

# JOM THE MAGAZINE

JUNE 2023

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

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

## BACK TO BUSINESS AT TMS2023



TMS  
20.982  
Aluminium

Springer

# TMS THANKS THE FOLLOWING EXHIBITORS

for their participation in the TMS 2023 Annual Meeting & Exhibition (TMS2023) in San Diego, California:

THE WORLD COMES HERE.  
**TMS 2023**  
152<sup>nd</sup> Annual Meeting & Exhibition

- ABB, Inc.
- Advanced Optical Technologies
- Alemnis AG/Angstrom Scientific Inc.
- ALMEX USA, Inc.
- AMAZEMET Sp. Zo. o
- Boise State University
- Bruce Oakley Inc.
- Bruker
- California Nanotechnologies
- Cameca
- Carl Zeiss Microscopy, LLC
- Ceotherm Industrial Furnaces
- CompuTherm, LLC
- DTE
- EBSD Analytical
- EDAX
- Elsevier
- EnPot Ltd
- ETA Inc
- Eurofins EAG Laboratories
- FemtoTools AG
- FormAlloy
- GLAMA
- Haarslev Industries Press Technology GmbH + Co.Kg
- Henry Royce Institute for Advanced Materials
- Hycast AS
- Hydrova
- INTEREP Inc
- JH Technologies
- KLA Corporation
- Leica Microsystems
- Light Metal Age
- Maschinenfabrik Gustav Eirich GmbH & Co KG
- Michelli Weighing & Measurement
- Micro Materials Ltd
- MTI Corporation
- Nanovea
- NASA Physical Sciences Informatics (PSI)
- Netzsch Instruments NA LLC
- Nuclear Science User Facilities
- Pacific Northwest National Laboratory (PNNL)
- Plastometrex Limited
- Precimeter Inc.
- PROTO
- Psylotech Inc
- Quantum Design
- REL, Inc.
- Research in Germany & German Materials Society (DGM)
- RHI Magnesita GmbH
- RUMUL North America LLC
- SAMI
- Schrödinger
- Sistem Teknik Industrial Furnaces Ltd.
- STAS
- Synton Mdp AG
- TA Instruments
- Techmo Car S.p.A.
- Tekna
- Tenova Inc.
- TESCAN
- Tesla, Inc.
- Thermo Calc Software Inc.
- Thermo Fisher Scientific
- Total Materia AG
- UES Inc.
- University of North Texas: Center for Agile and Adaptive Additive Manufacturing
- Virtual Lab. Inc
- Wagstaff, Inc.
- XtaLight

## TMS ALSO RECOGNIZES THE FOLLOWING SPONSORS FOR HELPING TO MAKE TMS2023 A SUCCESS:



Seeing beyond



## SEE YOU NEXT YEAR IN ORLANDO FOR TMS2024!

Don't miss your opportunity to be an exhibitor or sponsor at the TMS 2024 Annual Meeting & Exhibition, scheduled for March 3-7, 2024, in Orlando, Florida. For more information, visit [www.tms.org/TMS2024](http://www.tms.org/TMS2024).

THE WORLD COMES HERE.  
**TMS 2024**  
153<sup>rd</sup> Annual Meeting & Exhibition



5700 Corporate Drive  
Suite 750  
Pittsburgh, PA 15237  
USA  
Phone: 1-724-776-9000  
Web: [www.tms.org/JOM](http://www.tms.org/JOM)  
E-mail: [membership@tms.org](mailto:membership@tms.org)

#### Publisher for TMS

James J. Robinson,  
*Executive Director*

#### Operations Management

Matt Baker,  
*Department Head, Content*

#### JOM: The Magazine

Lynne Robinson,  
*Department Head, Marketing  
and Communications*

Kelly Zappas,  
*JOM: The Magazine Editor*

Cheryl M. Geier,  
*Senior Graphic Designer*

#### Contributing Writers

Ashley-Anne Bohnert,  
*Marketing Manager*

Megan Enright,  
*Events Marketing Lead*

Jillian Schultz,  
*Marketing Assistant*

#### Graphics Support

David Rasel,  
*Head of Visual  
Communications*

Bob Demmler,  
*Visual Communications  
Coordinator*

#### Advertising

Ky Carlson, Sales Coordinator  
[ky.carlson@ewald.com](mailto:ky.carlson@ewald.com)

## ABOUT THE COVER



This month's cover is designed by David Rasel, TMS Head of Visual Communications, and features photos taken by Rasel and Bob Demmler, Visual Communications Coordinator, throughout the week at the TMS 2023 Annual Meeting & Exhibition in San Diego, California, in March. This issue of *JOM: The Magazine* tells the story of TMS2023 in a series of five articles, each looking at a different aspect of this multifaceted event. You can view the complete photo collection at [www.flickr.com/photos/tmsevents](http://www.flickr.com/photos/tmsevents).



### 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](http://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](http://www.tms.org/JOM).

#### About TMS:

The Minerals, Metals & Materials Society (TMS) is a professional organization that encompasses the entire range of materials science and engineering, from minerals processing and primary metals production to basic research and the advanced applications of materials. Learn more at [www.tms.org](http://www.tms.org).

#### Postmaster:

Send address changes to: *JOM: The Magazine*, 5700 Corporate Drive Suite 750, Pittsburgh PA, 15237 USA. Periodicals postage paid at Pittsburgh, PA and additional mailing offices.

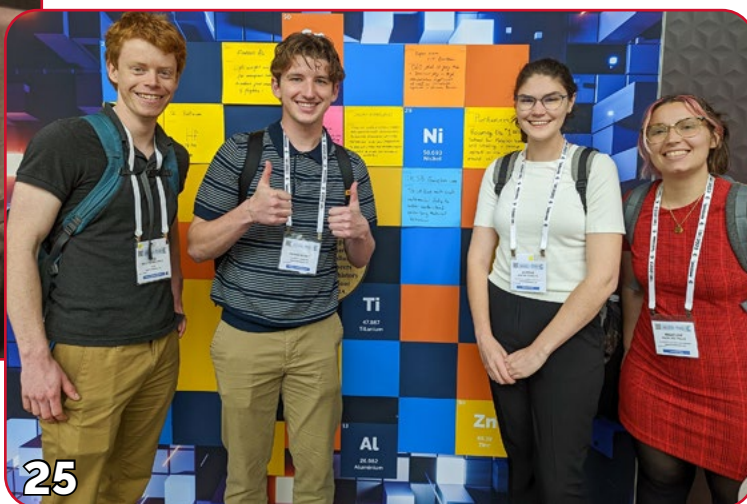
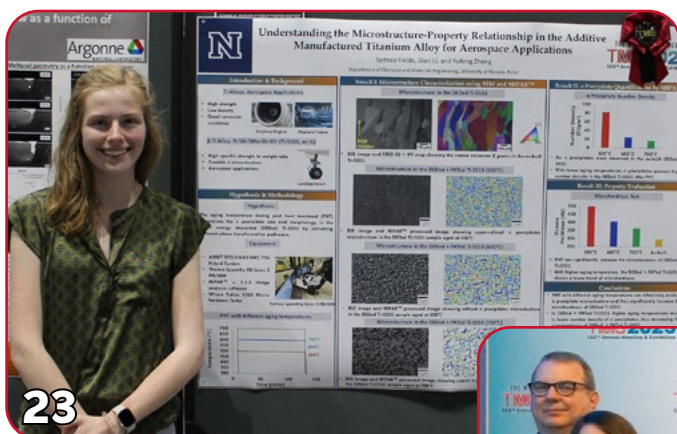
# TABLE OF CONTENTS

## FEATURES

- 6:** Back to Business at TMS2023: Kelly Zappas
- 11:** Featured Sessions and Invited Speakers at TMS2023: Kelly Zappas
- 15:** Networking and Professional Development Events at TMS2023: Kelly Zappas and Megan Enright
- 21:** Best Poster Recipients Announced at TMS2023: Jillian Schultz
- 24:** TMS Members: The Essential Elements of TMS's Future: Kelly Zappas

## DEPARTMENTS

- 3:** In the Final Analysis: James J. Robinson
- 4:** JOM Technical Topics
- 5:** TMS Member News
- 26:** In Case You Missed It: Business News from the Field
- 27:** TMS Meeting Headlines



# IN THE FINAL ANALYSIS

*"I know who you are. You're famous. I see you every month in JOM."*

*—Attendee at TMS2023 after introducing myself*

Beyond that quote, do we really need to know anything more about last March's TMS2023 to declare it a success? One of the 4,499 attendees inflated my ego, so "Victory!" Let's move on with planning TMS2024. . . . No can do: My reliably ego-deflating conscience says, "Hang on a minute Mr. Executive Director. Your self-esteem should be very low among TMS2023's performance metrics. Like, really low." Okay, okay. Let's have a look at some less Jim-a-ta-tive and more quantitative numbers as to how well TMS did in convening and serving the materials community in a surprisingly cool and soggy San Diego, California. Can do.

We will assess by considering TMS2023 performance statistics as well as opinions from our post-event survey:

1. With so many of our event-planning aspirations unceremoniously COVID-crushed during 2020, 2021, and 2022, we knew that setting an attendance goal of 4,300 for TMS2023 was risky. To the credit of our full community, we exceeded planned attendance by about 5%. Better, this year's meeting looked a lot like the "normal" that has long characterized our annual meeting and exhibition. TMS2023 is our 4<sup>th</sup> best-attended annual meeting, attracting only 182 fewer registrants than the record TMS2020, which was held just days before the Great Pandemic Shutdown. The return to form is a significant relief for our association and the field that we serve.
2. Who were the registrants? Rounding, 1,300 were TMS professional members; 1,100 were nonmember professionals; 1,400 were students. That is a record turnout for students—tomorrow's professional members.
3. With all of the students in attendance, it is no surprise that the number of teams for the 16<sup>th</sup> TMS Materials Bowl posted a record as well: 16 schools competed. Congratulations to the University of Minnesota—Twin Cities on winning their second championship in a row.
4. Having people attend is one thing, having a good experience on arrival is another. For insight, we survey all event participants. One of our key questions for comparative purposes asks attendees to rate the meeting on a scale of "excellent," "good," "average," "fair," and "poor." I tend to aggregate the "excellent" and "good" scores to get a sense of general positivity and the "fair" and "poor" scores to get a sense of general negativity. The general positivity rating among professionals for TMS2023 is 79%, which tracks well with an average score of 78% for the last nine years (tossing out the two pandemic meetings). As for general negativity, TMS2023 scores 7% as compared to the non-COVID multiyear average of 5%.
5. While on site, the most popular activity, aside from networking, was attending technical sessions. We were well-equipped as more than 4,900 presentations were proposed for the meeting. The most popular programming tracks for abstract submissions were additive technologies, advanced materials, and materials processing. On site, professionals espoused to be most interested in the following tracks: additive technologies, light metals, and nuclear materials.

I also review the data for insights on what event amenities stand out in the positivity and negativity scores. For TMS2023, positivity was strongly on the side of Wi-Fi access. We've been beaten up over this in the past, so hooray for progress! For negativity, the drubbing once again goes to our food and beverage offerings. We know that coffee running out is an annoyance, but driving rain has an especially negative impact on a food truck experience. I apologize for that. Come see how we do better with TMS2024 in Orlando. We'll surely dodge the rain as the whole event will be under the single (very large) roof of the Hyatt Regency! When you see me there, my positivity rating will go up if you comment on how famous I am!

Volume 75

Number 6

June 2023



James J. Robinson  
Executive Director

 @JJRofTMS

*"TMS2023 is our  
4th best-attended  
annual meeting. . . .  
The return to form is a  
significant relief for our  
association and the  
field that we serve."*

*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](http://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](http://www.tms.org/JOM) to log in for access to technical journal articles on the Springer website.

## // JUNE 2023

### Advanced Technology for Electronic Packaging and Interconnection Materials

**Scope:** Advanced progress in devices requires new materials and technologies to meet the electrical, thermal, mechanical, reliability and environmental demands. The special topic addresses current research in new and existing materials for emerging interconnects and electronic packaging.

**Editor:** Albert T. Wu, National Central University

**Sponsor:** Electronic Packaging and Interconnection Materials Committee

### Advanced Magnetic Materials for Energy and Other Functional Applications and Devices

**Scope:** This topic focuses on developments in the design, manufacture, characterization, and/or modeling of emerging and traditional magnetic materials for energy applications and functional devices. Included are hard and soft magnets as well as magnetic materials with functional properties (e.g., magnetoelastic, magnetostrictive, magnetocaloric, and magnetoelectric materials).

**Editors:** Zachary Morgan, Oak Ridge National Laboratory, and Zachary Tener, Oak Ridge National Laboratory

**Sponsor:** Magnetic Materials Committee

### Fatigue and Fracture of Additively Manufactured Materials

**Scope:** An understanding of the mechanical properties of additively manufactured materials is critical to their improvement and wider-scale adoption. Additive manufacturing processing results in unique microstructures, defect structures, and surface roughness that all play a role in the eventual properties of the fabricated components. This special topic covers recent advancements in the characterization, assessment, modeling, and improvement of the fatigue and fracture properties of additively manufactured materials, including metals, ceramics, polymers, and composites.

**Editor:** Allison Beese, Penn State University

**Sponsor:** Additive Manufacturing Committee

### High-Temperature Phases and Processes for Enabling Cleaner Production of Metals and Energy

**Scope:** This special topic on thermodynamics and modeling of high-temperature phases and processes aims to frame a comprehensive discussion and data sharing that promote the advancement of environmentally friendly and economic production of metals and renewable energy technologies.

**Editors:** Fiseha Tesfaye, Abo Akademi University; Joseph Hamuyuni, Metso Outotec; Hong Peng, University of Queensland; Chukwunwike O. Iloeje, Argonne National Laboratory; and Dirk Verhulst, Devv

**Sponsors:** Recycling and Environmental Technologies Committee, Energy Committee, Process Technology and Modeling Committee



## Contribute to *JOM*: The Journal

Visit [www.tms.org/JOM](http://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](mailto:mbyko@tms.org).

# TMS MEMBER NEWS

## Share the Good News!

Contact Kelly Zappas, *JOM: The Magazine* editor, at [kzappas@tms.org](mailto:kzappas@tms.org) to share your professional accomplishments. Please note that only news submitted by current TMS members will be considered.

## TMS Members Lead 3D Printing Project

Two TMS members in the Materials Science and Engineering Department at the University of Arizona are conducting a \$1.2 million project to design alloys for 3D printing objects that can withstand hypersonic speeds. **Sammy Tin**, department chair, and **Andrew Wessman**, assistant professor, are



Sammy Tin



Andrew Wessman

Photo Credit: University of Arizona

leading the project funded by a grant from the Office of Naval Research's Defense University Research Instrumentation Program. During this project, the team aims to create novel metallic alloys optimized for the additive manufacturing process and with the ability to withstand the extreme conditions of hypersonic flight, including high temperatures and high stress levels.

Sammy Tin, a TMS member since 1995, has served on a variety of TMS committees including the Emerging Professionals Committee, the High Temperature Alloys Committee, and the Structural Materials Division (SMD) Council. Andrew Wessman has been a TMS member since 2001. He previously served on the High Temperature Alloys Committee, as a symposium organizer for the TMS 2022 Annual Meeting & Exhibition (TMS2022), and as an organizer for the 10th International Symposium on Superalloy 718 & Derivatives, held from May 14–17, 2023.

## Full AIME Oral Histories Now Available



The American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) has released the full videos of several TMS member oral histories as part of the AIME Oral

History Project. This project supports the Institute's mission, by preserving and promoting achievements in the fields and sharing prominent member stories

with future generations. The full videos are now available for:

- **Diran Apelian**, Worcester Polytechnic Institute
- **Alex King**, Ames National Laboratory
- **Thaddeus "Ted" Massalski**, Carnegie Mellon University (deceased)
- **Alexander Scott**, TMS (retired)

Visit the Oral Histories web page at [aimehq.org](http://aimehq.org) to learn the story of your profession in the words of those who have lived it.

## Registration Opens for 2023 TMS Aluminum Courses



The TMS Aluminum Courses return with two courses to be held in September 2023. This popular program was paused due to the global pandemic, with these two courses being the first offered since 2019. These events will be held concurrently from **September 10-14, 2023**, in the same location, **The Gulf Hotel Bahrain, Manama, Kingdom of Bahrain**. Each course will have a plant tour of their respective interest areas. However, registration for these events is separate, and participants must attend only the sessions of the



course for which they specifically registered. The two courses offered are:

**Anode Technology for the Aluminum Industry Course:** [www.tms.org/Anode2023](http://www.tms.org/Anode2023)

**Control of Potline Scrubber & Fugitive Emissions for Aluminum Smelters Course:** [www.tms.org/PSFE2023](http://www.tms.org/PSFE2023)

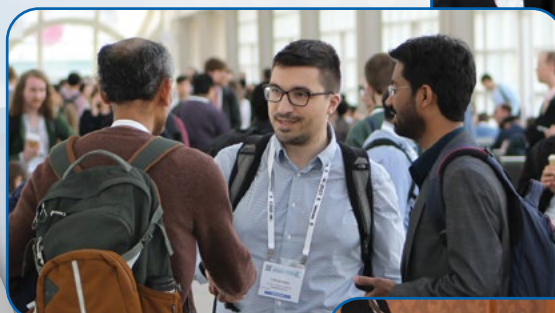
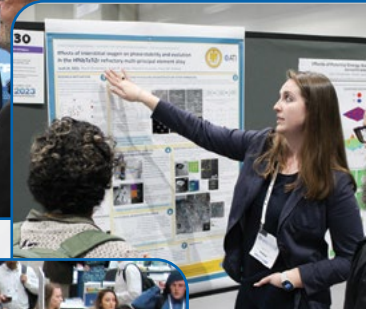
Registration is now open for both courses. Register by July 31, 2023, to take advantage of a discounted registration fee.

# TMS 2023

# BACK TO BUSINESS

# AT TMS2023

Kelly Zappas







With nearly 4,500 attendees gathered in San Diego, California, the TMS 2023 Annual Meeting & Exhibition (TMS2023) was the fourth best-attended meeting in TMS history, marking a return to business as usual (more or less) after two decidedly *unusual* years for the Society's biggest event. By comparison, approximately 2,600 individuals came together in person for TMS2022 in Anaheim, California. (Because TMS2022 was a hybrid event, an additional 1,114 attendees participated virtually in the conference.) One year earlier, TMS2021—held as a fully virtual conference—attracted 2,967 attendees from around the world.

This year's event, held March 19-23 in one of TMS's most popular meeting locations, brought the conference back closer to its pre-COVID participation numbers. The last time TMS met in San Diego was in 2020 (shortly before widespread pandemic shutdowns began) when more than 4,600 individuals came together for the largest meeting in the Society's history.

This issue of *JOM* offers a look into the technical session rooms, the networking receptions, the student competitions, and the special events that brought the community together over the course of five days in March. Find more photos on Flickr at [www.flickr.com/photos/tmsevents](http://www.flickr.com/photos/tmsevents).

## TMS2023 HOSTS SOLD-OUT EXHIBITION

With a total of 69 exhibiting companies, the TMS2023 Exhibit Hall was filled with booths and exhibitors demonstrating their products and services, from Monday, March 20, through Wednesday, March 22.

On Monday and Tuesday evenings, two separate networking events—an opening reception and a happy hour—gave attendees an opportunity to gather for food, drinks, and networking with exhibitors and each other. Each event featured a unique poster session highlighting different topics on each night. Poster presenters were on hand each night to discuss their work with attendees.

For information on participating as an exhibiting company in the TMS 2024 Annual Meeting & Exhibition (TMS2024) in Orlando, Florida, please contact Gavin McAuliffe, TMS2024 Exhibit Manager, Corcoran Expositions, at [gavin@corcexpo.com](mailto:gavin@corcexpo.com).



## TMS2023 PROCEEDINGS

Eleven TMS2023 conference proceedings were published and made available for free online access to registrants. These volumes are also now available for purchase through the TMS Bookstore. TMS members are eligible for 40% discounts on these and other TMS proceedings. Log in to [www.tms.org/Bookstore](http://www.tms.org/Bookstore) to access member discount codes.



From left to right: 2022 TMS President Jud Ready presents a copy of *Light Metals 2023* to this year's editor, Stephan Broek, at the TMS Aluminum Committee meeting. Also pictured is Dmitry Eskin, chair of the TMS Aluminum Committee.

2022 TMS President Jud Ready (center, left) presents a copy of *Magnesium Technology 2023* to (from left to right) editors Steven Barela, Victoria M. Miller, and Petra Maier at the TMS Magnesium Committee Meeting. Not pictured are editors Aerial Leonard and Neale R. Neelameggham.

## TMS2023 BY THE NUMBERS

### Attendance

- 4,499:** Total attendees
- 1,393:** Student attendees
- 69:** Exhibiting companies
- 58:** Countries represented

### Technical Program

- 3,316:** Oral presentations
- 677:** Poster presentations
- 105:** Symposia presented
- 486:** Sessions presented

### Food and Beverage

- 831:** Gallons of coffee served during breaks
- 200:** Gallons of lemonade served
- 86:** Gallons of hot tea served

## BRAD BOYCE TAKES OFFICE AS 2023 TMS PRESIDENT

At each year's TMS Annual Meeting, leadership transitions take place on the TMS Board of Directors, and the Society's new president is installed.

Brad Boyce of Sandia National Laboratories took office as 2023 TMS president and offered these comments during his speech at the TMS-AIME Awards Ceremony at TMS2023: "I am really looking forward to the year ahead as the president of this great Society. To me, TMS is more than just a collection of scientists and engineers. It's a home; it's a family. Our passion for materials innovation is what pulls us together."

Boyce is a distinguished member of the technical staff at Sandia, where his research interests lie in micromechanisms of deformation and failure. Within TMS, he has chaired the TMS Mechanical Behavior of Materials Committee and the TMS Programming Committee, and he has served on the TMS Board of Directors, the TMS Foundation Board of Trustees, and numerous other committees, both technical and functional. He is also a past recipient of the TMS Brimacombe Medal and the TMS Structural Materials Division Young Leaders Professional Development Award.

As Boyce's term began, Jud Ready of the Georgia Institute of Technology concluded his term as 2022 TMS president. Ready also addressed the audience at the TMS-AIME Awards Ceremony held on Wednesday evening at TMS2023.



Society leadership transfers from 2022 TMS President Jud Ready (right) to 2023 TMS President Brad Boyce (left) during the TMS-AIME Awards Ceremony at TMS2023.

"The world comes to TMS' is a slogan of ours—because at our meetings and on-line, TMS connects members to technical communities of excellence," said Ready. "Approximately 4,500 individuals are connecting here, in this place, at TMS2023. That's only a couple hundred people less than our current largest meeting, TMS2020, also held here in San Diego."

The change in leadership also included Srinivas Chada moving into the role of vice president. Chada will serve as president in 2024.

## MEET THE 2023 TMS BOARD OF DIRECTORS



Seven new members joined the TMS Board of Directors at TMS2023. The 2023 Board is pictured here. **Front row, left to right:** Alexis Lewis, Elsa Olivetti, Jonathan Madison, Saryu Fensin, Viola Acoff, Paul Mason, James Robinson. **Back row, left to right:** Suveen Mathaudhu, Edward Williams, Kester Clarke, Michael Titus, Jud Ready, Brad Boyce, Srinivas Chada, Timothy Rupert.

## DAVID DANIELSON DELIVERS TMS2023 PLENARY TALK



Earlier in his career, David Danielson viewed the third “M” in the name of The Minerals, Metals & Materials Society (TMS) as the most prominent. But in recent years, as managing director of Breakthrough Energy Ventures, he finds that his focus has shifted. “As I really dug in on what’s going to drive impact for climate change,”

he said, he found that 90% of his projects were more related to mining and metals. “I’m finding that there is tremendous opportunity in a whole new generation of scientists, technologists, and entrepreneurs in mining, minerals, and metals.”

In his TMS2023 plenary presentation, “Gigaton Opportunities at the Intersection of Materials and Climate Technology,” Danielson discussed some of these projects and identified key problems that TMS members could help to solve that would have the greatest impact on climate change.

Danielson explained that we are currently on track to produce more than 80 gigatons of carbon dioxide emissions per year by 2050 (up from current levels of around 50 gigatons per year). But where we need to be is zero carbon dioxide emissions by 2050 to avoid the worst effects of climate change.

“If you view 2050 through an innovation lens,” he said, “the time to be launching companies to solve this challenge is today.” Working backwards, he pointed out that for a new technology to be operating to scale by 2050, it would take roughly 20 years to deploy. That means that by 2030, it would need to be commercially demonstrated and initially entered into the market. Because it takes approximately ten years to commercialize a new technology, if you want clean technology in place by 2050, you need to launch it today.



The two biggest problems he identified were steel and cement. “We need brilliant materials scientists to get after solutions in these two areas,” he said, emphasizing that the time to start implementing those solutions is now. “I’d encourage you only to use your talents on important projects,” said Danielson, who noted the importance of all three “M”s (minerals, metals, and materials) in projects going forward.

As we move away from fossil fuels, for example, we’ll face a much more materials-intensive economy, he said. There will be increasing demand for electric vehicle-related metals (such as copper, nickel, cobalt, and lithium) and any resulting mining boom will need to be more environmentally friendly than mining projects of the past.

“We’ll need about 1,000 more mines for these four metals,” he said. “And much more attention is being paid to sustainable mining, because we don’t want to trade one bad environmental impact for another.”

Danielson provided examples of projects addressing these problems, including Lilac Solutions, which is extracting lithium from dilute brines to deliver lithium cheaply; KoBold Metals, which is finding new metal resources using artificial intelligence; and Redwood Materials, which is recycling lithium-ion batteries into materials for the electric vehicle industry.

“These are the kind of innovations that are possible,” he said. “There’s a huge opportunity to get a whole new generation of minerals, metals, and materials students interested in these problems.”

Following the presentation, Danielson answered questions from the audience and accepted a certificate commemorating his role as plenary speaker from 2022 TMS President Jud Ready.

## SEE YOU IN ORLANDO FOR TMS2024

Next year, TMS returns to another popular meeting location for the TMS 2024 Annual Meeting & Exhibition (TMS2024). The conference will take place in Orlando, Florida, at the Hyatt Regency Orlando resort. This venue will be the location for all TMS2024 technical programming as well as social and networking events.

To be a part of the TMS2024 technical program, submit your abstract today through the TMS2024 website at [www.tms.org/TMS2024](http://www.tms.org/TMS2024). There, you can view a full list of topic areas and symposia planned for the upcoming conference. Abstracts are due July 1, 2023.



# TMS2023

## FEATURED SESSIONS AND INVITED SPEAKERS

### AT TMS2023

Kelly Zappas



Nearly 4,000 oral and poster presentations were delivered at 105 symposia during the TMS 2023 Annual Meeting & Exhibition (TMS2023), March 19–23, in San Diego, California. Among these were keynote sessions on various technical topics, symposia honoring distinguished members of the community, and award lectures delivered by leaders in the field. The following pages offer a look at a selection of these featured sessions from TMS2023.

### LIGHT METALS KEYNOTE SESSION



The 2023 Light Metals Keynote Session, which opened the TMS Light Metals Division's technical programming for the week, focused on the topic of Research and Process Optimization through Computer Modelling and Digitalization. Eight invited speakers gave presentations and then participated in a panel discussion. Speakers included (pictured, from left to right): **Matthew Krane**, Purdue University; **Marlen Bertram**, International Aluminium Institute;

**Arild Hakonsen**, Hycast AS; symposium organizer **Dmitry Eskin**, Brunel University; **Andre-Felipe Schneider**, Hatch Ltd.; **Nancy Holt**, Hydro Aluminium AS; **Markus Apel**, Access RWTH-Aachen; and **Jayson Tessier**, Alcoa Corporation.



The final speaker of the morning was **Elsa Olivetti** (pictured, speaking) from the Massachusetts Institute of Technology. Her talk, "Data Driven Methods to Increase Aluminum Recycling," looked at challenges to achieving sustainability through recycling. "One thing that has been

consistent over the presentations in this session is the value of using models," said Olivetti, who discussed how metallurgists can leverage ever more powerful computational and data science tools to improve recyclability.

## MAGNESIUM TECHNOLOGY KEYNOTE SESSION

Four presenters delivered invited talks at the Magnesium Technology 2023 Keynote Session to open the Magnesium Technology symposium at TMS2023.

**Andrew Sherman**, Terves LLC, opened the session with the talk, "Sustainable Domestic Manufacturing and Protecting Intellectual Property in a Post-America Invents Act World," which looked at efforts to bring magnesium manufacturing back to the United States and the importance of protecting patents, particularly for small businesses. "I believe there's a lot of opportunity for magnesium," said Sherman. "I'm pretty heavily invested."



**Aaron Palumbo** (pictured, speaking), Big Blue Technologies, next discussed "Reductant Consideration in Thermal Pathways to Primary Magnesium Metal Production." The session was rounded out with presentations by **Norbert Hort**, Helmholtz-Zentrum Hereon, and **Carolyn Woldring**, Magsorbeo Biomedical.

## ADDITIVE MANUFACTURING KEYNOTE SESSION



LEGO® building blocks were one of the best analogies that **Matteo Seita** could think of to describe his work in metal additive manufacturing. "Additive manufacturing is like play," he said, "because you design materials by assembling different pieces." Seita, who is Granta Design Assistant Professor in the

Department of Engineering at the University of Cambridge, gave his talk, "Microstructure Design Freedom in Metal AM: A LEGO® Analogy" as part of the Additive Manufacturing Keynote Symposium at TMS2023. Seita (pictured, speaking) delivered his talk as the recipient of the 2023 TMS Young Innovator in the Materials Science of Additive Manufacturing Award.

This well-attended session also featured talks by **Moataz Attallah**, University of Birmingham; **Melanie Lang**, Formalloy; and **Mohsen Seifi**, ASTM International and Case Western Reserve University. A total of eleven symposia were presented during the week of TMS2023 in the topic area of Additive Technologies.

## ACTA MATERIALIA SYMPOSIUM

Four distinguished TMS members were honored for significant contributions to the materials science and engineering communities at a special Acta Materialia Symposium during TMS2023. Each awardee delivered an invited talk at the symposium.



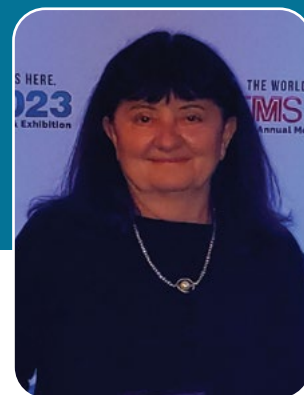
**Ben Britton**, University of British Columbia, delivered the Acta Materialia Mary Fortune Global Diversity Lecture, "Diversity & Diffraction."



**Charles Ward**, U.S. Air Force Research Laboratory, delivered the Acta Materialia Hollomon Award for Materials and Society, "Bringing Materials and Manufacturing Technology Together."



**Raymundo Arroyave**, Texas A&M University, delivered the Acta Materialia Silver Medal Lecture, "Multi-Disciplinary Systems Optimization Approaches to Alloy Design."



**Tresa Pollock**, University of California-Santa Barbara, delivered the Acta Materialia Gold Medal Lecture, "Have Alloy Design and Discovery Fundamentally Changed?"

## HONORARY SYMPOSIA

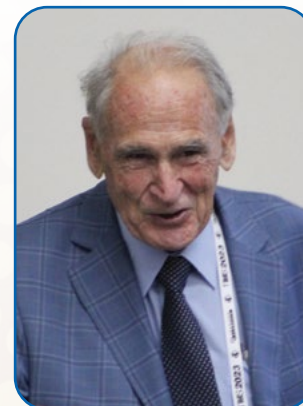
Five TMS members were honored throughout the week at TMS2023 for their distinguished contributions to the minerals, metals, and materials science and engineering communities at the following symposia:



- Alloy Behavior and Design across Length-Scales: An SMD Symposium Honoring **Easo George**
- Frontiers in Solidification: An MPMD Symposium Honoring **Jonathan A. Dantzig**
- Materials Genome, CALPHAD, and a Career over the Span of 20, 50, and 60 Years: An FMD/SMD Symposium in Honor of **Zi-Kui Liu**
- New Directions in Mineral Processing, Extractive Metallurgy, Recycling, and Waste Minimization: An Extraction & Processing Division Symposium in Honor of **Patrick R. Taylor**
- 60 Years of Taking Aluminum Smelting Research and Development from New Zealand to the World: An LMD Symposium in Honor of **Barry J. Welch**



**Patrick Taylor** addresses friends and colleagues at a dinner held in his honor in conjunction with his TMS2023 honorary symposium.



**Barry Welch** speaks at his honorary symposium, where he delivered the talk "The Need to Respect the Interlink between Science, Physics, and Cell Design in an Environmentally Responsible Manner - The Next Big Challenge for Aluminium Smelting."

## NIX AWARD SYMPOSIUM



**Eduard Arzt**, (pictured, speaking) INM – Leibniz Institute for New Materials and Saarland University, delivered the 2023 William D. Nix Award Lecture as part of the Nix Award and Lecture Symposium IV: Learning from Nature—From Insight to Sustainable Innovation. His talk, "From Bioinspiration to Machine Learning—a New Concept for Object Manipulation," looked at gecko-inspired fibrillar adhesives that can both grip and release micro-objects using a pick-and-place robot. His talk opened a session of invited speakers that also included **Subra Suresh**, Nanyang Technological University, Singapore; **Xuan Zhang**, INM–Leibniz Institute for New Materials; and **Christoph Keplinger**, Max Planck Institute for Intelligent Systems.

## AWARD LECTURES AT TMS2023



**Corale L. Brierley** (left), Brierley Consultancy LLC, accepts the Extraction & Processing Division Distinguished Lecturer Award from EPD Chair Elsa Olivetti. Brierley delivered the lecture, "New Directions for Biotechnology Practices in Metals Extraction."



**Carl Koch** (right), Kobe Steel Distinguished Professor, North Carolina State University, accepts the Institute of Metals/Robert Franklin Mehl Award from 2022 TMS President Jud Ready. He delivered the award lecture, "Metallurgical Engineering to Materials Science and Engineering: Evolution of a Profession and TMS."



**Gerbrand Ceder** (right), University of California, Berkeley, accepts the William Hume-Rothery Award from 2022 TMS President Jud Ready. Ceder delivered the award lecture, "Ab Initio Thermodynamics and Kinetics from Alloys to Complex Oxides."

## FRONTIERS OF MATERIALS SYMPOSIA

Three Frontiers of Materials Symposia, organized by individuals selected through TMS's competitive Frontiers of Materials awards program, were presented on hot or emerging technical topics in materials at TMS2023. In addition to inviting speakers and organizing their symposia, each of the three award recipients (pictured here) also delivered keynote talks on their selected topics.



**Alison Dunn**, University of Illinois Urbana-Champaign, delivers the keynote talk at her symposium, Functional Composition Control of Surface Mechanics in Soft, Water-Swollen Gels.



**Ashwin Shahani**, University of Michigan, speaks at the symposium he organized, Intermetallic Alloys at the Edge of Complexity: Structural and Kinetic Aspects.

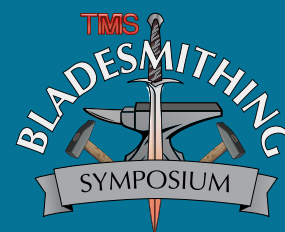


**Yuji Zhao**, Rice University, is the keynote speaker at his symposium, Ultra-Wide Bandgap Materials and Heterostructures for Next Generation Power, RF, and Quantum Applications.

## BLADESMITHING SYMPOSIUM

The one-day Bladesmithing Symposium, held on Tuesday, March 21, featured talks related to past and future TMS Bladesmithing Competitions. The session opened with a keynote talk by David Sapiro, Schonpiro Materials, who competed in the first TMS Bladesmithing Competition in 2015, and ended with a standing-room-only talk by Suveen Mathaudhu, Colorado School of Mines, titled "This is the Way—Discovering the Secrets of Beskar Metallurgy," which was based on the cover story from the December 2022 issue of *JOM: The Magazine*.

The TMS Bladesmithing Competition will return at the TMS 2024 Annual Meeting & Exhibition in Orlando, Florida. Learn how to enter a team in the competition and sign up for contest updates at [www.tms.org/Bladesmithing](http://www.tms.org/Bladesmithing).





# TMS2023

# NETWORKING AND PROFESSIONAL DEVELOPMENT EVENTS

## AT TMS2023

Kelly Zappas and Megan Enright



More than just a technical conference, the TMS 2023 Annual Meeting & Exhibition (TMS2023) offered attendees ample opportunity to meet other members, exchange ideas, establish working collaborations, and develop lasting friendships. These pages provide a look at the networking, social, and professional development events at TMS2023 that helped attendees to make valuable connections and to grow their skillsets.

## TMS-AIME AWARDS CEREMONY

When **Carolyn Hansson** presented the 2023 Acta Materialia Gold Medal Award to **Tresa Pollock** at the TMS-AIME Awards Ceremony, Hansson pointed out that the award had been established in 1973 but was being awarded to a woman for the first time in its 50-year history. The announcement brought a standing ovation for Pollock and Hansson and provided a memorable moment from this joint ceremony hosted by TMS and the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME). The event took place on Wednesday, March 22, to celebrate the achievements of a wide range of professionals and students, with more than 50 individuals honored over the course of the evening.

The ceremony included the presentation of the 2023 Class of TMS Fellows. The Fellow award is the Society's highest honor, and each of the new inductees gave a few brief comments upon accepting their awards.

Many of the awardees credited their success to the teams that they worked with and the mentors who had helped them along the way.



**Carolyn Hansson**, left, congratulates **Tresa Pollock**, right, at the 2023 TMS-AIME Awards Ceremony. In the background, 2023 TMS President Brad Boyce (left) and 2022 President Jud Ready (right) join the crowd's standing ovation.



“These efforts and the knowledge gained aren't accomplished alone. I'm not standing up here because of what I did but because of what we did.”

—Irene Beyerlein,  
2023 TMS Fellow



“I think we all should think more about how we can lift others up, instead of about winning. I hope I can continue the tradition of lifting the people up around me.”

—James Warren,  
2023 TMS Fellow

You can view a recording of this year's awards ceremony at [www.youtube.com/ChannelTMS](http://www.youtube.com/ChannelTMS).

## WORKSHOPS AND SHORT COURSES



**Harriet Kung**, U.S. Department of Energy, offered ten recommendations for career success at the inaugural Asian/Pacific Islander (API) Workshop and Reception at TMS2023.

TMS2023 hosted five workshops and short courses on technical and professional topics. The offerings included three events that required paid registration: Introduction to Aluminum Electrolysis Course, Lead-Free Solder and Interconnect Workshop, and Additive Manufacturing Materials and Processes Workshop. In addition, two all-new professional development workshops were offered, at no charge, to all TMS2023 attendees.

The **Communications Skills Workshop** featured a two-part conversation designed to help participants communicate

technical ideas to various audiences more clearly. In the first part of the workshop, **Eric Thiesen** of Metglas Inc., offered tips on creating targeted communications. “Make sure that you know your story,” he advised the audience, because if you don't know what it is you want to communicate, he pointed out, your audience won't either. Following Thiesen's presentation, **Michael Bakas**, Army Research Office, looked at creating clear and effective PowerPoint presentations. Bakas echoed Thiesen's advice, noting that you need to know exactly what message your audience should receive. “For most presentations,” Bakas said, “people want to hear the key takeaways first. Then provide the technical details.”

This workshop was organized by the TMS Professional Development Committee, chaired by **Kathy Lu**.

The second new workshop was the inaugural **Asian/Pacific Islander (API) Workshop and Reception**. Four invited speakers gave introductory talks that shared tips and advice on how to build a successful career and navigate the professional world as an API. Following the presentations, the speakers engaged in an informal panel discussion with the audience. The speakers were: **Meimei Li**, Argonne National Laboratory; **Vincent Yuan**, Los Alamos National Laboratory; **Harriet Kung**, U.S. Department of Energy; and **Amit Misra**, University of Michigan. Misra's presentation was titled “How Do I Advocate for Myself?” The wording of this question was deliberate. “You have to do the work and take the initiative for yourself,” he told the audience. “In your professional and personal life, you have to be your own advocate.”

## 2023 TMS MATERIALS BOWL



Minnesota Twins team members (from left to right) **Moujhuri Sau**, **Ashlie Hamilton**, **Trevor Totten**, and **Regina Gonzalez Lona** celebrate their Materials Bowl win at TMS2023.

The Minnesota Twins team—from the University of Minnesota-Twin Cities—took home the TMS Materials Bowl trophy for the second consecutive year. **Ashlie Hamilton**, the only member to compete on both winning teams, was joined in the 2023 competition by team mates **Moujhuri Sau**, **Trevor Totten**, and **Regina Gonzalez Lona**. Carnegie Mellon University's Titanium Tartans took second place, and the University of Florida team placed third.

The competition, which consisted of two rounds of play, was followed by an informal networking reception that was open to all TMS2023 attendees.

## CAREER DEVELOPMENT SESSIONS FOR STUDENTS

Writing a cover letter? Shorter is better. Need a letter of reference? Provide your referee with ample time to write it and guidance on what to include. Not sure what type of position you want? Talk to as many people as possible. These were just a few of the topics covered—and a sampling of the advice given—during the **Ace the Job Hunt Workshop**, a new event offered for students and early-career professionals at TMS2023.



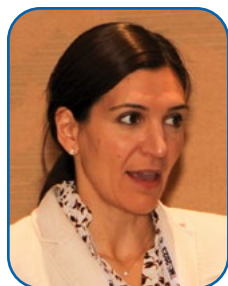
From left to right, panelists **Wendy Gu**, **Chukwunwike Iloeje**, **Chelsea Appleget**, and **Emma White** discuss how to Ace the Job Hunt at a workshop for students and early-career professionals.

A panel of professionals representing industry, academia, and government offered tips and answered questions in this interactive event.

Panelists included: **Wendy Gu**, Stanford University; **Chukwunwike Iloeje**, Argonne National Laboratory; **Chelsea Appleget**, The Aerospace Corporation; and **Emma White**, DECHEMA-Forschungsinstitut. The event was organized by the TMS Emerging Professionals Committee.

This new event followed the **Student Career Forum**, a regular feature of the TMS Annual Meeting & Exhibition's student program, in which professionals share stories of their career paths. This year's Student Career Forum participants included: **Jun Hu**, Cleveland-Cliffs; **Soumya Varma**, KLA Corporation; **Mary O'Brien**, Los Alamos National Laboratory; **Mengying Liu**, Washington and Lee University; **Ian Daniel McCue**, Northwestern University; and **Damien Touret**, IMDEA Materials Institute. You can watch excerpts from this year's discussions now at [www.youtube.com/ChannelTMS](http://www.youtube.com/ChannelTMS).

## EMERGING PROFESSIONAL TUTORIAL LUNCHEON AND LECTURE

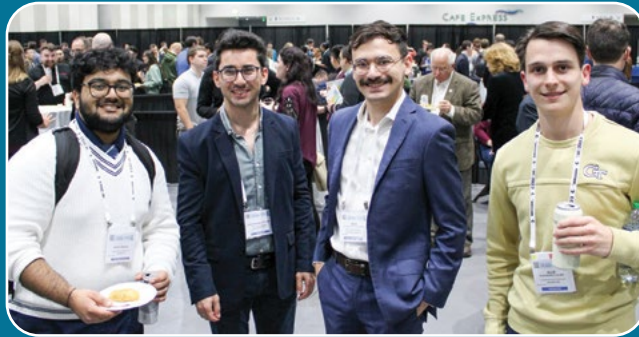


At the Emerging Professional Tutorial Luncheon and Lecture, three invited speakers gave talks on their background, research, and tips for fellow emerging professionals in the materials science and engineering fields. **Danielle Cote** (pictured, left), Worcester Polytechnic Institute, presented "The Role of Early Career Professionals in Increasing Diversity in the STEM Professions." She discussed methods of increasing the retention of women in the professional sector and included tips for managing a work-family

life balance. **Grace Gu** (pictured, center), University of California, Berkeley, discussed her research using algorithm-driven approaches to develop composite prototypes inspired by naturally occurring phenomena, like the structure of a conch shell. She encouraged participants to apply these lessons to their everyday lives and prompted attendees to learn from the things that work for others, but to adapt those to fit their own lives, stating "life is complicated, but there are infinite opportunities." **Yu Zou** (pictured, right), University of Toronto, gave the talk, "Harnessing Defects in Materials: An Analogy with Professional Development." Zou began by sharing some of the personal barriers he overcame to reach his career goals. He emphasized that defects not only make materials (and people) more interesting but also stronger.

## SCENES FROM NETWORKING RECEPTIONS

### TMS Welcome Reception



### TMS Fellows and Invited Guests Reception



### TMS-AIME Awards Ceremony Reception



### Exhibit Opening Reception and Poster Session I and Exhibit Hall Happy Hour and Poster Session II



## DIVERSITY AND INCLUSION BREAKFAST

More than 65 people participated in the **Fresh Coffee, Fresh Ideas: Diversity and Inclusion Breakfast**, organized by the TMS Diversity, Equity, and Inclusion (DEI) Committee. Over breakfast, participants discussed topics related to diversity and inclusion such as moving beyond imposter syndrome, DEI in the training journey, and overcoming anxiety in the workplace. The audience also participated in an interactive poll to provide input on plans for the Fifth Summit on Diversity in the Minerals, Metals, and Materials Professions (DMMM5), to be co-located with the TMS 2025 Annual Meeting & Exhibition (TMS2025) in Las Vegas, Nevada.



## EPD/MPMD LUNCHEON



"Collectively, we are not competing against each other, but against time." This was part of **Paramita Das's** message to the audience assembled at the Extraction & Processing Division (EPD)/Materials Processing & Manufacturing Division (MPMD) luncheon at TMS2023. Das is global head of marketing,

development and ESG (chief marketing officer); metals and minerals, Rio Tinto. She leads marketing for metals and minerals globally and the establishment of a more environmental, social, and governance (ESG)-centric approach in the Atlantic region.

"No longer just a 'nice to have,' ESG is going to be a must have," she said, in a talk that outlined how an ESG outlook has led to greater transparency and the development of low- and zero-carbon products.

## SMD/FMD LUNCHEON



Members of the TMS Structural Materials Division (SMD) and Functional Materials Division (FMD) came together to recognize their scholarship and award recipients, share lunch with their colleagues, and hear from invited speaker **Roger Narayan**, University of North Carolina and North Carolina State

University. Narayan's talk, "Additive Manufacturing of Medical Devices: Past, Present, and Future," began with a look at the early innovators in biomaterials—who were largely surgeons, rather than materials scientists—progressing to more current developments, such as wearable devices and 3D printed microneedles.

The presentation explored the use of several types of additive manufacturing technologies to create advanced medical devices, including devices for transdermal drug delivery and transdermal sensing.

## LMD LUNCHEON



"We make impossible parts," said **Slade Gardner**, president and founder of Big Metal Additive and invited speaker at the Light Metals Division (LMD) Luncheon at TMS2023. Gardner explained that some parts are impossible due to their geometries, while others are just impossible to get due to supply chain issues.

During his talk, Gardner shared examples of projects that Big Metal Additive has developed using their hybrid metal additive manufacturing technology—including an unmanned underwater vehicle and a satellite made of additive-produced parts. Conventional satellite designs have labor-intensive assembly processes, so Gardner's team wanted to create individual components that could be efficiently assembled. They allotted two weeks to assemble the components once they had been created; it took only two days. Based on this process, Gardner believes they could make and assemble a satellite in under 30 days.



In addition to Gardner's presentation, the luncheon featured a talk by **Marley Downes**, Drexel University, who is the 2023 Light Metals Division Scholarship recipient. Downes gave a brief talk on her work with MXenes.



## TECHNICAL COMMITTEE MEETINGS

In addition to the three division luncheons, which gathered attendees who share the same affiliation in TMS's five technical divisions, all 34 of TMS's technical committees met in person during the week of TMS2023 in San Diego.

TMS technical committees are made up of volunteer members who work together to develop technical programming for TMS conferences, organize technical topics to be published in *JOM: The Journal*, and provide many more key contributions to the Society. Within the TMS division structure, these groups provide a gathering place for members interested in a specific technical topic related to the broader minerals, metals, and materials community.

Technical committee membership is open to all active TMS members as a benefit of membership. If you were unable to attend a technical committee meeting at TMS2023 but would like to become involved in committee activities, please visit [www.tms.org/Committees](http://www.tms.org/Committees). There, you can view a complete listing of TMS committees, select the one that most closely matches your interests, and fill out the Technical Committee Interest form. A TMS representative will then follow up with additional information for you.

Not sure if you are a TMS member (and therefore eligible for committee membership)? Please keep in mind that all TMS2023 attendees who registered for the conference at the non-member professional registration rate received a complimentary TMS membership for the remainder of 2023. If you are still unsure of your membership status, log in to [members.tms.org](http://members.tms.org) and visit your member profile.

# TMS 2023

## BEST POSTER RECIPIENTS

### ANNOUNCED

#### AT TMS2023

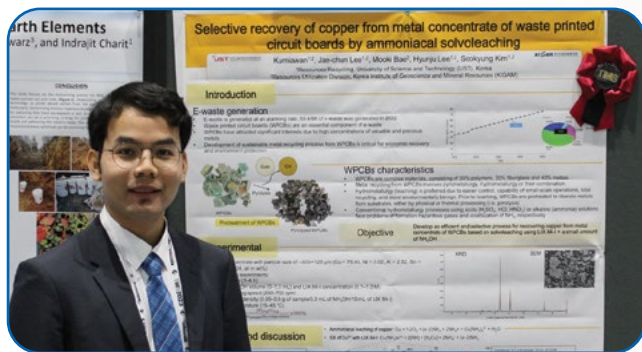
Jillian Schultz



The TMS 2023 Annual Meeting & Exhibition (TMS2023), in San Diego, California, March 19–23, 2023, recognized undergraduate and graduate posters for excellence in the 2023 Technical Division Student Poster Competition. The Materials Characterization Committee also recognized quality work through a poster competition. Congratulations to all the award recipients who are featured on the following pages.

## TECHNICAL DIVISION STUDENT POSTER CONTEST WINNERS

### Extraction & Processing Division



**Graduate:** "Selective Recovery of Copper from Metal Concentrate of Waste Printed Circuit Boards by Ammoniacal Solvo-leaching," **Kurniawan Kurniawan**, Korea University of Science and Technology

### Functional Materials Division



**Graduate:** "Synthesis and Characterization of Fullerene-Antibody Conjugate Energetic Nanoparticles (FACE-NP) for Bladder Cancer Treatment," **Carolina Colón**, Georgia Institute of Technology

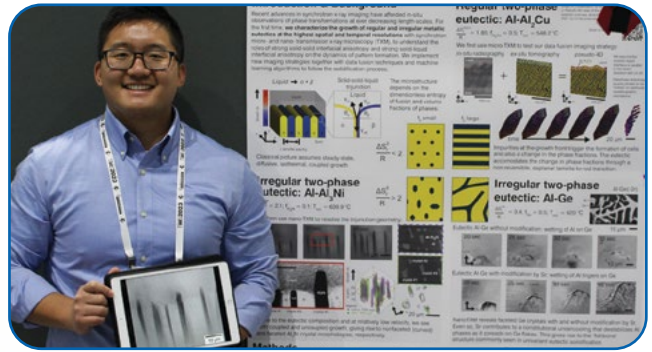
# Table of Contents

## Functional Materials Division



**Undergraduate:** "Investigation of High Entropy Precursor Powder Synthesis for Transparent Ceramic Synthesis," **Marlena Alexander**, University of Tennessee Knoxville

## Materials Processing & Manufacturing Division



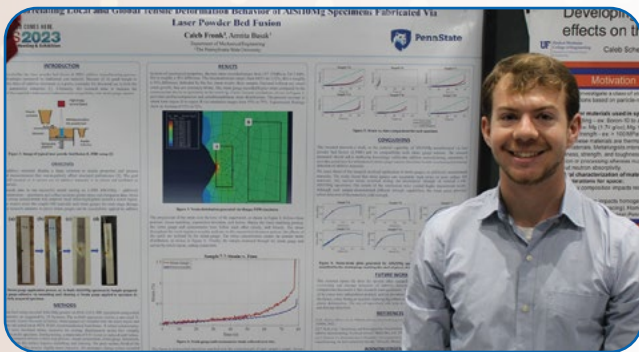
**Graduate:** "In Operando Synchrotron X-ray Tomography Study of Fine Eutectic Polyphase Solidification Patterns," **Paul Chao**, University of Michigan

## Light Metals Division



**Graduate:** "Transition Mechanism for the Metastable Phases in Al-Zn-Mg Alloys: A Novel Molecular Dynamics Approach," **Yu-ning Chiu**, National Cheng Kung University

## Light Metals Division



**Undergraduate:** "Correlating Local and Global Tensile Deformation Behavior of AlSi10Mg Specimens Fabricated Via Laser Powder Bed Fusion," **Caleb Fronk**, Penn State University

## Materials Processing & Manufacturing Division

**Undergraduate:** "Assessing Laser Powder Bed Additive Manufacturing Part Quality via In-Situ Monitoring & Machine Learning," **Ana Love**, University of New Mexico (not pictured)

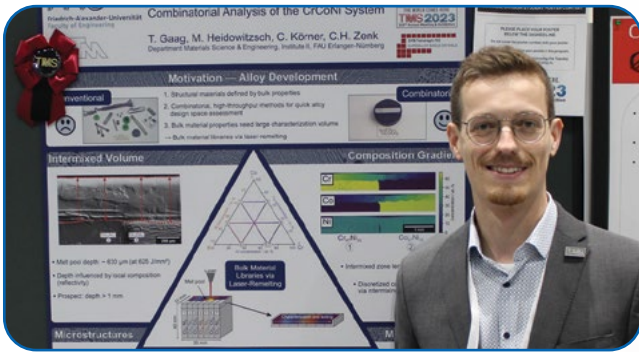
**PARTICIPATE IN THE 2024 STUDENT POSTER CONTEST**

The 2024 TMS Technical Division Student Poster Contest will soon be open for abstract submissions. Check the TMS 2024 Annual Meeting & Exhibition (TMS2024) website in the coming months for details on how to enter. Then plan to join us at the Hyatt Regency Orlando in Orlando, Florida, for TMS2024, March 3-7.

Learn more at [www.tms.org/TMS2024](http://www.tms.org/TMS2024).

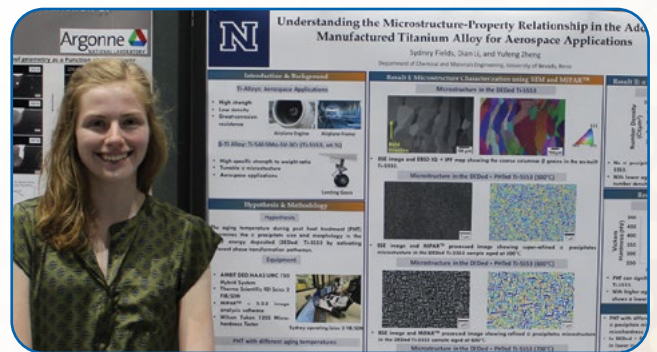


## Structural Materials Division



**Graduate:** "Bulk Material Libraries via Laser-Remelting: Combinatorial Analysis of the CrCoNi System," **Tobias Gaag**, Friedrich-Alexander-Universität Erlangen-Nürnberg

## Structural Materials Division



**Undergraduate:** "Understanding the Microstructure-Property Relationship in the Additively Manufactured Titanium Alloy for Aerospace Applications," **Sydney Fields**, University of Nevada, Reno

## EPD MATERIALS CHARACTERIZATION COMMITTEE BEST POSTER AWARD

This award recognizes the individual excellence of a poster within the Materials Characterization subject area presented in a session sponsored by the Extraction & Processing Division (EPD). These posters were presented at the TMS 2022 Annual Meeting & Exhibition in Anaheim, California, and recognized at the TMS 2023 Annual Meeting & Exhibition in San Diego, California.

### First Place

"Characterization of Chiral Spin Structures in Pt/Co/Ni Based Magnetic Superlattices," **Nisrit Pandey, Maxwell Li, Marc De Graef, and Vincent Sokalski**, Carnegie Mellon University

### Second Place

"Influence of Laser Scan Speed on the Diffusion and Vaporization of a Solid-state Electrolyte Produced Using Laser Powder Bed Fusion," **Leanna Hao, Katherine Acord, and Julie Schoenung**, University of California, Irvine

### Third Place

"Computer Vision for Microvia Characterization," **Nikhil Damani, Pragna Bhaskar, Mohan Kathaperumal, and Madhavan Swaminathan**, 3D Systems Packaging Research Center, Georgia Institute of Technology

## VIEW MORE PHOTOS FROM TMS2023

Hundreds more photos are now available to view from TMS2023 events on Flickr at [www.flickr.com/photos/tmsevents](http://www.flickr.com/photos/tmsevents). Browse the photos for an overview of activities at the meeting or to find pictures of yourself and your colleagues.

# TMS MEMBERS:

## THE ESSENTIAL ELEMENTS OF TMS'S FUTURE

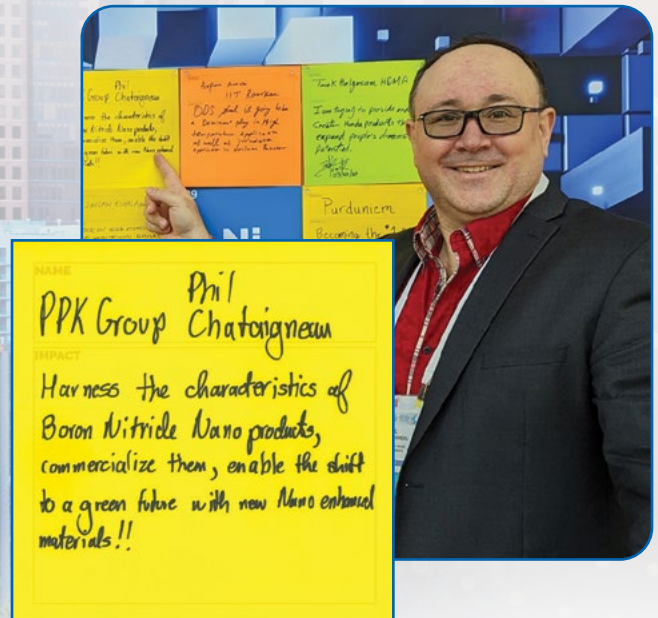
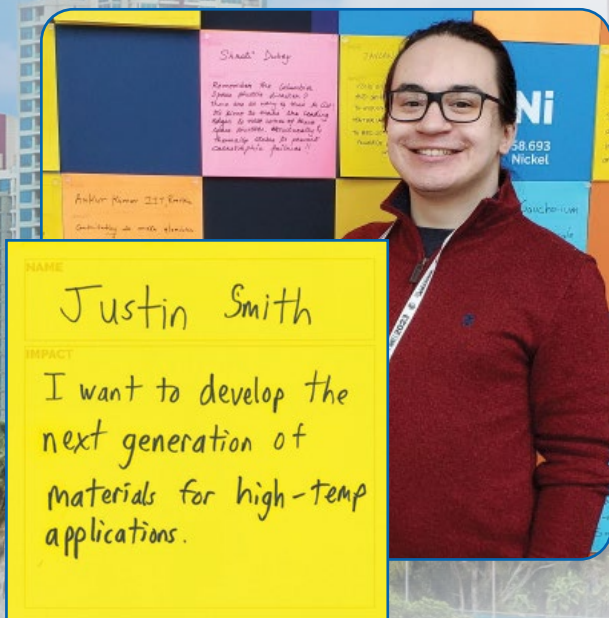
### Kelly Zappas

How do you hope to impact the future of TMS and the materials science and engineering community? That's the question TMS asked its members to reflect upon at the TMS 2023 Annual Meeting & Exhibition (TMS2023) in San Diego, California. The TMS Member Welcome Center, which greeted attendees in the entryway of the San Diego Convention Center, featured a wall with the headline "You are an Essential Element of the Future of TMS." Here, attendees were encouraged to write messages on brightly colored paper and add them to the blank spaces in the periodic table-themed display.

Responses ranged from sincere to silly, with

many contributors describing their research goals, others leaving element-themed jokes, and several commenting on how much they were enjoying the experience of TMS2023. On these pages, you'll find a sampling of these comments and photos of the contributors. Images were also posted on Twitter and Instagram. (Search #TMSAnnualMeeting.)

Because where we're going is inspired by where we came from, visitors were also encouraged to view the AIME History Walk display at TMS2023, which outlined key historical moments from the shared history of TMS and the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME).

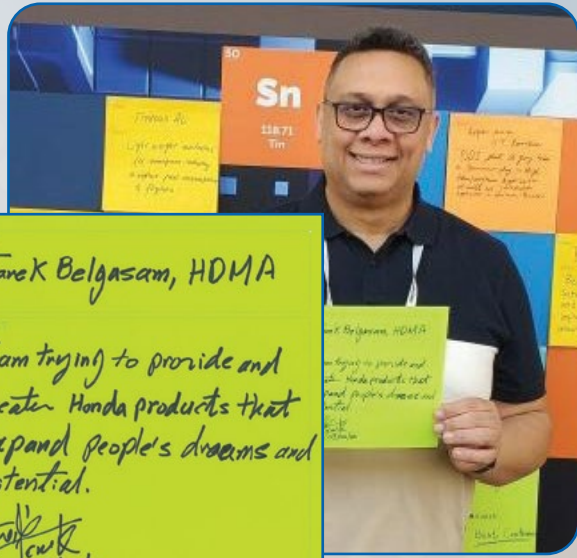


# Table of Contents



NAME: Nicole


IMPACT: Help educate the next generation of engineers



NAME: Tarek Belgasam, HDMA

IMPACT: I am trying to provide and create Honda products that expand people's dreams and potential.

03/22/23



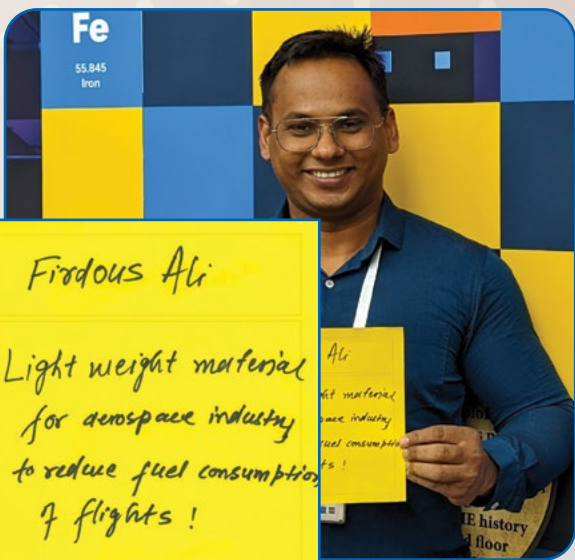
NAME: UCSB Gauchos

IMPACT: To utilize multi-scale multimodal data to better understand underlying material behavior




NAME: MAT<sup>2</sup>SIMium

IMPACT: God made the bulk  
Devil invented the interface  
We model them!



NAME: Firdous Ali

IMPACT: Light weight material for aerospace industry to reduce fuel consumption of flights!



NAME: JAYLAN ELHALAWANI

IMPACT: FOCUS ON USING ATOMISTIC MODELS AND COMPUTATIONAL SIMULATIONS TO EXPAND DISCOVERY OF NOVEL MATERIALS AND NEW PROPERTIES TO REDUCE NEED FOR EXPERIMENTS TOWARDS A MORE SUSTAINABLE WORLD !!

In Case You Missed It:

# BUSINESS NEWS FROM THE FIELD

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 Kelly Zappas at [kzappas@tms.org](mailto:kzappas@tms.org).



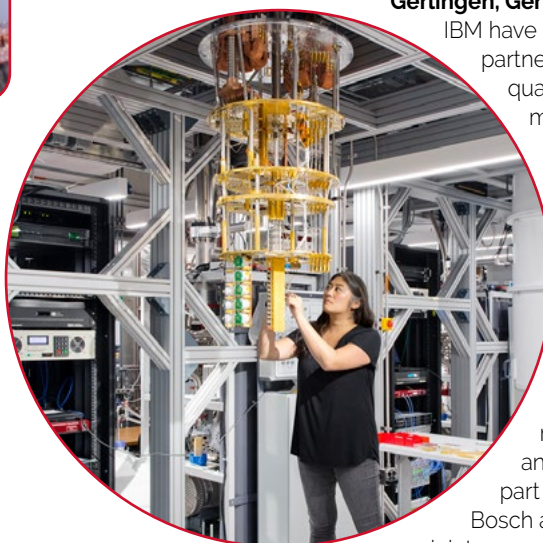
**Raleigh, North Carolina:** Aja Labs, a venture-backed materials innovation company, has raised \$2.5 million in a seed round of funding to use for the development and commercialization of biomaterial hair fibers made from plant material. Under the consumer brand Nourie, these patent-pending hair extensions have a time-release function to deliver a nutrient complex to natural hair during wear time. Black scientists and inventors make up the team at Aja Labs and with this product they hope to change the hair extension industry, which is dominated by costly low-quality, irritant-laden petrochemical-based plastics. (Photo Credit: Aja Labs)

## New Nanoscale 3D Printing Material Developed at Stanford

**Stanford, California, USA:** Researchers at Stanford University have designed a new material for nanoscale 3D printing. This material has the ability to absorb two times as much energy as materials of similar density and could potentially be used to make better lightweight protective lattices. To design this material, the Stanford engineers included metal nanoclusters in their printing medium. These were found to be a good catalyst for the two-photon lithography printing method. The combination of the metal nanoclusters with acrylates, epoxies, and proteins were successful. The combination with proteins yielded a print rate of 100 millimeters per second, about 100 times faster than other nanoscale protein printing. This material was then tested with several different lattice structures and with the nanocluster-polymer composite all the structures showed an ability to absorb energy, impressive strength, and remarkable recoverability.

## Green Aluminum Used in Motorcycles

**Iwata, Japan:** Yamaha Motor Co. reached an agreement with a supplier of aluminum ingot to procure green aluminum and began to use it as a raw material for Yamaha motorcycle parts in February 2023. Green aluminum is refined using renewable energy sources which emit less carbon dioxide during the manufacturing process. For the first time, green aluminum is being used in Japanese motorcycles and Yamaha has plans to expand its use in other models in the future. As aluminum accounts for 12% to 31% of the total motorcycle weight, utilizing green aluminum is one method for reducing carbon dioxide emissions for the manufacturing part of the product's life cycle.



**Gerlingen, Germany:** Bosch and IBM have announced their partnership on a strategic quantum computing materials science engagement for fuel cells and batteries. Both companies will collaborate to research and further develop potential applications of quantum computing in materials science and engineering as part of this engagement.

Bosch and IBM will carry out joint research and enable and execute case projects for fuel cells, electric engines, or advanced sensor materials. (Pictured: IBM Quantum scientist Maika Takita in lab. Photo Credit: IBM)

## Large Lithium Deposit Discovered in Iran

**Hamedan, Iran:** Officials from Iran's Ministry of Industry, Mines, and Trade have announced the discovery of a massive lithium deposit in one of the country's western provinces. The deposit is believed to hold 8.5 million tons of lithium. If accurate, this would make this deposit the second-largest in the world. Lithium is a crucial component for lithium-ion batteries used in electric vehicles and in rechargeable batteries.

## Steppe Gold Plans to Acquire Anacortes Mining

**Ulaanbaatar, Mongolia:** Steppe Gold Ltd announced that it has entered a binding letter of intent with Anacortes Mining Corporation in order to acquire all shares of Anacortes in an all-share transaction. This proposed transaction would transform Steppe Gold into a leading junior producer of gold. The board of Anacortes recommended the agreement to the shareholders unanimously. Steppe Gold officials hope the transaction will increase Steppe Gold's diversity and increase their assets.

# TMS MEETING HEADLINES

Meeting dates and locations are current as of March 27, 2023.  
For the most recent updates on TMS-sponsored events, visit [www.tms.org/Meetings](http://www.tms.org/Meetings).



## TMS Fall Meeting 2023 @ Materials Science & Technology (MS&T)

October 1-4, 2023  
Columbus, Ohio, USA

**Housing Deadline:  
September 7, 2023**

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 the TMS Fall Meeting.

[www.tms.org/TMSFall2023](http://www.tms.org/TMSFall2023)



## 3rd World Congress on High Entropy Alloys (HEA 2023)

November 12-15, 2023  
Pittsburgh, Pennsylvania,  
USA

**Abstract Deadline:  
June 16, 2023**

HEA 2023 will attract research leaders from industry, government, and academia from across the globe, as well as students and postdocs interested in the science and engineering of metallic materials and high-performance alloys.

[www.tms.org/HEA2023](http://www.tms.org/HEA2023)



## TMS 2024 Annual Meeting & Exhibition (TMS2024)

March 3-7, 2024  
Orlando, Florida, USA

**Abstract Deadline:  
July 1, 2023**

The TMS Annual Meeting & Exhibition brings together more than 4,000 engineers, scientists, business leaders, and other professionals in the minerals, metals, and materials fields for a comprehensive, cross-disciplinary exchange of technical knowledge.

[www.tms.org/TMS2024](http://www.tms.org/TMS2024)



## The 15th International Symposium on Superalloys (Superalloys 2024)

September 8-12, 2024  
Champion, Pennsylvania,  
USA

**Abstract Deadline:  
July 31, 2023**

The conference is held every three to four years to explore all aspects of metallurgical processing, materials behavior, and microstructural performance for a distinct class of 718-type superalloy and derivatives.

[www.tms.org/  
Superalloys2024](http://www.tms.org/Superalloys2024)

## Other Meetings of Note



## TMS Specialty Congress 2024

June 16-20, 2024  
Cleveland, Ohio,  
USA

[www.tms.org/  
SpecialtyCongress/2024](http://www.tms.org/SpecialtyCongress/2024)



## TMS 2025 Annual Meeting & Exhibition (TMS2025)

March 23-27, 2025  
Las Vegas, Nevada,  
USA

[www.tms.org/TMS2025](http://www.tms.org/TMS2025)



## TMS Specialty Congress 2025

June 15-19, 2025  
Anaheim, California,  
USA

[www.tms.org/  
SpecialtyCongress/2025](http://www.tms.org/SpecialtyCongress/2025)



## Extraction 2025 Meeting & Exhibition (Extraction 2025)

November 16-20, 2025  
Phoenix, Arizona,  
USA

[www.extractionmeeting.org/  
Extraction2025](http://www.extractionmeeting.org/Extraction2025)

## Energy Materials 2023

October 10-13, 2023  
Huzhou, Zhejiang,  
China

**Co-sponsored by TMS**

## 10th International Symposium on Lead and Zinc Processing (PbZn2023)

October 18-20, 2023  
Changsha, China

**Co-sponsored by TMS**

## OTC Brasil 2023

October 24-26, 2023  
Rio de Janeiro,  
Brazil

**Co-sponsored by TMS**

## 11th Pacific Rim International Conference on Advanced Materials and Processing

November 19-23, 2023  
Jeju, South Korea

**Co-sponsored by TMS**

# TMS SPECIALTY CONGRESS 2024

**JUNE 16-20, 2024**

**Cleveland Hilton | Cleveland, Ohio, USA**

**#TMSpecialtyCongress**

## SAVE THE DATE

**ONE REGISTRATION. THREE MEETINGS. COUNTLESS BENEFITS.**

The TMS Specialty Congress annually convenes the Society's recurring specialty meetings under one roof with a single registration fee. Explore your technical interest in a focused, small event environment, while also having access to cross-disciplinary learning and collaboration opportunities with aligned materials communities. **Call for abstracts opens June 2023.**

**PLAN TO JOIN US AT OUR INAUGURAL CONGRESS IN 2024!**

### 2024 CO-LOCATED MEETINGS



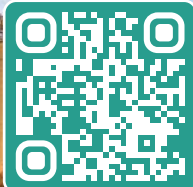
Key issues and future pathways in the implementation of artificial intelligence.



Science and technology associated with numerically controlled forming methodologies.



Cutting edge R&D efforts surrounding mechanical behavior over a wide range of material types.



For details and to sign up for updates, visit:

**[www.tms.org/SpecialtyCongress/2024](http://www.tms.org/SpecialtyCongress/2024)**

# CALL FOR ABSTRACTS

THE WORLD COMES HERE.

# TMS 2024

**153<sup>rd</sup> Annual Meeting & Exhibition**

**MARCH 3–7, 2024**

HYATT REGENCY ORLANDO | ORLANDO, FLORIDA, USA

#TMSAnnualMeeting | [www.tms.org/TMS2024](http://www.tms.org/TMS2024)



**SUBMIT YOUR WORK BY JULY 1**

**SUBMIT YOUR ABSTRACT TODAY AND PLAN TO JOIN US IN 2024**  
at the Hyatt Regency Orlando in Orlando, Florida, to share your work.

This is a new venue for TMS, and the resort will be the location for all TMS2024 programming and events. Plan to stay at the headquarters hotel for easy access to activities, five on-site restaurants, and a number of additional amenities.

## MARK YOUR CALENDAR WITH THESE KEY DATES

**July 1, 2023:** Abstracts Due | **October 2023:** Registration Opens  
**March 3–7, 2024:** Conference Dates

**SEE YOU IN ORLANDO!**

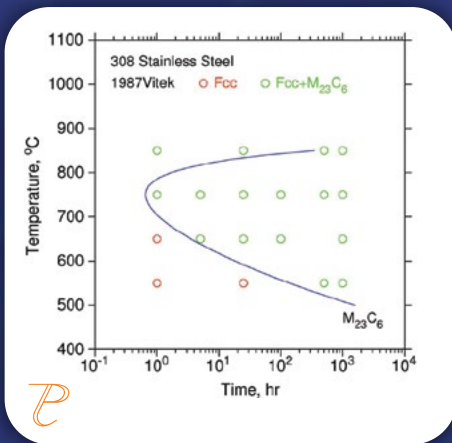
# Thermo-Software

Empowering Metallurgists, Process Engineers and Researchers

## What if the materials data you need doesn't exist?

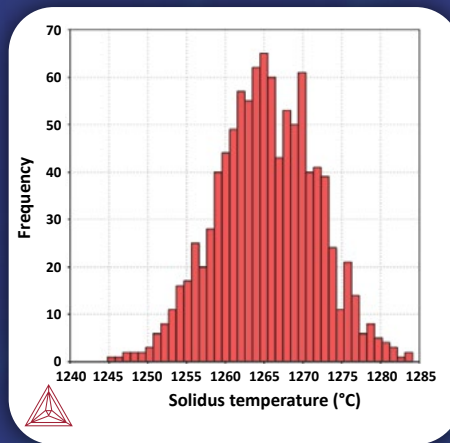
### Gain insight into materials processing

#### Precipitation



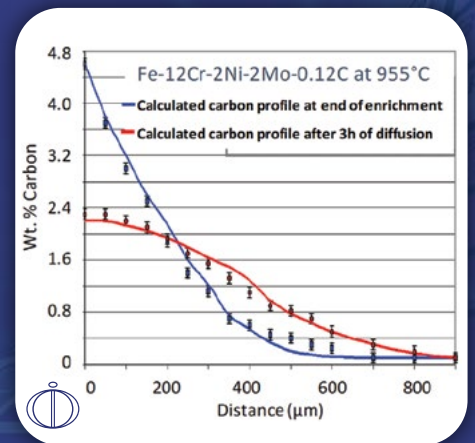
Time temperature precipitation of  $M_{23}C_6$  in 308 stainless steel

#### Solidification



Solidus variation within Alloy 718 specification (Gaussian,  $n=1000$ )

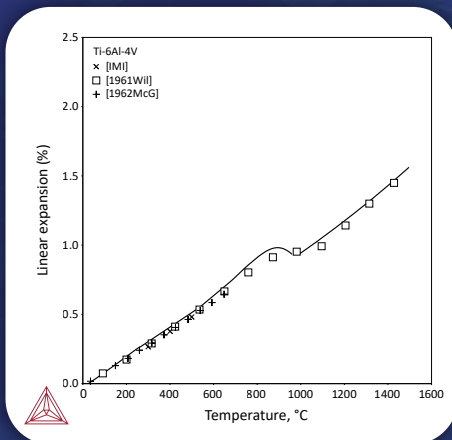
#### Diffusion



Carbon diffusion profile near surface during carburization of a martensitic stainless steel

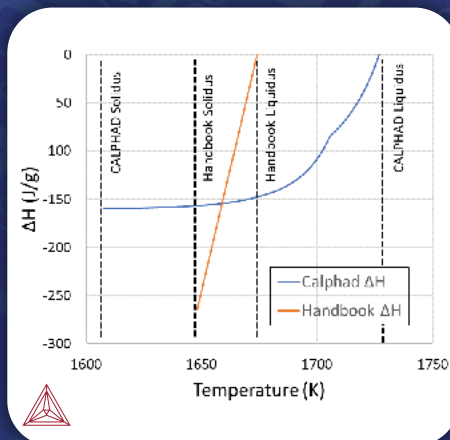
## Predict a wide range of materials property data

#### Thermophysical Data



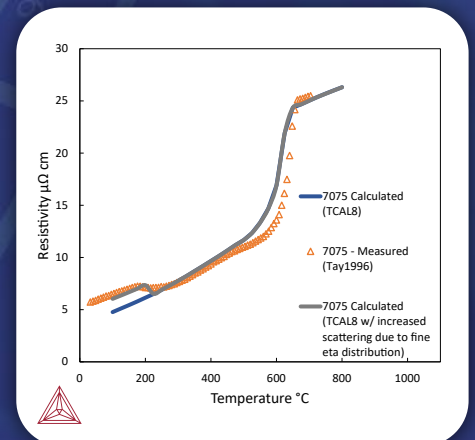
Linear expansion vs temperature for Ti-6Al-4V

#### Thermodynamic Properties



Calculated latent heat compared to handbook values for a specific 316L stainless steel chemistry

#### Electrical Resistivity



Calculated electrical resistivity of aluminum alloy 7075