson.

The talk will look at market opportunities that can arrive with clean energy transitions and key materials technology barriers that must be overcome.

"With solutions to these critical materials problems resulting from research that is supported by enlightened governments and industry leaders, a new global energy economy can emerge quite naturally," writes Anderson. "This new sustainable economy has the potential to create millions of excellent jobs across a host of new supply chains, along with many more generations of smiling grandchildren!"

A TMS member since 1982 and a 2015 TMS Fellow, Anderson is an active TMS volunteer, having served on a variety of technical and functional committees and the TMS Board of Directors. He is being honored for providing a broad range of leadership in mentoring and outreach spanning academia, transferring fundamental knowledge to applications, and encouraging engagement in public policy.

HANSSON HONORED AT MS&T SYMPOSIUM



Carolyn M. Hansson

The TMS Corrosion and Environmental Effects Committee and TMS Steels Committee are planning a special symposium in honor of **Carolyn M. Hansson**, University of Waterloo, at MS&T22. The symposium, **Resisting Degradation from the Environment**, will honor Hansson's research and pioneering experiences as a woman in science, technology, engineering, and math (STEM).

Hansson is a professor at the University of Waterloo in the Department of Mechanical and Mechatronics Engineering and cross-appointed to the Department of Civil and Environmental Engineering. She was the first female student to attend the Royal School of Mines at Imperial College, London, and the first woman to graduate with a Ph.D. in metallurgy from that institution. She has been a member of TMS for more than 50 years, was elected a TMS Fellow in 1997, and, in 2021, she celebrated her 80th birthday.

A key feature of this symposium will be a 45-minute "fireside chat" with Hansson and two interviewers that will allow Hansson to tell her story in a way that encourages a deeper level of interaction and networking than a typical symposium. She'll discuss her career path, advice for young people in moving forward in a research and academic career, and future research paths in her field that excite her. The technical scope of this symposium are topics that intersect with one or more of her areas of expertise.



Attendees enjoy a bite to eat while they mingle at the Welcome Reception, hosted by the MS&T Partners, at MS&T21.

NEW FOR 2022: IMPROVE YOUR NETWORKING SKILLS EVENT



Attendees at MS&T21 enjoy a chance to network during a break from the technical programming.

TMS will introduce a new professional development event—open to all MS&T22 attendees—at this year's meeting. The **Improve Your Networking Skills Workshop by TMS** will teach participants practical approaches to networking in this session on Monday, October 10, from 4:00 p.m. to 5:00 p.m.

First, **Emily Kinser** of 3M and vice chair of the TMS Professional Development Committee will offer tips on identifying personal networking goals, learning how to lower barriers to personal networking, and developing a personal "elevator speech." This will be followed by a hands-on networking activity to practice new skills.

There is no fee to attend the event, but participants are asked to fill out a simple registration form through the MS&T22 website to provide organizers with an accurate headcount.

EMERGING PROFESSIONALS EVENT PLANNED



Joy Gockel

On Tuesday, October 11, TMS will host an event for early-career professionals from noon to 2:00 p.m. The **TMS Emerging Professionals Tutorial Luncheon and Lecture** will feature an invited presentation from **Joy Gockel**, associate professor at the Colorado School of Mines.

All MS&T22 registrants are welcome to attend the lecture, but to receive lunch, participants must purchase a ticket through the MS&T22 registration form.

ADDITIVE MANUFACTURING MATERIALS AND PROCESSES WORKSHOP PLANNED

To complement the extensive additive manufacturing programming planned for MS&T, TMS will offer a workshop on Sunday afternoon, October 9, from 1:00 p.m. to 5:30 p.m., prior to the start of technical programming on Monday morning.

The **Additive Manufacturing Materials and Processes Workshop** will familiarize participants with current additive manufacturing (AM) processes; current AM practice for metals, polymers, and ceramics; modeling of AM processes, microstructural evolution, and service properties; and current challenges and research opportunities. This workshop is designed for people in the materials community already familiar with AM processes who want to learn more. Academics and researchers will also benefit from discussions about current challenges to the full adoption of AM.

The workshop will be led by four expert instructors: **Sneha Narra**, Carnegie Mellon University; **Joy Gockel**, Colorado School of Mines; **Scott Thompson**, Kansas State University; and **Kirk Rogers**, The Barnes Global Advisors.

Participants can register for the course through the MS&T22 registration form.

A FULLER IN-PERSON EXPERIENCE

Due to the COVID-19 pandemic, MS&T20 was held as a fully virtual event, and, as meetings gradually began opening up again, MS&T21 was held as a hybrid meeting, with both in-person and on-demand elements. For 2022, MS&T returns to a fully in-person event, so that attendees can participate in live discussions with presenters, visit the enhanced exhibit hall, and connect face-to-face with other attendees.

Registration for MS&T22 is now open. You can register for the discounted early registration rate by September 15 at www.matscitech.org/MST22.

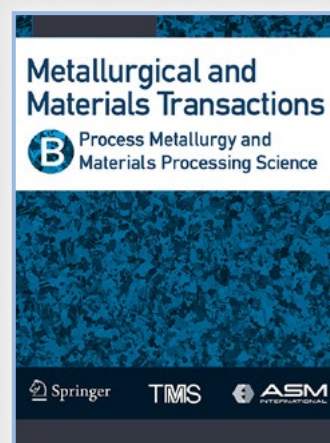
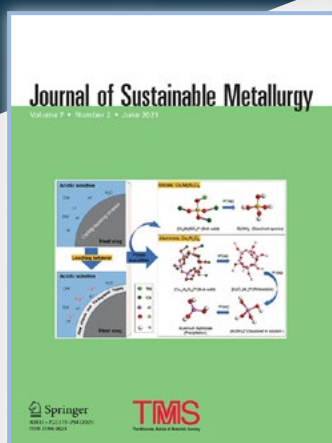
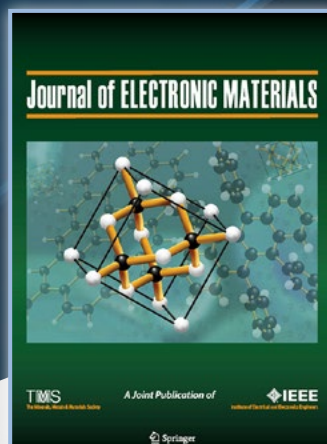
LOOKING AHEAD TO MS&T23



Plans are also now underway for MS&T23, which will be held October 1–5, 2023, in Columbus, Ohio. Symposium proposals have been collected and programming plans are being developed. Visit www.matscitech.org in October to view programming plans and submit your abstract.

Impact Factors Increase for All TMS Journals: A Look at Key Journal Metrics from 2021

Kelly Zappas



All six journals published by TMS achieved healthy Impact Factor increases, according to the 2021 Journal Citation Reports (Clarivate Analytics, 2022), which were released in June. *Journal of Sustainable Metallurgy*, which received its first Impact Factor in 2019, saw the greatest increase, from 2.347 in 2020 to 3.068 in 2021.

The following list shows the 2021 Impact Factors for each TMS journal (with a comparison to 2020 in parentheses):

- *Integrating Materials and Manufacturing Innovations* (IMMI): 3.551 (3.404)
- *JOM*: 2.597 (2.471)

- *Journal of Electronic Materials* (JEM): 2.047 (1.938)
- *Journal of Sustainable Metallurgy* (JSM): 3.068 (2.347)
- *Metallurgical and Materials Transactions A* (MMTA): 2.726 (2.556)
- *Metallurgical and Materials Transactions B* (MMTB): 2.872 (2.470)

"As TMS strives to be the go-to technical society for the materials community, the annual increases to the Impact Factors within our family of journals indicate we are continuing to capture the relevant trends in the field," said Judy Schneider, TMS Content Director and Professor at The University

of Alabama in Huntsville. "We appreciate the contributions from the materials community to publish results from your cutting-edge technology."

A journal's Impact Factor is the average number of citations counted in a given Impact Factor year for articles published in the two preceding years. It is based on the number of citations of a journal's content divided by the number of citable articles published by that journal. Impact Factor is just one of many factors to consider when evaluating journal performance.

While Impact Factor can vary from year to year for a variety of reasons, TMS journals have

"As TMS strives to be the go-to technical society for the materials community, the annual increases to the Impact Factors within our family of journals indicate we are continuing to capture the relevant trends in the field."

—Judy Schneider, TMS Content Director

generally tracked in a positive direction (see Figure 1) and have also achieved strong placement in Clarivate's ranking by subject categories (see Table I).

Table II shows a more comprehensive overview of 2021 key metrics across the entire TMS journal portfolio. *Metallurgical and Materials Transactions A* had the most total citations (37,356) and the most total downloads (1,131,009) among TMS journals in 2021, compared to 34,499 citations and 1,026,350 downloads for this journal in 2020.

To access TMS's entire library of journals, visit the Journals section of the TMS website at www.tms.org/Journals. TMS members should log in to the TMS website before clicking on the individual journal links to ensure full access to content.

TMS Journal Impact Factors

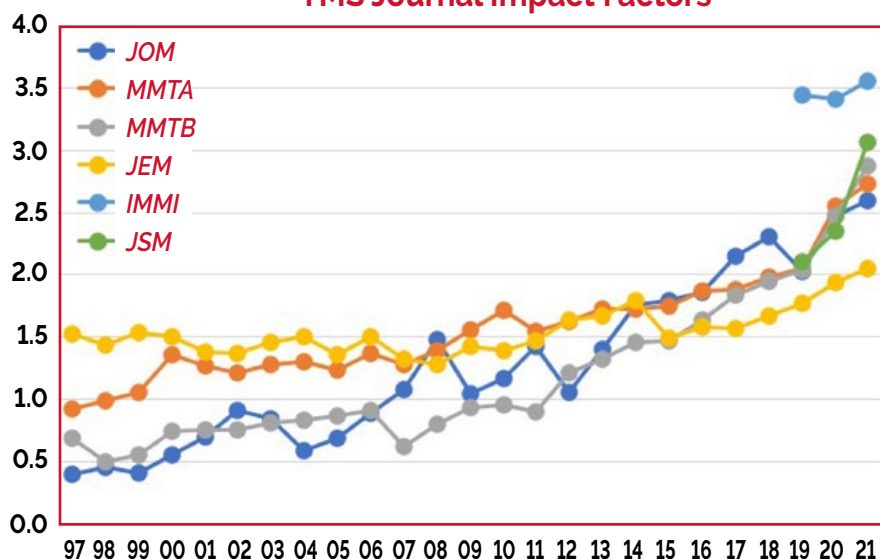


Figure 1. This chart shows 25 years (1997–2021) of TMS Journal Impact Factors. *IMMI* and *JSM*, TMS's two newest journals, received their first Impact Factors in 2019.

Category Name	2021 Total Journals	<i>IMMI</i>	<i>JOM</i>	<i>JEM</i>	<i>JSM</i>	<i>MMTA</i>	<i>MMTB</i>
Materials Science, Multidisciplinary	345	188	232	259	-	222	215
Metallurgy & Metallurgical Engineering	79	-	26	-	21	24	23
Mineralogy	30	-	12	-	-	-	-
Mining & Mineral Processing	20	-	11	-	-	-	-
Engineering, Electrical & Electronic	276	-	-	172	-	-	-
Physics, Applied	161	-	-	131	-	-	-
Green & Sustainable Science & Technology	47	-	-	-	40	-	-
Engineering, Manufacturing	51	27	-	-	-	-	-

Table I. This table presents the subject categories assigned to TMS journals and the 2021 rank of the journals within these categories.

Key Metrics	<i>IMMI</i>	<i>JOM</i>	<i>JEM</i>	<i>JSM</i>	<i>MMTA</i>	<i>MMTB</i>
2021 Impact Factor	3.551	2.597	2.047	3.068	2.726	2.872
5-Year Impact Factor	4.612	2.973	1.815	4.000	2.801	2.834
Total Citations 2021	896	15,413	15,379	1,296	37,356	13,007
Total Downloads 2021	87,787	812,727	398,486	159,096	1,131,009	527,635

Table II. This table shows 2021 key metrics—five-year Impact Factor, total citations, and total downloads—for TMS journals in addition to their most recent Impact Factors.

In Case You Missed It:

BUSINESS NEWS FROM THE FIELD



Stockholm, Sweden: The HYBRIT pilot facility is a first-of-its-kind rock cavern storage facility in Luleå, Sweden. Vattenfall, SSAB, and LKAB launched the facility's test period that will run until 2024. The hydrogen storage facility will play an important role in the overall value chain for fossil-free iron and steel production. Producing fossil-free hydrogen gas when there is a lot of electricity and using stored hydrogen gas when the electricity system is under strain will ensure a steady production of sponge iron. (Photo Credit: SSAB)

New Standard Published for 3D Printing

New York City, New York, USA: The American Society of Mechanical Engineers (ASME) published an updated standard, based on research by the National Institute of Standards and Technology (NIST), that includes language specifically for 3D printing. The standard, titled Y14.46 Product Definition for Additive Manufacturing, identifies important features unique to 3D printing and outlines how they should be documented. The guidance could help engineers from a broad array of industries communicate to manufacturers, product inspectors, and others more effectively. Its widespread adoption could clear a persistent roadblock to the application of 3D printing at a larger scale, unlocking the environmental and economic benefits associated with the technology.

ArcPacific Resources Locates Lost Mine

Vancouver, Canada: ArcPacific Resources Corp. identified the location of an early 1900s era gold-copper mine, previously incorrectly plotted in the government database, during ongoing work at its 100% owned LMSL Project located in the Quesnel Trough, British Columbia's primary copper and gold producing belt. The company's extensive compilation identified three samples from the vicinity of the newly located mine workings, two of which assayed as follows: 50.83 g/t gold, 125.4 g/t silver; 0.92g/t gold, 130 g/t silver (BC ARIS Report 26468).

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.



Pittsburgh, Pennsylvania, USA: Nextrack LLC, the global market leader in utility-scale solar trackers, and BCI Steel, a Pittsburgh-based steel fabricator, reopened the Bethlehem Steel manufacturing factory in Leetsdale, Pennsylvania, to produce solar tracker equipment for large-scale solar power plants. The steel processing plant will incorporate both BCI's new and reshored equipment shipped to the U.S. from factories in Malaysia and Brazil. (Photo Credit: Nextrack)

Shape, Hydro Partner on Automotive Parts

Grand Rapids, Michigan, USA: Shape Corporation, a global tier-one automotive supplier of multi-material impact energy management and lightweight body structures, has entered into an agreement with Norsk Hydro ASA, a leading producer of aluminum and renewable energy. The partners plan to explore and bring to the U.S. market automotive components utilizing Hydro CIRCAL, the company's brand of recycled aluminum made with a minimum of 75% recycled, post-consumer aluminum scrap, certified by third-party auditors DNV GL, and has a market-leading CO₂ footprint of 2.3 kg CO₂e/kg aluminum, or less. CIRCAL® is expected to deliver an estimated 70% CO₂ reduction versus the North American average for aluminum when including Scope 1, 2, and 3 emissions.

Steel Facility Expands

Delta, Ohio, USA: North Star BlueScope Steel completed an expansion to its facility in Fulton County in the northwestern region of Ohio. The \$700 million addition aims to increase annual hot-rolled coil production by 850,000 tons. New elements include a third electric arc furnace, a second slab caster, and a new shuttle facility. The site has maintained 397 full-time employees with \$30 million in annual payroll and now has room for more than 90 new full-time positions with \$5.9 million.

TMS MEETING HEADLINES

Meeting dates and locations are current as of July 25, 2022.

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



Materials Science & Technology 2022 (MS&T22)

October 9–12, 2022
Pittsburgh,
Pennsylvania, USA

**Advance
Registration and
Housing Deadlines:
September 15, 2022**

Learn from those who are on the cutting edge of their disciplines, share your work with the leading minds in your field, and build the valuable cross-disciplinary collaborations unique to this conference series at MS&T22.

[www.matscitech.org/
MST22](http://www.matscitech.org/MST22)



TMS 2023 Annual Meeting & Exhibition (TMS2023)

March 19–23, 2023
San Diego,
California, USA

**Discount Registration
Deadline:
January 31, 2023**

Plans are underway for five honorary symposia at TMS2023, highlighting the contributions of these distinguished members: Barry J. Welch, Easo George, Jonathan A. Dantzig, Zi-Kui Liu, and Patrick R. Taylor. Learn more about these and other featured sessions on the Technical Program section of the TMS2023 website.

[www.tms.org/
TMS2023](http://www.tms.org/TMS2023)



Superalloy 718 & Derivatives 2023

May 14–17, 2023
Pittsburgh,
Pennsylvania, USA

**Manuscript Deadline:
September 16, 2022**

The Superalloy 718 & Derivatives 2023 conference will explore all aspects of metallurgical processing, materials behavior, and microstructural performance for a distinct class of 718-type superalloy and derivatives. Start planning now to join colleagues and make new contacts at the conference's tenth installment.

[www.tms.org/
Superalloy718-2023](http://www.tms.org/Superalloy718-2023)



7th World Congress on Integrated Computational Materials Engineering (ICME 2023)

May 21–25, 2023
Orlando, Florida, USA

**Abstract Deadline:
December 5, 2022**

ICME 2023 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/
ICME2023](http://www.tms.org/ICME2023)

Other Meetings of Note



Materials Science & Technology 2023 (MS&T23)

October 1–5, 2023
Columbus, Ohio, USA
www.matscitech.org



TMS 2024 Annual Meeting & Exhibition (TMS2024)

March 3–7, 2024
Orlando, Florida, USA
www.tms.org/TMS2024



TMS 2025 Annual Meeting & Exhibition (TMS2025)

March 23–27, 2025
Las Vegas, Nevada, USA
www.tms.org/TMS2025

COPPER-COBRE 2022 (Copper 2022)

November 13–17, 2022
Santiago, Chile
Co-sponsored by TMS

European Metallurgical Conference (EMC 2023)

June 11–14, 2023
Düsseldorf, Germany
Co-sponsored by TMS

OTC Brasil 2023

October 24–26, 2023
Rio de Janeiro, Brazil
Co-sponsored by TMS

Materials in Nuclear Energy Systems (MINES 2023)

December 10–14, 2023
New Orleans, Louisiana, USA

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Technical Meeting and Exhibition

MS&T 22

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152nd Annual Meeting & Exhibition

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- San Diego is a **convenient travel spot for international attendees**, with direct flights arriving from Canada, Mexico, Europe, and Asia.
- In 2023, we will return to the San Diego Convention Center but use a new headquarters hotel, so prepare to join us at the **Hilton San Diego Bayfront** for TMS2023!

MARK YOUR CALENDAR WITH THESE KEY DATES:

October 2022: Registration Opens

January 31, 2023: Discount Registration Deadline

February 23, 2023: Housing Deadline



The New Headquarters Hotel:
HILTON SAN DIEGO BAYFRONT



STAY UPDATED AT:
www.tms.org/TMS2023



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—**Suveen Mathaudhu**

University of California, Riverside

2021 Brimacombe Medalist



TMS

BRIMACOMBE MEDALIST

Suveen Mathaudhu

For sustained excellence and achievement in business, technology, education, public policy, or science related to materials science and engineering. And for a record of volunteer service with professional membership to TMS for at least 5 continuous years.

Presented March 17, 2021

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SUBMIT YOUR ABSTRACT

FOR THE 2023 TMS BLADESMITHING
SYMPOSIUM BY OCTOBER 14, 2022

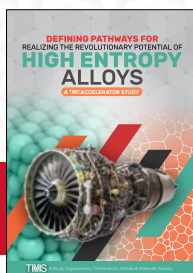


Submit technical presentations on
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March 19–23, 2023.

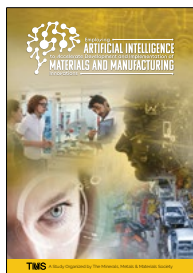


www.tms.org/Bladesmithing



TMS STUDIES

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"The action plans in *Defining Pathways* give stakeholders a detailed framework of prioritized recommendations to help accelerate the discovery, development, and implementation of these potentially game-changing materials."

—Dan Miracle, HEA Study Team Chair
from "Unlocking the Potential of High Entropy Alloys with
New TMS Study" in *JOM: The Magazine*, January 2022



Review the complete list of TMS science and
accelerator studies at **www.tms.org/studies**



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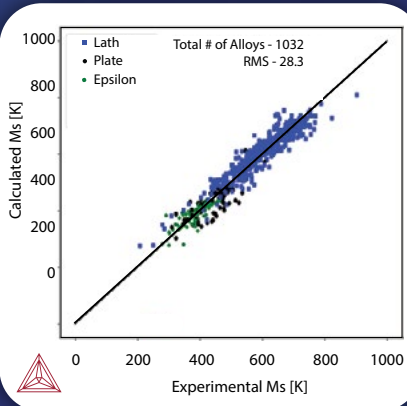
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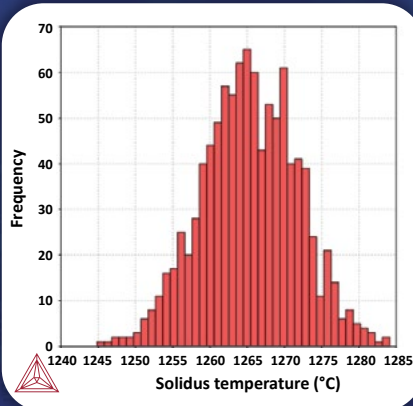
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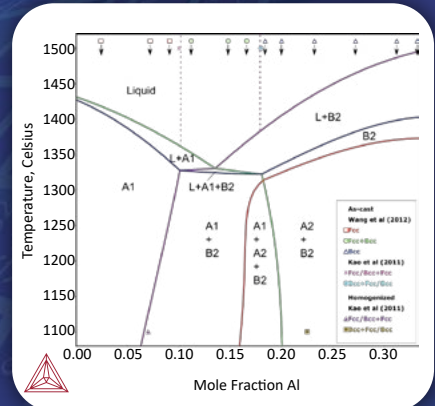
Comparison of calculated and experimental Ms temperatures for a wide range of steels

Nickel



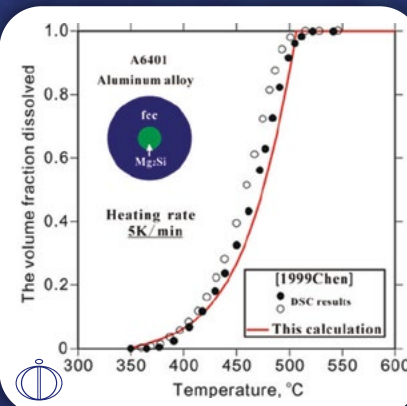
Variation in solidus temperature over 1000 compositions within alloy 718 specification

High Entropy Alloys



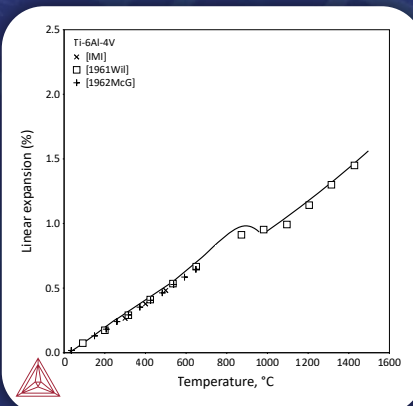
Calculated phase diagram along the composition line of CoCrFeNi-Al

Al Alloys



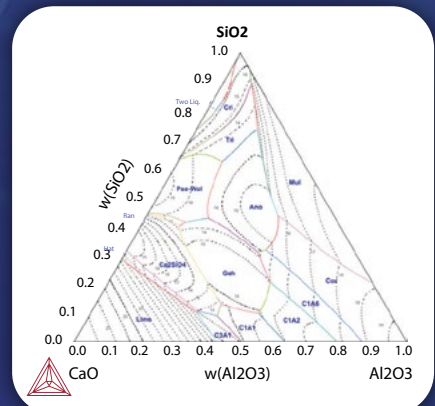
Dissolution of Mg₂Si precipitate in Alloy A6401

Ti and TiAl Alloys



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

Oxides



Ternary liquidus projection in oxide systems