

# JOM THE MAGAZINE

OCTOBER/NOVEMBER 2022

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

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

**TOPICS  
SPARK  
NEW  
IDEAS  
IN 2022**



Protecting the Investment in Your Career //

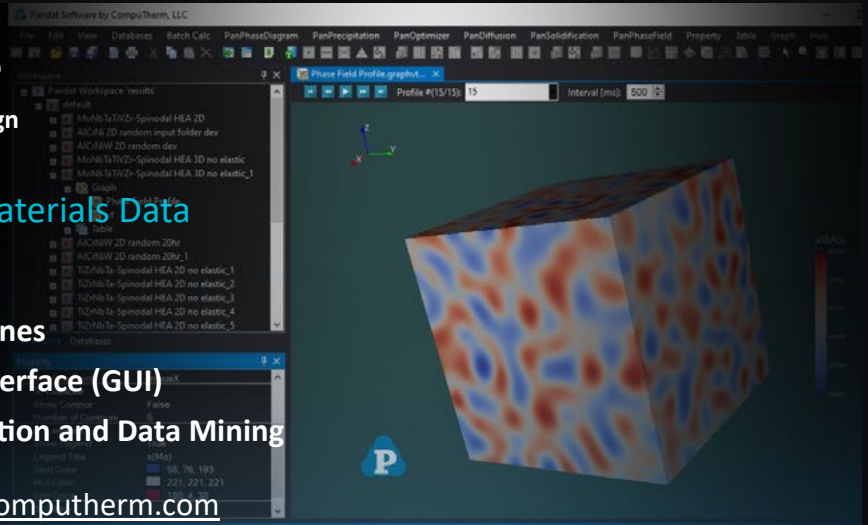
TMS

 Springer

One Unified Workspace, Numerous Materials Data

- ✔ Cutting Edge Software Technologies
- ✔ Intelligent and Reliable Simulation Engines
- ✔ Friendly and Flexible Graphical User Interface (GUI)
- ✔ Large Scale of High-Throughput Calculation and Data Mining

Web: [www.computherm.com](http://www.computherm.com) Email: [info@computherm.com](mailto:info@computherm.com)



Pandat Software



PanDatabases

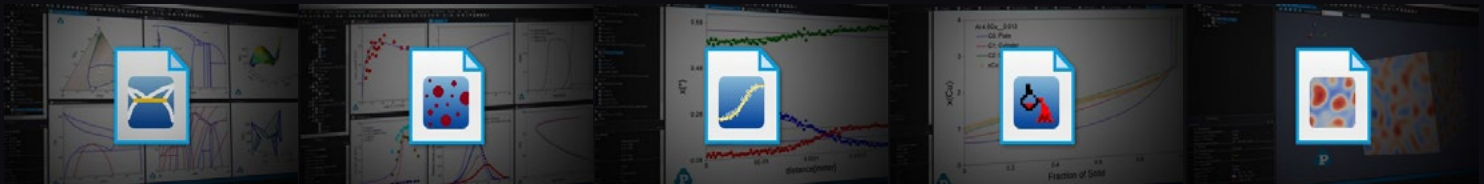


ICME & MGI Applications

- Al – based alloys
- Co – based alloys
- Cu – based alloys
- Fe – based alloys
- Mg – based alloys
- Ni – based alloys
- Ti – based alloys
- TiAl – based alloys
- Refractory alloys
- High-entropy alloys
- More...

## Pandat Software Modules

Pandat Software adopts modular design and enables users to easily switch between modules and perform various types of simulations in the same workspace.



**PanPhaseDiagram**

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

**PanPrecipitation**

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

**PanDiffusion**

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

**PanSolidification**

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

**PanPhaseField**

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



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

Kaitlin Calva,  
Magazine Principal Editor

Cheryl M. Geier,  
Senior Graphic Designer

#### Contributing Writers

Ashley-Anne Bohnert,  
Marketing Manager

Megan Enright,  
Events Marketing Lead

Ann Ritchie,  
Technical Communications  
Lead

Kelly Zappas,  
Membership Communications  
Lead

#### Graphics Support

David Rasel,  
Head of Visual  
Communications

Bob Demmler,  
Visual Communications  
Coordinator

#### Advertising

Contact [sales@tms.org](mailto:sales@tms.org)  
for information.

# TMS

 Springer

## ABOUT THE COVER



This cover image features original work from Joalet Steenkamp, TMS member and organizer of the Furnace Tapping 2022 conference. The image, "Flying Sparks," depicts lancing the tap-hole of a submerged arc furnace at a South African producer of charge chrome. It represents the technologies discussed at Furnace Tapping 2022, held with the TMS 2022 Annual Meeting & Exhibition (TMS2022). Steenkamp wrote an overview article in this issue as part of a series that takes a deeper look at the three co-located meetings that were a part of TMS2022. The inset image connects to 2022 TMS President Jud Ready's perspective article on how TMS membership can protect your investment of time and resources in your career.

"Flying Sparks" photo credit: © Joalet Steenkamp, 2016.



## 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 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 **JOM** Volume 74 Number 10 October/November 2022

## // FEATURES

- 10:** A Closer Look at TMS2022 Co-Located Events: Kelly Zappas
- 13:** The 'Hole' Picture: Looking Back at Furnace Tapping 2022: Joalet Steenkamp
- 16:** Highlights from the Fourth Diversity Summit: New Location, New Topics: Lynne Robinson and Kelly Zappas
- 21:** Creating, Teaching, and Revering Value: Highlights from an EPD Symposium in Honor of Diran Apelian at REWAS 2022: Elsa Olivetti
- 26:** Protect Your Career Investment: Renew Your TMS Membership Today: Jud Ready
- 29:** The 2021 TMS Annual Financial Report: Ellen Cerreta and James J. Robinson
- 31:** Building a Brighter Future: The TMS Foundation 2021 Annual Report
- 35:** Meet Abby Cisko, Home Renovator: Kelly Zappas

## // DEPARTMENTS

- 5:** In the Final Analysis: James J. Robinson
- 6:** JOM Technical Topics
- 7:** TMS Member News
- 39:** In Case You Missed It: Business News from the Field
- 40:** TMS Meeting Headlines





# Thermo-Calc Software

Empowering Metallurgists, Process Engineers and Researchers

## Do you rely on handbook data?

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

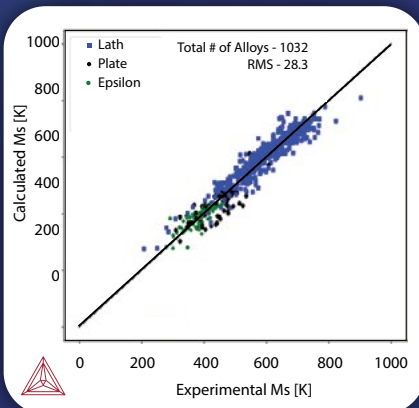
### With Thermo-Calc you can:

- ✓ **Calculate** phase-based properties as a function of composition, temperature and time
- ✓ **Fill in** data gaps without resorting to costly, time-consuming experiments
- ✓ **Predict** how actual vs nominal chemistries will affect property data
- ✓ **Base Decisions** on scientifically supported models
- ✓ **Accelerate** materials development while reducing risk
- ✓ **Troubleshoot** issues during materials processing

## Over 40 Thermodynamic and Kinetic Databases

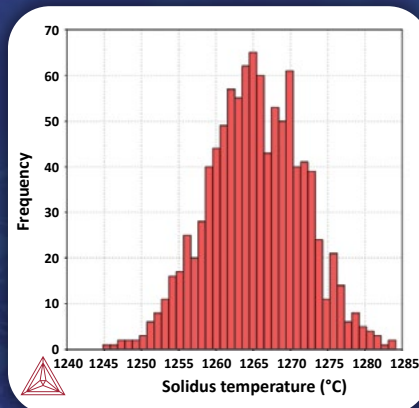
Choose from an extensive selection of thermodynamic and mobility databases in a range of materials, including:

### Steel and Fe-Alloys



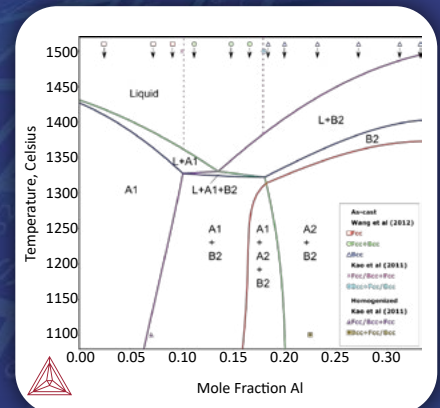
Comparison of calculated and experimental Ms temperatures for a wide range of steels

### Nickel



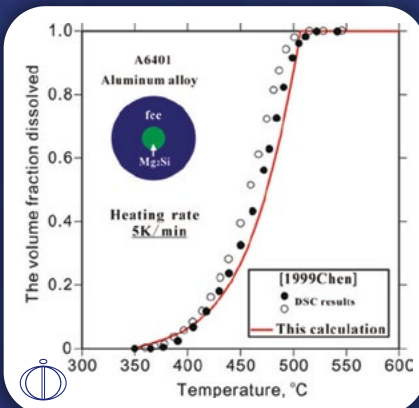
Variation in solidus temperature over 1000 compositions within alloy 718 specification

### High Entropy Alloys



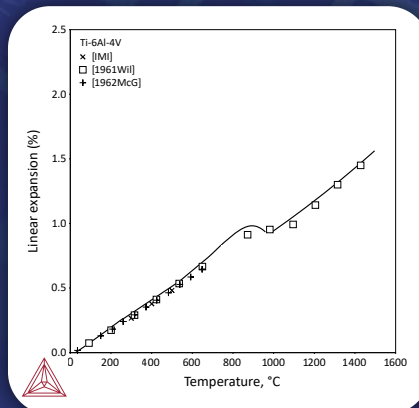
Calculated phase diagram along the composition line of CoCrFeNi-Al

### Al Alloys



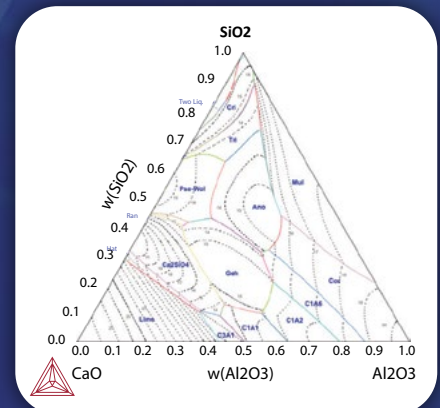
Dissolution of Mg<sub>2</sub>Si precipitate in Alloy A6401

### Ti and TiAl Alloys



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

### Oxides



Ternary liquidus projection in oxide systems

# WHERE MATERIALS PEOPLE

# COLLABORATE

TMS makes a global community of materials professionals accessible to you. Connect in person at TMS events or reach out virtually to begin building or growing your network of international colleagues and experts.



**Connect** at In-Person Meetings



**Join** a Technical Committee



**Find** Colleagues and Mentors



Renew Your TMS  
Membership for 2023!  
[members.tms.org](https://members.tms.org)

**TMS** ( MEMBERSHIP



# IN THE FINAL ANALYSIS

*"I find the TMS Board related meetings (including retreats) to be the best 'meetings' experience that I have encountered in my professional career. . . . The breadth of the big topics covered shows that we are consistently seeking to improve and not just go through the motions."*

—TMS Board Member (Anonymously), August 2022

A painless primer on TMS civics: the individual members of TMS are the owners of the Society. The members set the Society's bylaws and they elect willing volunteers to sit on the Board of Directors to steward the Society, create a governance structure, and assure that the interests of members are well represented. TMS has 14 Board members with each serving a three-year term. These officers and directors take the job very seriously, and the Society has benefited mightily from our Board of Directors' commitment over the decades.

The TMS Board typically convenes six times per year, focusing their limited time together on providing the Society with strategic direction, updating governance practices and policies, addressing the uncharted, considering new initiatives, and keeping a weather eye on the headwinds and tailwinds impacting our resources, financial and otherwise. As I write, the Board has just finished a two-day session at TMS headquarters.

Day one was a retreat. Three separate subjects were discussed: whether the TMS Vision and Mission Statements should be updated (yes, they should); defining our vision and guiding principles for the TMS Annual Meeting & Exhibition for the remainder of the decade (the plan, "TMS Connects," culminates almost two years of work); and whether we should add a fourth goal to the "TMS Aspires" Strategic Plan that would advance industrial engagement (that's an affirmative). The latter two items should be finalized by MS&T22; the discussion of modifying the Vision and Mission Statements will carry into the new year.

Day two was a business meeting. Particular attention was given to our financial status as the pandemic and international travel issues pruned participation in our 2022 meetings. Curtailed attendance means less revenue. Conversely, we added event expense by deploying hybrid participation options and incorporating COVID mitigation measures. Less revenue + more expense = us projecting a 2022 deficit exceeding \$1 million. Fortunately, we have accumulated reserves built on years of positive outcomes and can endure the shortfall. The underlying philosophy is to take a long-game view and keep our staff and operational capacity intact in anticipation of a more normal 2023. Companion topic: the Board accepted the 2021 audit—another unqualified opinion from our auditors.

Beyond the balance sheets, . . . at the request of the Membership and Student Development Committee, the Board approved changing the committee's name to Membership Diversity and Development Committee, with the director position on the Board being similarly renamed. The Board had requested that such a change be made so as to better reflect the Board's commitment to diversity, equity, and inclusion. Separately, the Board discussed whether the Society should maintain or modify its traditional stance of neutrality in accepting participation by scientists and engineers from countries that may be under some form of sanction. The Board retained the traditional position of TMS remaining neutral unless required to take action in response to a legal requirement. Also, with a global mindset, the Board asked the Public and Governmental Affairs Committee to work with the Technical Division Council and consider whether TMS should have a climate change position and, if yes, to propose a position statement.

Consideration of some of the above will continue at MS&T22; some will carry into next year. Simultaneously, there will be new topics that are introduced and start new discussion cycles. As the introductory quote reminds us, the Board seeks to improve. In my assessment, they do an exceptionally good job at this.

Volume 74

Number 10

October/November 2022



James J. Robinson  
 Executive Director

[@JJRoTMS](https://twitter.com/JJRoTMS)

*"The Society has benefited mightily from our Board of Directors' commitment over the decades."*

# JOM TECHNICAL TOPICS

**JOM**  
THE MAGAZINE

*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 access technical journal articles on the Springer website.

## // OCTOBER 2022

### Cold Dwell Fatigue of Titanium Alloys

**Scope:** This special topic summarizes the state of the art in understanding and modeling dwell fatigue failure of titanium alloys.

**Editors:** Adam Pilchak, Materials Resources LLC, and Michael Gram, Pratt & Whitney

**Sponsor:** Titanium Committee

### Properties and Evolution of Defects and Interfaces: Part I

**Scope:** This special topic focuses on defects and interfaces for optimal material.

**Editors:** Tianyi Chen, Oregon State University; Zhe Fan, Lamar University; and Shijun Zhao, City University of Hong Kong

**Sponsor:** Nanomechanical Materials Behavior 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).

## // NOVEMBER 2022

### Furnace Tapping

**Scope:** Tapping a pyrometallurgical smelter is not an easy task and a well-managed tapping process is essential for safe furnace operations. This topic presents a multi-disciplinary picture of the tapping of furnaces.

**Editors:** Joalet Steenkamp, University of the Witwatersrand, Quinn Reynolds, Mintek

**Sponsor:** Pyrometallurgy Committee

### Interactions Between Biomaterials and Biological Tissues and Cells

**Scope:** This topic covers physical, mechanical, biological, and biochemical interactions between engineered biomaterials and biological tissues and cells.

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

**Sponsor:** Biomaterials Committee

### Properties and Evolution of Defects and Interfaces: Part II

**Scope:** This special topic focuses on defects and interfaces for optimal material.

**Editors:** Tianyi Chen, Oregon State University; Zhe Fan, Lamar University; and Shijun Zhao, City University of Hong Kong

**Sponsor:** Nanomechanical Materials Behavior Committee

### Recent Advances in Multicomponent Alloys and Ceramics

**Scope:** This special topic explores recent experimental and computational advancements in multicomponent alloys and ceramics.

**Editors:** Yong-Jie Hu, Drexel University; Bin Ouyang, Florida State University; Cormac Toher, University of Texas at Dallas; and Stefano Curtarolo, Duke University

**Sponsor:** Alloy Phases Committee

### Refractory Materials for Corrosive or High Temperature Environments

**Scope:** This topic focuses on advanced designs of refractory metals, alloys and compounds, and innovative processes to improve material performance.

**Editors:** Chai Ren, University of Utah, and Ravi Enneti, Global Tungsten

**Sponsor:** Refractory Metals & Materials Committee



# TMS MEMBER NEWS

## Share the Good News!

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

## Joel Andersson Recognized by the American Welding Society



**Joel Andersson** was awarded the Adams Memorial Membership Award by the American Welding Society. This award recognizes educators with teaching activities that have advanced the knowledge of welding of their undergraduate or postgraduate students. The

honor will be bestowed to Andersson at an awards ceremony held in conjunction with the FABTECH 2022 conference in November 2022.

Andersson is a professor of materials science and director of production technology at University West. He has been a TMS member since 2005 and is currently serving as the chair of the organizing committee for the upcoming TMS conference Superalloy 718 & Derivatives 2023.

## Donald R. Sadoway Honored by European Patent Office



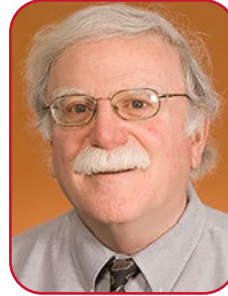
**Donald R. Sadoway**, Ambri and Massachusetts Institute of Technology, was awarded the 2022 European Inventor Award in the Non-EPO Countries category by the European Patent Office (EPO). Sadoway received this award for his invention of liquid metal batteries for storing renewable energy. These

liquid metal batteries are designed to store solar and wind energy and are made from locally sourced raw materials. They provide a cost-effective, long-term storage solution.

First awarded in 2006, this award celebrates the spirit of innovation and recognizes the creativity of inventors whose technical, scientific, and intellectual skills contribute to technological progress and economic growth, improving the daily lives of others.

Sadoway has been a member of TMS since 1978 and was elected to the 2021 class of TMS Fellows. He is also a recipient of the 2013 Extraction & Processing Division (EPD) Distinguished Lecturer Award and the 2014 Educator Award.

## David Laughlin Receives Emeritus Status at CMU



In July 2022, **David Laughlin**, Department of Materials Science and Engineering, Carnegie Mellon University (CMU), was awarded emeritus status. Laughlin received his B.S. in metallurgical engineering from Drexel University and a Ph.D. in materials science from the Massachusetts Institute of

Technology. He began working for CMU's College of Engineering in 1974 and, in 2001, he was recognized as the Alcoa Professor of Physical Metallurgy.

A TMS member since 1974, Laughlin has served on a variety of TMS committees including the Magnetic Materials Committee and the Publications Coordinating Committee. He is a recipient of the 2009 Functional Materials Division (FMD) Distinguished Scientist/Engineer Award, the 2012 American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) Honorary Membership Award, and is a member of the 2008 class of TMS Fellows. He served as the principal editor of *Metallurgical and Materials Transactions* from 1987 to 2016.

## Alan Luo Awarded by Advanced Casting Research Center



**Alan Luo**, The Ohio State University, was honored with the M.C. Flemings Award for scientific contributions to solidification processing by the Advanced Casting Research Center. Luo has been a TMS member since 1999 and has served on multiple TMS committees including

the Magnesium Committee, the Professional Development Committee, the Solidification Committee, and the Aluminum Committee. Luo has also served on the TMS Board of Directors as Light Metals Division (LMD) Director/Chair. He is a recipient of the 2013 Brimacombe Medal, the 2020 LMD Technology Award, the 2021 LMD Distinguished Service Award, and the 2021 Bruce Chalmers Award.



## Content Added to TMS Member Library

Nearly 900 individual papers from 16 volumes have been added to the online TMS Member Library. Available exclusively to TMS members, the library contains a collection of more than 3,400 technical articles from TMS publications.

The new additions include papers from past TMS volumes on topics such as automotive alloys, metal-matrix composites, aluminum cast house, mineral industry technologies, modeling, and more. You can browse an alphabetical listing of all titles or search the collection by paper title, author, or keyword.

To access the library, log in to [members.tms.org](http://members.tms.org) and click on the TMS Member Library link.



## TMS Seeks Board Nominations

TMS is accepting nominations for two Board of Directors for the 2024–2027 term until January 15, 2023. The open positions are **Presidential Rotation** and **Program Director**.

The Presidential Rotation encompasses three successive one-year positions: Vice President, President, and Past President. All three roles are officer positions within the Society and carry unique responsibilities. The role of President includes serving as the chair of the Board of Directors.

The Program Director guides the development and implementation of long-range plans and short-term goals and objectives for the organization with regard to programming activities undertaken on behalf of the Society.

Nomination packages for applicants to these positions will be considered by the Society's Nominating Committee, which will then recommend a candidate for each position to the Board of Directors. If approved by the Board of Directors, these endorsed candidates will be presented to the general membership for approval by July 2023.

For complete job descriptions and qualifications for each office, as well as nomination instructions, visit the Board Nominations page in the Society Governance section of the Society website at [www.tms.org/BoardNominations](http://www.tms.org/BoardNominations). For additional information, contact Deborah Hixon, TMS Awards Program Manager, at [hixon@tms.org](mailto:hixon@tms.org).



## Celebrating 50 Years of TMS Membership

Thirty TMS members are joining the TMS Legion of Honor as they celebrate 50 years of membership in 2021. These members first joined TMS in 1971, when it was still a constituent society of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME), and have been active in Society events and activities in the past five decades. Congratulations to the following members—we salute their dedication and contributions to TMS and to the fields of minerals, metals, and materials science and engineering.

Charles L. Bauer  
 Leslie J. Fekete  
 Paul A. Flinn  
 Raymond A. Fournelle  
 John B. Goddard  
 Michael F. Henry  
 Sung K. Kang  
 Joachim G. Krueger  
 Frank Lawson  
 David C. Lynch  
 Robert Mehrabian  
 Edward E. Mild  
 Farghalli A. Mohamed  
 Jerry F. Newman  
 William E. Pattullo  
 Brian Ralph  
 Irshad A. Rana  
 James W. Reeves  
 Lothar H. Reh  
 Gordon M. Reid  
 Jef R. Roos  
 Alexander Scott  
 Edgar A. Starke Jr.  
 David T. Stevenson  
 Izumi Sukekawa  
 John L. Sundstrom  
 Engelbrecht Von Tiesenhausen  
 Thomas J. Wardle  
 Michael J. Weins  
 Thomas E. Weyand





## TMS2023 Opens Late News Poster Session

More than 4,500 abstracts have been submitted for the TMS 2023 Annual Meeting & Exhibition (TMS2023), scheduled for March 19–23 in San Diego, California. Abstract submissions are now closed for oral presentations, but you can still submit an abstract for the TMS2023 Late News Poster Session. **Abstracts will be accepted through December 21, 2022.** These poster-only submissions will be included in the conference poster session, but you will not be able to submit a manuscript for the conference proceedings.

Abstract submissions are also now open for the Bladesmithing 2023 Symposium and the Technical Division Student Poster Contest. Visit the TMS2023 Technical Program page at [www.tms.org/TMS2023](http://www.tms.org/TMS2023) to learn how to submit your work for these events.

TMS2023 will be held at the San Diego Convention Center & Hilton San Diego Bayfront. San Diego is a traditionally popular meeting destination for many attendees and hosted our best-attended meeting ever in 2020. All attendees are encouraged to stay at the Hilton San Diego Bayfront—the new TMS headquarters hotel for 2023—for maximum convenience to the convention center and to networking and social events. Housing reservations are now open, book your room at the attendee rate today.

If you are planning to attend TMS2023 and will need a travel visa to enter the United States, TMS strongly encourages you to begin the process now. Visit the TMS2023 Travel Visas page for more information and to request a visa invitation letter.



## Update Your Member Profile

Have you moved recently? Changed positions? Shifted your research focus? Let TMS know! Provide TMS with your most recent information through your TMS member profile. Remember to update your technical interests so that TMS can provide you with a customized membership experience.

This year, two new member profile options have been developed to improve our service to you. First, you can now use the **"Preferred First Name"** category to enter the name you would like to see on meeting badges. This option is perfect for those instances where the formal name listed in your member profile is not the name you prefer to go by when attending meetings or introducing yourself to colleagues.

Second, we are asking members to provide cell phone numbers and permission to send occasional text messages. TMS will utilize text-message reminders for critical items only, including member dues renewal or deadlines regarding your presentations, journal submissions, or events you are attending. The goal is to make sure that you don't miss important notifications, but messages will be infrequent. Messages will only be sent to members who answer "Yes" to the question, **"Would you like to receive occasional text alerts from TMS?"** on their member profile.

Both of these updates—and any others you would like to make—can be made in minutes by logging in to [members.tms.org](http://members.tms.org) and choosing "Edit Your Profile" under Member Tools.

## In Memoriam

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

Amal Biswas  
 John Boxall  
 Harold Rajcevic  
 Sachchidananda Ray  
 David Snow  
 Herbert Veltman



# A CLOSER LOOK AT TMS2022 CO-LOCATED EVENTS

Kelly Zappas



"Flying Sparks" photo credit:  
© Joalet Steenkamp,  
2016

"A Closer Look at TMS2022 Co-Located Events" serves as an introduction to a thematic group of articles in the October/November 2022 issue of *JOM: The Magazine*, rounding out the coverage of the TMS 2022 Annual Meeting & Exhibition (TMS2022). The article package features overviews of the three co-located meetings that took place with TMS2022—Furnace Tapping 2022; the Fourth Summit on Diversity in the Minerals, Metals, and Materials Professions (DMMM4); and REWAS 2022. For additional information, contact Kaitlin Calva, *JOM: The Magazine* Principal Editor, at [kcalva@tms.org](mailto:kcalva@tms.org).



The TMS 2022 Annual Meeting & Exhibition (TMS2022) made history, in more ways than one. For many attendees, TMS2022 was a return to the in-person conference experience after the fully virtual meeting in 2021. Another noteworthy element this year: TMS2022 was actually four meetings in one, with three distinct co-located events—Furnace Tapping 2022; the Fourth Summit on Diversity in the Minerals, Metals, and Materials Professions (DMMM4); and the REWAS 2022 Symposium.





The co-located meeting concept allows TMS Annual Meeting attendees to participate in smaller specialty meetings that might otherwise be held as standalone events, while still retaining access to the extensive technical program, exhibit, and networking events offered at the TMS Annual Meeting. It essentially gives participants access to a number of events in a single location for a single registration fee. This issue of *JOM: The Magazine* takes a closer look at all three of these TMS2022 co-located events, sharing details from special sessions or topics that were discussed and key outcomes of the meetings.

The first article in this series provides a summary of Furnace Tapping 2022 from organizing committee chair Joalet Steenkamp, Glencore Technologies. A self-described “meeting point of science, technology, and skill,” this conference gave attendees an opportunity to discuss issues related to tap-hole design, maintenance, and operation, among other topics. Steenkamp’s overview features the meeting’s two keynote addresses and a panel discussion that involved a mix of in-person and virtual panelists among the stand-out moments of the four sessions included in Furnace Tapping programming. An additional contribution to this issue of the *Magazine* from Steenkamp includes her original artwork—a photograph depicting lancing the tap-hole of a submerged arc furnace—featured on the cover as well as in this article.

Next, *JOM: The Magazine* covers DMMM4, which was originally scheduled for 2021 but shifted to TMS2022 so that it could be held in person. DMMM4 was developed to provide attendees with novel, actionable, and measurable approaches to improving diversity, equity, and inclusion (DEI) in the workplace and profession in addition to sharing skills, knowledge, and inspiration for implementation. The summit offered four concurrent sessions, including two hands-on workshop experiences, two all-summit plenary sessions, structured networking events, and informal opportunities for discussion. This article focuses, in particular, on the concepts and inspiration shared in the opening all-summit keynote delivered by Viola L. Acoff, University of Alabama.

Elsa Olivetti, Massachusetts Institute of Technology and lead organizer, explores REWAS 2022 in the final article of this series. Covering the latest technical and societal developments enabling sustainability within our global economy and a special focus on **RE**cycling and **WAS**te management, this year’s iteration focused on Developing Tomorrow’s Technical Cycles. Six symposia and one poster session made up the REWAS 2022 program, and in this article, Olivetti specifically looks at the Diran Apelian Honorary Symposia. Invited speakers covered topics motivated and inspired by Apelian’s wealth of expertise and contributions in metals processing, aluminum and battery recycling, sustainability, education in materials science, and more.

Many of the conversations initiated at TMS2022 sessions and events will continue at the TMS 2023 Annual Meeting & Exhibition (TMS2023), scheduled for March 19–23 in San Diego, California. In total, more than 95 symposia are planned in 14 technical topics over the course of four days at TMS2023.

Visit [www.tms.org/TMS2023](http://www.tms.org/TMS2023) to learn more about programming and special event plans at TMS2023 and plan to join us in San Diego for the next iteration of the TMS Annual Meeting & Exhibition.

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

### MAKE YOUR PLANS NOW!

The TMS Annual Meeting & Exhibition returns to San Diego, California, in 2023—will we see you there? Don’t miss these important dates as you make plans to attend TMS2023.

**Registration Opens: October 2022**

**Discount Deadline: January 31, 2023**

**Housing Deadline: February 23, 2023**

**Meeting Dates: March 19–23, 2023**





# THE 'HOLE' PICTURE: LOOKING BACK AT FURNACE TAPPING 2022

Joalet Steenkamp



"Flying Sparks" photo credit:  
 © Joalet Steenkamp,  
 2016

"An example of problem-based conferencing, the Furnace Tapping series was established to serve the pyrometallurgical industry at large."

—Joalet Steenkamp

The third in the series, Furnace Tapping 2022 was co-hosted with the TMS 2022 Annual Meeting & Exhibition (TMS2022) in Anaheim, California, USA. It followed on Furnace Tapping 2018, hosted in Skukuza in the world-renowned Kruger National Park in South Africa, and Furnace Tapping 2014, hosted in the UNESCO World Heritage site in the Cradle of Humankind in South Africa.

An example of problem-based conferencing, the Furnace Tapping series was established to serve the pyrometallurgical industry at large. It focuses on a very specific challenge: tapping of furnaces. Various perspectives on the topic are typically drawn upon with participants represented by industry, consultants, service providers, and research institutions.

This was also the case for Furnace Tapping 2022. Over the two days, presentations ranged from operational practices to tap-hole designs, material and equipment selection, and the application of various modelling techniques in optimizing these aspects.

Joalet Steenkamp posing next to the banner for Furnace Tapping 2022.







Merete Tangstad (photo right, at podium), Norwegian University of Science and Technology, delivering her keynote address on the first day of programming for Furnace Tapping 2022.



The program included two keynote addresses. Merete Tangstad, professor at the Norwegian University of Science and Technology, reported on “Controlled Tapping – The Research Project” on day one. Her talk focused on building on the understanding and experience of tapping through modelling, industrial campaigns, and lab experiments to describe the tapping rate and mechanisms that affect furnace tapping.

Isabelle Nolet, associate at Hatch in South Africa, reported on “PGM-Ni-Cu Tapping: An Updated Industry Survey” on day two. Nolet cited many new trends since the original 2014 survey, including innovations in technology, safety, and environmental considerations, and called for a new industry survey to take place with wider participation and more specific objectives. Both presentations were very well-received and set the tone for the presentations to follow on each of the respective days.

A panel discussion was included in the second day's programming. It was facilitated by Gerardo Alvear Flores of Rio Tinto and opened by short presentations from each of the panel members on the topic of the session, “The Good, The Bad, and The Ugly of Furnace Tapping.” The panel consisted of Harmen Oterdoom (independent consultant, Germany); Stanko Nikolic (Glencore, Australia); Ryan Walton (Rio Tinto, USA); Christine Wenzl (RHI Magnesita, Austria); Stefan Schmidt (Aurubis, Germany); and Isabelle Nolet (Hatch, South Africa). The lively and interactive discussion, which ranged from improvements and ideal environments to safety for operators, allowed for members of the audience to engage with panel members which added significant value to the event.



A unique draw for this year's Furnace Tapping programming was the hybrid nature of the TMS2022 meeting as a whole; this allowed presenters and audience members to participate in the conference either in person or via livestreaming, like Christine Wenzl (far right), RHI Magnesita, who appeared virtually as a plenary session panelist.



As with the previous two events, Furnace Tapping 2022 included a standalone proceedings volume. All abstracts were reviewed by the organizers, and authors of accepted abstracts were invited to submit full-length manuscripts to the proceedings. Only papers included in the proceedings were included in the program for presentation. Additionally, a special topic on Furnace Tapping is included in the November 2022 issue of *JOM: The Journal*. This topic contains a selection of invited papers, some solicited from researchers that were unable to meet the deadlines for the symposium but who could also contribute significantly to the field. (**Editor's Note: See sidebar, "Additional Reading," for more details on these resources.**)

The COVID-19 pandemic did affect programming, due to travel restrictions or other factors. However, the robust programming system at TMS allowed for last minute changes to be made even the day before, which was quite impressive. Furthermore, the first session on the second day of Furnace Tapping programming was hosted in a venue that allowed for livestreaming. This allowed for broader participation from people who were unable to travel, including presenters, participants in the panel discussion, and attendees.

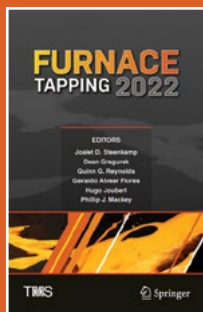
I do look forward to organizing Furnace Tapping 2026 and to continuing the conversation around tapping of furnaces.

## ADDITIONAL READING

Did you miss Furnace Tapping at TMS2022? Want more Furnace Tapping content? Here are two ways you can catch up and keep up with the industry while plans come together for the next conference:

**1. Furnace Tapping 2022, available at the TMS Bookstore portal**

Visit [www.tms.org/Bookstore](http://www.tms.org/Bookstore) log in to see the discount, and enter the appropriate code when checking out on the Springer website.



**2. Furnace Tapping special topic in *JOM: The Journal***

Visit [www.tms.org/JOM](http://www.tms.org/JOM) to log in and access technical articles on Springer from this invited topic in the November 2022 issue.

## THANK YOU

### ORGANIZING COMMITTEE

- **Joalet Steenkamp**,  
*Chair, Glencore XPS, Canada*
- **Dean Gregurek**,  
*RHI Magnesita, Austria*
- **Quinn Reynolds**,  
*Mintek, South Africa*
- **Gerardo Alvear Flores**,  
*Rio Tinto, Singapore*
- **Hugo Joubert**,  
*Tenova Pyromet, South Africa*
- **Phillip J. Mackey**,  
*P.J. Mackey Technology Inc., Canada*

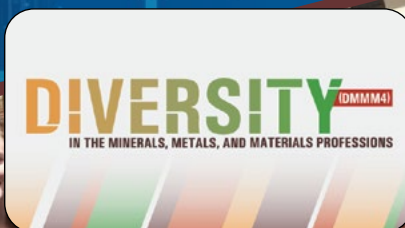
### SPONSORS

- The South African Institute of Mining and Metallurgy
- TMS Extraction & Processing Division
- TMS Pyrometallurgy Committee
- TMS Process Technology and Modelling Committee
- TMS Materials Characterization Committee
- TMS Industrial Advisory Committee

Joalet Steenkamp, Chief Metallurgist, Pyrometallurgy and Furnace Integrity, Glencore XPS, was chair of the Furnace Tapping 2022 organizing committee. A TMS member since 2009, Steenkamp has been actively involved in several technical committees and currently serves as the vice chair of the Pyrometallurgy Committee.

# HIGHLIGHTS FROM THE FOURTH DIVERSITY SUMMIT: NEW LOCATION, NEW TOPICS

Lynne Robinson and Kelly Zappas



Clarissa Yablinsky, Los Alamos National Laboratory, led a personal and interactive Q&A session with Viola L. Acoff, University of Alabama, during the all-conference opening plenary session.

“The first word that comes to mind is **POWERFUL**. The messages from the speakers and the discussions were moving, powerful, and motivating.”  
—Summit Attendee



Attendees started DMMM4 off with small group discussions on topics such as outreach, overcoming anxiety, accessibility, and more at the Fresh Coffee, Fresh Ideas: Diversity and Inclusion Breakfast.

*“The first word that comes to mind is **POWERFUL**. The messages from the speakers and the discussions were moving, powerful, and motivating.”*

Shared as a written comment in the follow up survey to the Fourth Summit on Diversity in the Minerals, Metals, and Materials Professions (DMMM4), this perspective reflected a common theme expressed throughout the two-day summit, co-located with the TMS 2022 Annual Meeting & Exhibition (TMS2022). Building on the work accomplished in the previous three DMMM Summits, the 2022 iteration gave attendees the opportunity to engage in important discussions with speakers, panelists, and each other on achieving true inclusion in the workplace.

Holding a DMMM Summit concurrent with a TMS annual meeting was a new twist on this signature TMS program, which had been previously organized as a standalone specialty conference. Originally slated to take place in conjunction with TMS2021, DMMM4 was included as part of annual meeting registration to provide access to members who would not typically be funded to travel to a non-technical meeting. As with everything in life, these plans changed in the wake of the COVID-19 pandemic.





Neurodiversity was a new topic explored at DMMM4, starting with an overview offered by Lawrence Fung (inset), Stanford Neurodiversity Project, as the closing all-conference plenary keynote speaker. On right: Summit attendees at the Celebrate Diversity Luncheon on Wednesday afternoon, before Fung's presentation.

**"I love that TMS supports these summits. None of my other professional societies are doing anything like this. I think it's very important and it's reaching a lot of people. Continuing to focus on educating and inspiring, while providing concrete skills and strategies, will ensure our summits continue to have maximum value."**

**—Summit Attendee**

The DMMM4 Organizing Committee decided to postpone the summit when TMS2021 was pivoted to a virtual meeting to preserve what was considered the heart of the event—in-person networking, rich small group discussions, meaningful exchanges with panelists, and supportive, informal conversations.

Many DMMM4 survey respondents indicated that the summit was worth the wait, with 54% giving it an overall rating of "excellent" and 36% rating it "good." The survey also revealed strong support for continuing to co-locate the DMMM summit series with the TMS annual meeting, with 48% of survey respondents indicating a preference for this. As one attendee commented in the survey, "Co-locating with TMS2022 was excellent for the potential for broadening participation and should be considered for future events." Five percent of the respondents favored going back to a standalone conference.

Of the 29% indicating "Other" options, most comments provided insights into how future summits co-located at the TMS annual meeting could be improved to facilitate the ability of annual meeting attendees to participate in summit programming between technical session commitments. These suggestions are being carefully considered as a new DMMM Organizing Committee comes together to plan the fifth summit.

Beyond experimenting with the annual meeting co-location, DMMM4 introduced a new topic in the DMMM series—engaging those with physical, cognitive, or sensory challenges. This programming focus was developed in response to a 2018 STEM Inclusion Study supported by the National Science Foundation revealing that 16% of TMS members identified as being differently abled and reporting more negative workplace experiences than respondents who did not identify as having these challenges. To provide a foundation for deeper exploration of this issue, the closing plenary session featured the keynote, "Maximizing the Potential of Neurodiversity in the Employment and Educational Settings," by Lawrence Fung, Director, Stanford Neurodiversity Project. (For an overview of the concepts shared by Fung, read "Neurodiversity: An Invisible Strength?" published in the September 2022 *JOM: The Magazine*.)

Another variation on previous summit programs was devoting the All-Summit Opening Keynote exclusively to sharing the personal and professional journeys of well-known TMS colleagues as leaders of change in the diversity, equity, and inclusion space. This resulted in some of the most memorable moments in the history of the summit series.



Viola L. Acoff (inset), The University of Alabama, kicked off the summit by sharing her inspiring personal story of her remarkable life and career during the opening keynote session.

### Viola L. Acoff Keynote Opens Dialogue

As the lead speaker at the DMMM4 Opening Keynote session, Viola L. Acoff shared her powerful “origin story” with the audience. It began with her childhood days in Bessemer, Alabama (yes, named after the Bessemer steel process). It continued with her introduction to engineering at the age of 10 when the first of her sisters became an engineering major. (Ultimately, five of the seven daughters in her family majored in engineering.) And it intensified when, during her own undergraduate years in engineering, she read an article that said less than 0.5% of all Ph.D. degrees awarded in engineering went to African Americans. She looked around at her fellow students, taking classes and doing research just like she was, and thought, “I can do this.”

So Acoff earned her Ph.D. and secured a position at The University of Alabama.

“When I was hired as a tenure-track assistant professor at The University of Alabama’s College of Engineering in 1994, I was the first woman hired in the Department of Metallurgical and Materials Engineering. I was also the first Black tenure-track female faculty member hired in the College at that time,” she said. “There were only about nine or ten women on the entire faculty of the College of Engineering and over half of us had been hired just over a three-year period.”

Because of her unique position, she encountered challenges to her authority from students who didn’t know how they should address her because she didn’t look like the other professors they had known. She also once received an anonymous letter—which she shared with summit attendees—that let her know, in explicit and

violent terms, that she didn’t belong and should not be teaching at the school.

It was a difficult time, and Acoff considered leaving Alabama for an HBCU (Historically Black Colleges and Universities), but there was one thing that stopped her. She was filling in for a colleague when a Black female student from that class, a graduating senior, came to Acoff and told her that she was the first Black faculty member the student had encountered in her entire four years at the university.

“We need you here,” the girl said.

“At that moment, I had confirmation that I was on the correct path,” said Acoff. “I realized that I was in a perfect place to help students from groups traditionally underrepresented in our field to navigate the road to equity and inclusion.”

So Acoff stayed. She built a career at the University of Alabama. And she mentored other young Black and female students to build their engineering careers.

“I think my most important accomplishment has been representation—simply being on the faculty,” said Acoff.

Acoff’s moving presentation set the stage for the panel discussion and group conversations that followed. The Voices of TMS panel offered the opportunity for four additional individuals to share their stories and engage in discussion with the audience. Panelists Lawrence Fung, Stanford University; Gabriel Ilevbare, Idaho National Laboratory; Suveen N. Mathaudhu, Colorado School of Mines; and Raul Rebak, GE Global Research, were featured in the panel, moderated by Clarissa Yablinsky, Los Alamos National Laboratory.

### Continuing the Conversations

Resources from DMMM4 sessions can be downloaded from the TMS Diversity, Equity, and Inclusion (DEI) Toolkit, made freely available as part of the TMS DEI website at [www.tms.org/Diversity](http://www.tms.org/Diversity). From this website, you can also view recordings of the DMMM4 Virtual Keynote Series, which the DMMM4 Organizing Committee developed as preparation for the in-person Summit event. You can also learn how to get involved with the TMS DEI Committee, the sponsoring committee of the summit series.

Please also watch the pages of *JOM: The Magazine* and other TMS member communications for updates

on DMMM5. While the pandemic created challenges in the planning and implementation of DMMM4, the response to and impact of the event held on March 2 and 3 of TMS2022 underscored the significance of the summit series to advancing a more inclusive culture within TMS and the profession it serves. As one DMMM4 attendee noted in the post-meeting survey, “I love that TMS supports these summits. None of my other professional societies are doing anything like this. I think it’s very important and it’s reaching a lot of people. Continuing to focus on educating and inspiring, while providing concrete skills and strategies, will ensure our summits continue to have maximum value.”



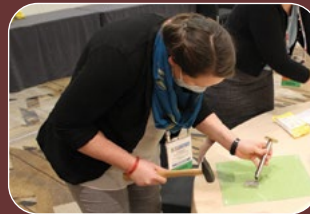
## Career Development Tools and Strategies



This session focused on sharing actionable tools and strategies for both employers and employees to enhance career development and progression of underrepresented populations. Keynoting the session was Stacie LeSure, Engineers for Equity, with her presentation, "Bruised But Not Broken: Storytelling as a Method to Share the Experiences and Persistence Strategies of African American Women in Engineering Degree Programs."

After a break, the session reconvened for a panel discussion on career development, moderated by Blythe G. Clarke, Sandia National Laboratories. LeSure joined fellow panelists Gabriel Ilevbare, Idaho National Laboratory; J.C. Zhao, University of Maryland; Jim Yurko, Apple; and Amit Misra, University of Michigan, to address audience questions about investing in career development, expanding career horizons, and the advancement of diversity in the STEM fields.

## STEM Outreach Case Studies and Best Practices



This session shared benchmark examples of STEM outreach supporting development of a more diverse STEM pipeline. Formal presentations were paired with a hands-on component where attendees were invited to try out classroom demonstrations such as hardness testing and a materials science superhero exercise, while finding inspiration for activities of their own.

Session highlights included Suveen N. Mathaudhu, Colorado School of Mines, relating his own passion for superheroes and hip hop to STEM concepts in his presentation, "Materials Calisthenics: Harnessing Your Interests to Inspire Diverse Audiences." In "Building Effective STEM Outreach Programs," Jessica A. Krogstad, University of Illinois Urbana-Champaign, explored methods of making outreach efforts more effective using current literature and local case studies. And Rajan Kumar, Stanford University, shared models for designing inclusive undergraduate research experiences in "Designing Inclusive Research Experiences for Undergraduates: A Case Study on the Stanford Materials Science and Engineering REU Program."

## The Invisible Pipeline: Recruitment/Retention of Underrepresented Minorities



Through a case study of the work that Idaho National Laboratory has undertaken to build a more inclusively diverse workforce, an overview of individual and collective actions needed for academic environments to become authentically diverse, and a personal reflection on the positive impact of peer-to-peer mentoring programs, this session explored strategies for removing the barriers that underrepresented minorities (URMs) face in pursuing a materials science and engineering career.

Following the formal presentations was a panel discussion titled, Building the Pipeline—Addressing Diversity Issues in Materials Science and Beyond. Panelists included Aerial D. Murphy-Leonard, The Ohio State University; Ashleigh Wright, University of Illinois Urbana-Champaign; and Michael Rawlings, TMS. In this conversation, panelists and audience members discussed the challenges in recruiting and retaining diverse students and employees as well as implementing recruitment strategies and fostering supportive, inclusive environments.



Before the official start of summit programming, attendees had a chance to reconnect at the DMMM4 Preview and Networking Mixer on Tuesday evening.

## THANK YOU

DMMM4 would not have been possible without the commitment and perseverance of the Organizing Committee

### ORGANIZING COMMITTEE

- **Aeriel D. Murphy-Leonard**  
*Chair, The Ohio State University*
- **Mark C. Carroll**  
*Honeywell*
- **Blythe G. Clark**  
*Sandia National Laboratories*
- **KC Cunningham**  
*ATI Specialty Alloys & Components*
- **Lauren M. Garrison**  
*Oak Ridge National Laboratory*
- **Atieh Moridi**  
*Cornell University*
- **Mitra L. Taheri**  
*Johns Hopkins University*
- **Ashleigh Wright**  
*University of Illinois Urbana-Champaign*

### COMMITTEE ADVISORS

- **Gerardo Alvear Flores**  
*Consultant, Non-Ferrous Metallurgy*
- **Megan J. Cordill**  
*Erich Schmid Institute of Materials Science, Austrian Academy of Sciences*
- **Jonathan D. Madison**  
*National Science Foundation*
- **Clarissa Yablinsky**  
*Los Alamos National Laboratory*

Thank you also, to the TMS Foundation, for its generous support of DMMM4.



### Combating Biases in STEM



This highly engaging session opened with Katie Thomas, Idaho State University, introducing attendees to a strengths-based approach to identifying, investing in, and leveraging the talents of diverse team members. Jonathan D. Madison, National Science Foundation, then led an activity in which participants played Buffalo, a card game by Tiltfactor designed to “subtly challenge your own stereotypes and unconscious bias through play.”

The program concluded with small group breakout discussions addressing the question, how does unconscious bias impact your experiences at work? Facilitated by Victoria Miller, University of Florida, these scenario discussions gave attendees a chance to put what they heard and learned during the summit into practice and share personal experiences relevant to the minerals, metals, and materials professions.



# CREATING, TEACHING, AND REVERING VALUE: HIGHLIGHTS FROM AN EPD SYMPOSIUM IN HONOR OF DIRAN APELIAN AT REWAS 2022

Elsa Olivetti



Photo credit: Jeff Fitlow/Rice  
 University courtesy NSF  
 Multimedia Gallery

“The symposium taught attendees first and foremost that collective, collaborative, and dedicated ingenuity are imperative for success.”

—Elsa Olivetti



Elsa Olivetti

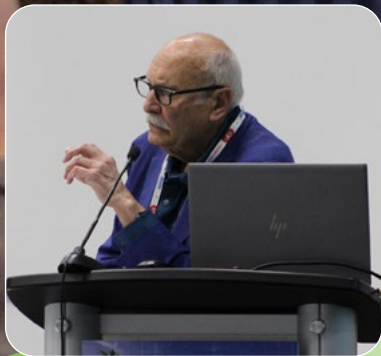
Hosted in Anaheim, California, from February 27 through March 3, 2022, the TMS Extraction & Processing Division (EPD) Symposium in Honor of Diran Apelian was scheduled with REWAS 2022, a sustainability driven conference held in conjunction with the TMS 2022 Annual Meeting & Exhibition (TMS2022). This year the theme of REWAS was Developing Tomorrow's Technical Cycles. This was a fitting title given the concurrent Apelian honorary symposium, as Apelian was a leading contributor to early REWAS meetings, which began in 1999, and has focused his career on fostering innovation in materials sustainability [1].

The honorary symposium, Coupling Metallurgy and Sustainability: An EPD Symposium in Honor of Diran Apelian, contained 20 talks, which were delivered live as well as through the on-demand platform. Themes covered included sustainability opportunities in aluminum, innovations in materials design, and processing and recycling as well as building sustainability in metals through partnerships. The symposium highlighted Apelian's broad impact on the field both as a retrospective view into critical scientific contributions by some of his closest colleagues and as a path forward for the community.



Diran Apelian





Diran Apelian (speaking, on left), University of California, Irvine, was honored with a number of presentations that covered topics motivated and inspired by Apelian's wealth of expertise in metals processing, aluminum and battery recycling, sustainability, education, and more. This honorary symposium was held as a part of REWAS 2022 at the TMS 2022 Annual Meeting & Exhibition.

Each speaker emphasized Apelian's ability to innovate and his focus on creating value for the benefit of society and people. Themes echoed throughout the conference included translation to implementation, working on real problems through strong collaborations, and leveraging fundamentals with a deep commitment to the science and engineering to make sustainability a reality. Several speakers also mentioned the importance of working with non-experts to both refine teaching pedagogy and mentorship but also, more importantly, to be inspired by new ideas by engaging future collaborators, leaders, and colleagues.



The above slide from Benjamin McDonald's presentation, "Current Perspectives in Metal Based Additive Manufacturing," honors milestones in Diran Apelian's career.

The audience learned that Apelian has fostered educational opportunities where teachers are facilitators of the learning environment and focus on *learning* rather than *teaching*. Through first-year project work and great problems seminars, Apelian enables students early on in their academic careers to focus on big, important, interdisciplinary problems that are open-ended and messy. By coupling these grand challenge-type problems with professional skills development, Apelian reinforces community-based collaboration and attracting engaged professionals into the domain. The symposium taught attendees first and foremost that collective, collaborative, and dedicated ingenuity are imperative for success.

One focus of the conference was Apelian's work in aluminum, a metal that will be pivotal to moving towards more sustainable materials use. As an area of interest for Apelian's entire career, aluminum exemplifies the opportunity to create value through innovations in sustainable practice. Apelian's contributions in aluminum demonstrate his commitment to understand relevant metallurgical processes in depth, build community, provide focused and consistent mentorship, and use cutting edge approaches linked to fundamentals all while demonstrating the importance of thoughtful use of resources. Aluminum has the potential to provide sustainable materials consumption as it offers lightweighting capability across mobility and industrial applications, can be processed through a variety of lower-cost manufacturing casting methods, and, if managed correctly, yields high recyclability at significant energy savings. These broad opportunities for aluminum were highlighted in talks by Bob De Saro, Sean Kelly, Aaron Birt and Emily Molstad, and John Weritz. De Saro and Molstad discussed how we can use Industry 4.0 breakthroughs to revolutionize aluminum operations from vastly improved recycling to continuous highly productive operations.

But, the metallurgical details will also be critical. For example, developing new recycled alloy series that leverage strengthening phases for high-performance structural applications was mentioned by Alan Luo. Brajendra Mishra spoke to innovations in emerging casting processes, such as semisolid metal processing that support non-turbulent flow. These advanced methods include thixotropic and direct metal writing approaches as well as additive approaches that enable reduced feedstock preparation. Benjamin MacDonald and Enrique Lavernia shared some further details on the opportunities to drive innovation in directed energy deposition, powder capture, and reuse, and Dan Thoma spoke to broader opportunities in additive manufacturing. In the metal processing field, Apelian and collaborators have developed approaches to derive value from the data gathered throughout a plant. This includes developing process innovations that overcome defect formation, leverage casting simulation, support multi-material design and manufacturing, and using datasets from high-pressure die casting situations to treat missing data.



Mishra emphasized the breadth of contributions represented including process innovation linked to data science, process developments in molten metal processing and heat treatment, thixotropic metal processing and melt cognition, development of advanced Al alloys, additive manufacturing, and entrepreneurship in scrap processing and Li-ion battery recycling. From a leadership perspective, Luo and Mishra spoke to the centers Apelian has led that provide a forum for industry to ground in academic education and research including the Advanced Casting Research Center, the Center for Heat Treating Excellence, the Center for Resource Recovery and Recycling, and the Center for Material Processing Data. Presenter Christina Meskers underscored the opportunity to move faster if we work together and these centers showcase that opportunity. These industry links were also emphasized in the presentation by Kevin Anderson and co-authors which provide examples of how to effectively incentivize sustainable materials design. Presenter Bart Blanpain emphasized the role of dissemination and communication with the example of the *Journal of Sustainable Metallurgy*, established in 2005 and spearheaded by Apelian as one of its founding editors.

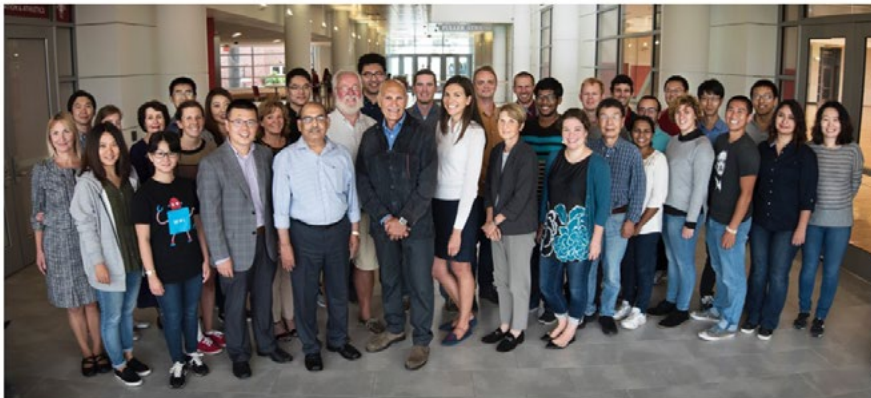
On education, Mishra, Glenn Daehn, and Carol Handwerker spoke to the foundational importance of materials-aware education to enable the next generations to build a technical and sustainable future and the critical need to move towards a more technically literate public. Daehn provided an example from the ASM Materials Education Foundation (which he and Apelian have both served as past board chairs) that connects to teachers in the classroom and increases the depth of their technical training and finding ways to incentivize not only continuing education, but also mechanisms for this to be incentivized in academia. Daehn's call to action was that in order for these efforts to scale we must build coalitions of like-minded groups, have professional societies collaborate, and establish culture based on solving problems. In particular, he cited the importance of building a coalition of the materials and manufacturing-related societies to develop robust programs of education in materials-based STEM that can support sustainability and U.S. manufacturing.

Handwerker's presentation linked seamlessly to that of Daehn and others where she posed the question,

"How do we as educators, scientists, and engineers create a sustainable ecosystem for educating, training, and empowering students to be leaders in sustainability?" Providing links from "The Tragedy of the Commons," she provided a call to action to view our students as the commons and asked the community to collaborate to help them become leaders in sustainability [2]. Foundational to this pursuit, Handwerker explored how we focus on explicitly articulating shared goals linked to individual goals, build and reciprocate trust, and generate ecosystems of co-creation in areas of national need. Guiding the audience through Elinor Ostrom's "Framework for Sustainable Social-Ecological Systems," she provided an example in electronic waste for how frameworks can organize relevant variables identified in theories and empirical research [3].

Benjamin McDonald's presentation, "Current Perspectives in Metal Based Additive Manufacturing," highlighted Diran Apelian's dedication to his students and belief in lifting others up through mentorship and collaboration.

## Lifting others



“REWAS 2022 taught the audience that we must learn how to dissect and harness complexity and work deeply across disciplines, rather than eliminate this complexity from our materials systems.”

—Elsa Olivetti

## REWAS 2022 PLENARY SESSION

Held on Monday afternoon, the REWAS 2022 plenary session was livestreamed to allow for broader access to programming by both in-person and virtual attendees. For those who participated online, the meeting platform allowed users to submit questions in real-time to maximize engagement in the session.



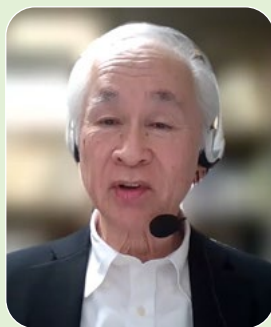
Themed around Developing Tomorrow's Technical Cycles, REWAS organizers Camille Fleuriault (left), Eramet Norway, and Elsa Olivetti shared introductory comments to kick off the conference. Diran Apelian, University of California, Irvine, opened the session

with, “Life Cycle of Materials—A Personal Journey.”



Next, Joe Cresko (left), Advanced Manufacturing Office, U.S. Department of Energy, highlighted pathways for energy efficiency, industrial electrification, low-carbon fuels, feedstocks, energy sources, and carbon capture and utilization for a more sustainable, low-

carbon industrial sector in his talk, “The Intersection Sustainable Manufacturing and Industrial Decarbonization.”



Frederic Clerc, Urban Future Lab, next shared, “EU and NA Perspectives on the Potential of Carbon Utilization: Business, Technology, and Policy Landscape.” To close the session, Takashi Nakamura (left), Tohoku University, proposed an integrated life cycle assessment evaluation that includes copper ore extraction, smelting, and recycling processes in an effort to achieve sustainable developments in the copper industry in his talk, “Actions of the Copper Industry towards Future Carbon Neutral Society.”

Don Sadoway spoke to transitioning industrial chemistry towards electrochemical pathways that could lead to decarbonization of steel (with a footprint of 10% of global CO<sub>2</sub> emissions) and facilitate grid-level storage enabling renewable energy technologies and more resiliency against disruption. In particular, his technical focus was on the use of molten oxide electrolysis and how one can build affordable technologies around good science, but he also amplified Apelian's messages to engage young people, thereby generating a culture of innovation, thinking outside the box (the “anti-expert”), invention, and creativity. By taking on tough problems in extractive metallurgy and energy storage while considering scale and recognizing that the engineer is the steward of the world's resources, Sadoway reflects Apelian's sentiments in making society better at cost and engaging emerging engineers.

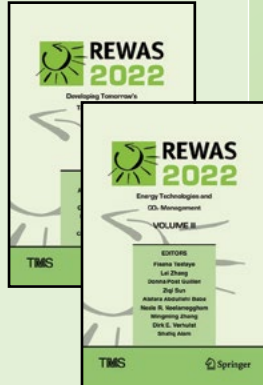
Julie Schoenung spoke to the role of chemicals management and considerations of the circular economy, providing a call to action on strengthening links between structure, property, and processing relationships with resource, environmental, and health impact considerations. Schoenung has innovated around methods to consider hazard, which is an inherent material property, human exposure, based on emissions and risk, contributing to the probability of disease. Schoenung's key messages were that as materials experts, we must be informed about the health and environmental impacts of materials selection decisions and ask ourselves, “Is the use of this chemical/substance/material necessary?” and, “Can we find an alternative substance, or an alternative overall design?”



## ADDITIONAL READING

For a more in-depth look at all of the topics covered during REWAS 2022, explore both proceedings volumes:

- **REWAS 2022: Developing Tomorrow's Technical Cycles (Volume I)**
- **REWAS 2022: Energy Technologies and CO<sub>2</sub> Management (Volume II)**



Visit the TMS Bookstore portal to access both titles and access your TMS member discount. Log in at [www.tms.org/Bookstore](http://www.tms.org/Bookstore) to see the discount and enter the appropriate code when checking out on the Springer website.

## THANK YOU

### LEAD ORGANIZERS

- **Camille Fleuriault**,  
*co-lead, Eramet Norway*
- **Mertol Göknelma**,  
*co-lead, Izmir Institute of Technology*
- **Elsa Olivetti**,  
*Massachusetts Institute of Technology*
- **Christina Meskers**,  
*Norwegian University of Science and Technology*

### SPONSORS

TMS Recycling & Environmental Technologies Committee.

# TMS

REWAS 2022 taught the audience that we must learn how to dissect and harness complexity and work deeply across disciplines, rather than eliminate this complexity from our materials systems. The sessions implicitly explained that this is hard because different theories and models are used by different disciplines and communities to analyze their parts of the complex multilevel whole. The Apelian Honorary Symposium gave the audience one strategy to embrace this complexity through building a dynamic and healthy community with industrial and public long-term vision and sustained commitment through industry, academia, and society partnerships. In Blanpain's words, we must have local metallurgical ecosystems that interconnect globally. Apelian and his community have emphasized the human dimension, taught us always to be in charge of your own obsolescence, and to set your ambition level high. As organizers of the sessions, we hope these lessons we learned from Apelian can help guide our community towards continued and heightened impact.

**Elsa Olivetti is an associate professor at the Massachusetts Institute of Technology (MIT) and was one of the organizers for REWAS 2022. A TMS member since 2009, she has been involved in several technical committees, including the Additive Manufacturing and Recycling & Environmental Technologies Committees, and is the current vice chair of the TMS Extraction & Processing Division.**

**Editor's Note: The following individuals also contributed to this article: Diran Apelian, University of California-Irvine; Bart Blanpain, KU Leuven; Glenn Daehn, The Ohio State University; Robert Desaro, Energy Research Company; Carol Handwerker, Purdue University; Alan Luo, The Ohio State University; Brajendra Mishra, Worcester Polytechnic Institute; Donald Sadoway Massachusetts Institute of Technology; Julie Schoenung, University of California-Irvine.**

### References

1. Camille Fleuriault, Mertol Gokelma, Alexandra Anderson, and Elsa A. Olivetti, *J. Sustain. Metall.*, 7, 406 (2021).
2. Garrett Hardin, *Science*, 162, 1243 (1968).
3. Elinor Ostrom, *Science*, 325, 419 (2009).

# Protect Your Career Investment: RENEW YOUR TMS MEMBERSHIP TODAY

**Jud Ready**



"No matter the problem, TMS can connect you with experts and resources in your field that can help you find the solution."  
—*Jud Ready*

## YOUR TMS MEMBERSHIP CHECKLIST

This month, take the following steps to prepare for another successful year of TMS membership:

- ✓ When you receive your dues renewal notice, log in to [members.tms.org](https://members.tms.org) to renew.
- ✓ Review your current education, employment, and contact information—as well as technical keywords—and update any information that has changed.
- ✓ Explore the updated [members.tms.org](https://members.tms.org) website to familiarize yourself with this new destination for accessing your member benefits.
- ✓ Consider getting more involved as a TMS member, by joining a technical committee for instance, to get the most out of the networking and learning opportunities available to you.



## WHICH BENEFITS DO TMS MEMBERS VALUE MOST?

According to the results of the 2022 TMS Membership Survey, here were the most popular TMS benefits among members:

1. Free digital access to all TMS journals
2. Opportunities to network with other TMS members
3. Ability to serve on TMS committees and other volunteer activities
4. Free digital access to 20 selected journals published by Springer
5. Digital access to nearly 3,000 technical articles in the TMS Member Library

Figure 1. The TMS Membership Survey, conducted via e-mail to professional members in May 2022, revealed the top five most valuable benefits of membership in TMS.

You have probably already seen notifications reminding you that it's time to renew your TMS membership for the coming year. The next time you get one, I encourage you to take a moment to visit the TMS website and renew your membership before going on with your day. I'm telling you this because renewing your TMS membership is *crucial* to protecting the resources and aspirations you have invested in your career.

But don't just take my word for it. The well-known career platform *Indeed* recommends that individuals join a professional membership association because it allows for collaboration with others in your field, demonstrates to hiring managers that you are committed to the profession, and is an effective way to meet industry leaders. I would argue that, in our field, TMS is THE Society that can help you meet these goals.

There is strength in numbers and in diversity of thoughts and ideas. As an international professional society that brings together individuals from around the world working in a wide variety of disciplines, TMS membership provides you with a unique network of colleagues who can help you find the

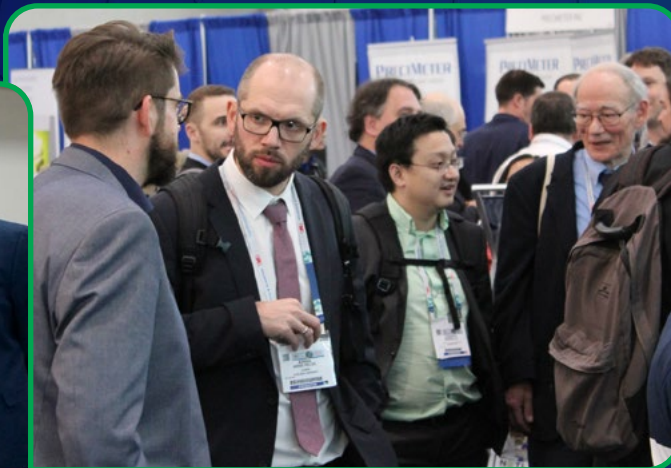
expertise you need to tackle any problem. Maybe you need professional advice on how to manage a staffing shortage, find a new job, or hire a qualified professional. Maybe you're looking for technical advice on how to integrate a new technology into your work. Or maybe you need insight into how colleagues in another country are handling issues similar to the ones you're facing. No matter the problem, TMS can connect you with experts and resources in your field that can help you find the solution.

As a current member, you are probably familiar with many of the ways that TMS keeps its community connected. We hold conferences, of course, such as the TMS Annual Meeting & Exhibition, and we share news about our members and their work every month in the pages of *JOM: The Magazine* that you receive in the mail.

This year, we asked our members to share what *their* most valued member benefits were—the ones that keep them renewing their memberships year after year—as part of the TMS Membership Survey. Figure 1 lists the top five “favorite” member benefits, according to the survey.

“I would argue that, in our field, TMS is THE Society that can help you meet these goals.”

—*Jud Ready*



I share this for two reasons: 1) Because lists make for good reading in a magazine, and 2) Because there might be a benefit on there that you haven't yet tried, but that your colleagues clearly think would be worth your while. You can learn more about any of these benefits and try them out at [members.tms.org](https://members.tms.org).

As we move into 2023, TMS will continue to offer all these benefits that our members have expressed appreciation for, even as we actively work on improving their value to members. For example, our most recent Impact Factor rankings showed that the reach and influence of all TMS journals—ranked our most popular benefit—is growing. With our return to fully in-person meetings for Materials Science & Technology 2022 (MS&T22) in October and the TMS 2023 Annual Meeting & Exhibition (TMS2023) in March, we're offering more of those popular opportunities for face-to-face networking and collaborations indicated in the survey. We've even recently expanded the TMS Member Library (ranked in the number five spot), adding close to 900 new

documents, so that this members-only archive now encompasses more than 3,400 technical articles for members to access.

In 2023, we're also making it easier for you to use these resources. TMS has remodeled the section of the website where you access your member benefits ([members.tms.org](https://members.tms.org)) to make it easier to navigate and find what you need. Be sure to spend a few minutes exploring the site and familiarizing yourself with the new layout so you'll know just where to find what you need when you need it.

In short, there are a lot of things that you can do with your TMS membership, and all of them serve to keep you connected to your colleagues and to the information and resources you need to protect your investment in your professional career.

So, take some time today to reacquaint yourself with your TMS member benefits, and when you receive your next membership dues notification from TMS, be sure to take action immediately to renew your membership for the coming year.

---

**"In short, there are a lot of things that you can do with your TMS membership, and all of them serve to keep you connected to your colleagues and to the information and resources you need to protect your investment in your professional career."**

**—Jud Ready**



# The 2021 TMS Annual Financial Report

Ellen Cerreta and  
James J. Robinson



For TMS, 2021 was a year to simultaneously honor the past and break with tradition. During this year, TMS celebrated 150 years of shared history with the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME), acknowledging a tradition of meeting and sharing research that stretches back to 1871. But 2021 also marked the first time in those 150 years when the Society's annual meeting was not held as a face-to-face event.

We honored our Society's distinguished history in a number of ways, launching a new website with an interactive timeline of milestones, releasing a new collection of recorded anniversary keynote presentations offering a look at key topics in the field today, and publishing a series of articles in *JOM: The Magazine* that together told the story of a Society that

a distance. This has since evolved into an added membership benefit that will last beyond the pandemic.

By the end of the year, we were moving toward normal operations. By October, the Materials Science & Technology 2021 (MS&T21) conference in Columbus,

**"For TMS, 2021 was a year to simultaneously honor the past and break with tradition."**

**—Ellen Cerreta and  
James J. Robinson**



Ohio, marked our first major in-person event in more than a year. As 2021 came to a close, we were looking forward to TMS2022, which would be held in person in Anaheim, California.

It was certainly not a typical year for TMS. The audited 2021 financial report presented here reflects the stress on the Society from the financial penalties we have endured from not being able to hold meetings in-person. But TMS weathered these difficult circumstances and we are optimistic about the future. Now, as we progress through 2022 and into 2023, we look forward to continuing the long-standing traditions of our past and working with the technologies that will propel us to better days ahead.

has meant a lot to its members and the profession for a long time.

At the same time, a worldwide pandemic required TMS to look at new ways to accomplish its goal of keeping connections strong among a global community of materials scientists and engineers. The TMS 2021 Virtual Annual Meeting & Exhibition, held in March, was a first for TMS members. Nearly 3,000 attendees participated, with almost 2,500 presentations delivered virtually. It wasn't how we'd hoped to spend our anniversary year, but it was a solid event that allowed our members a chance to stay connected at a time when travel wasn't possible for much of the world.

We also continued to expand our webinar offerings—available free to members—as a way to keep individuals in contact and learning from



**Ellen Cerreta**  
2021 TMS President

**James J. Robinson**  
TMS Executive Director

## WHO WE ARE

### Our Membership Totals

Students

3,597

Professionals

7,208

Total Membership

10,805

### Where Our Members Work

Academia

43%

Industry

34%

Government/Nonprofit

15%

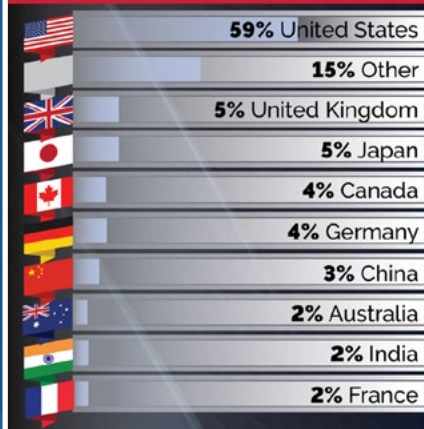
Retired

6%

Other

1%

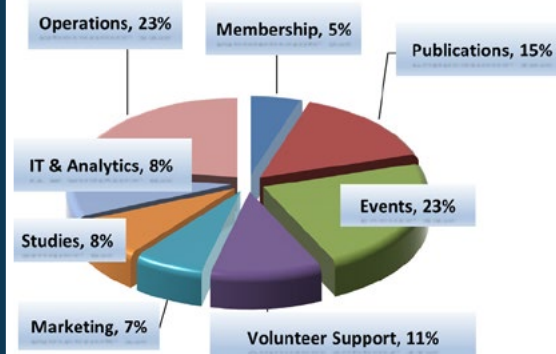
### Where Our Members Live



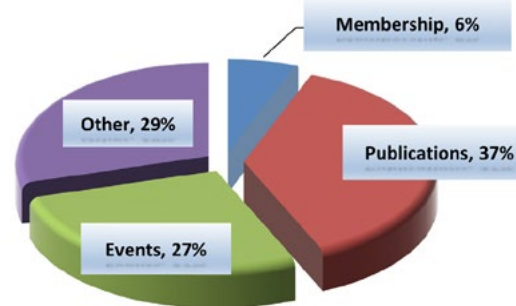
\*Percentages may not add up to 100% due to rounding.

## 2021 FINANCIAL REVIEW

### 2021 Operating Expenses by Program Area



### 2021 Operating Revenues by Program Area



### Summary Of Operations Revenues And Expenses

Years ending December 31, 2021 and 2020

REVENUES	2021	2020
Membership & Customer Service	\$402,865	\$497,488
Content	\$2,558,889	\$2,787,499
Events, Education & Exhibits	\$1,855,645	\$3,029,440
Volunteer Support	\$4,776	\$3,100
Strategic Communications & Outreach	\$41,719	\$25,141
New Initiatives, Science, and Engineering	\$176,706	\$155,576
IT and Data Analytics	\$0	\$0
Executive & Operations	\$1,792,370	\$989,097
<b>TOTAL REVENUES</b>	<b>\$6,832,970</b>	<b>\$7,487,341</b>

EXPENSES	2021	2020
Membership & Customer Service	\$312,460	\$273,382
Content	\$942,533	\$971,790
Events, Education & Exhibits	\$1,389,631	\$2,479,317
Volunteer Support	\$675,291	\$796,148
Strategic Communications & Outreach	\$428,763	\$393,139
New Initiatives, Science, and Engineering	\$487,906	\$496,746
IT and Data Analytics	\$522,278	\$485,881
Executive & Operations	\$1,411,870	\$1,386,741
<b>TOTAL EXPENSES</b>	<b>\$6,170,732</b>	<b>\$7,283,144</b>

<b>EXCESS OPERATIONS REVENUE</b>	<b>\$662,238</b>	<b>\$204,197</b>
----------------------------------	------------------	------------------





# TMS FOUNDATION

## Building a Brighter Future

The TMS Foundation 2021 Annual Report



## A LETTER FROM TMS FOUNDATION LEADERSHIP



**Garry W. Warren**  
Chair, TMS Foundation Board of Trustees Member, TMS Foundation Gold Society

In the last two years, the TMS Foundation has weathered an unimaginable storm along with the rest of the world. The uncertainty that came with the COVID-19 pandemic left many feeling vulnerable, yet the TMS Foundation has endured these global economic challenges and come out stronger. This perseverance is best demonstrated by the generosity of our donors.

21, a total of 348 individuals raised \$168,048 to increase awards for early career professionals, expand the TMS Family Care Grants program, and reinstate the Presidential

Scholarship. Sixty of those donors joined the TMS Foundation family with their first gift. During the 2021 year-end appeal campaign alone, which ran from October through the end of December, a total of \$79,924 was raised for a stronger future.

Overall, support for the TMS technical division scholarships as well as the Young Leaders Professional Development Awards grew, along with unrestricted donations to the Foundation. And 2021 saw an increase of 56 donors from 2020.

It is also worth noting the generosity of Battelle Memorial Institute and its former chief executive officer, Jeffrey Wadsworth, who each donated \$15,000 to the TMS Foundation. These contributions will ensure that the TMS Ellen Swallow Richards Diversity Award and the TMS Frank Crossley Diversity Award can both recognize recipients consistently in the future. This grant allowed the Ellen Swallow Richards Diversity Award to add a \$1,500 cash prize, and the Frank Crossley Diversity Award to add a \$500 travel stipend.

While we are all still processing and learning from the events of these last two years, know that the TMS Foundation is as strong as ever and growing still. Above all, we remain dedicated to our mission—*supporting the development of professionals in the minerals, metals, and materials community within the context of our global society*—and our goal—to *ensure the long-term sustainability and impact of the TMS Foundation programs*.

And we will continue to encourage you, colleagues and friends, to join us in achieving these objectives. Because when we work together, we can build a brighter future.

Sincerely,

"TMS membership has provided me with a community of colleagues as well as opportunities for growth in both professional development and technical research. I am very thankful for the support from the TMS Foundation, and I am looking forward to increased involvement in TMS SMD activities through this award."

—**Joy Gockel**, Wright State University, 2021 SMD Young Leader



## 2021 FOUNDATION BOARD OF TRUSTEES

### CHAIR

**Garry W. Warren**  
University of Alabama

### EXECUTIVE COMMITTEE REPRESENTATIVE

**Thomas Battle**  
Extractive Metallurgy Consultant

### TRUSTEES

**Viola Acoff**  
University of Alabama

**Brad Boyce**  
Sandia National Laboratories

**Carl M. Cady**  
Los Alamos National Laboratory

**Amy J. Clarke**  
Colorado School of Mines

**David DeYoung**  
Alcoa Technical Center

**James Foley**  
Los Alamos National Laboratory

**John Howarter**  
Purdue University

**Marc A. Meyers**  
University of California, Santa Barbara

**Ray Peterson**  
Real Alloy

**Linda Schadler**  
University of Vermont

**David Schifler**  
Office of Naval Research

**Robert D. Shull**  
National Institute of Standards and Technology

**Dan J. Thoma**  
University of Wisconsin-Madison

**Olivia D. Underwood Jackson**  
Sandia National Laboratories

### SECRETARY

**James J. Robinson**  
TMS Executive Director



The TMS Foundation supports students and young professionals with meaningful financial assistance and impactful career-building experiences. To learn more about the mission, vision, and history of the TMS Foundation, visit the About section at [www.TMSFoundation.org](http://www.TMSFoundation.org).

**PROGRAMS**

**STUDENTS**

By supporting scholarships, travel grants, and educational enrichment programs for students, the TMS Foundation helps remove barriers to education while encouraging a deeper involvement in the greater materials community.

**EARLY CAREER PROFESSIONALS**

The TMS Foundation supports professional recognition awards, opportunities for presenting work and developing symposia, and leadership development programs through its support for professionals at this key stage in their career development.


**ESTABLISHED PROFESSIONALS**

Awards supported by the TMS Foundation encourage diversity within the professions, outstanding mentors or educators, and distinguished achievements, helping to boost prestige within the fields.

**OUTREACH INITIATIVES**

The TMS Foundation also supports the *Materials Explorers™* high school outreach program and the TMS Bladesmithing Competition for college students, as well as student participation in the Electronic Materials Conference and the ASM Materials Camps.

“I am very grateful to the TMS Foundation for their support. Their efforts enrich TMS by fostering a strong and supportive community for young members and early career scientists. Through TMS events, the TMS Foundation catalyzes relationships among professionals from industry, academia, and national laboratories.”



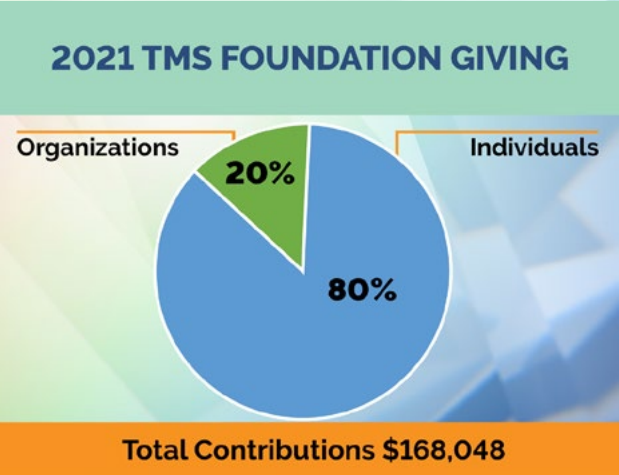
—James Pikul, University of Pennsylvania, 2021 Early Career Faculty Fellow

*The TMS Foundation is a unit of The Minerals, Metals & Materials Society (EIN: 25-1484913), which is a qualified 501(c)3 tax-exempt organization. Official registration and financial information may be obtained from the Pennsylvania Department of State by calling toll-free, within Pennsylvania, 1-800-732-0999. Registration does not imply endorsement.*

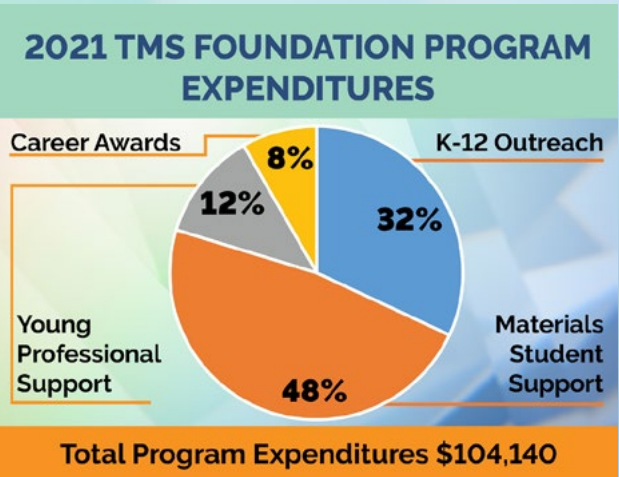
**TMS FOUNDATION 2021 FINANCIAL OVERVIEW**

The financial information below provides two perspectives on the TMS Foundation's performance in 2021:

- Donations, inclusive of new endowments being established
- Program expenditures, including all gifts issued through the Foundation



CONTRIBUTIONS	% Total	
Individuals	80%	\$133,748
Organizations	20%	\$33,300



PROGRAM EXPENDITURES	% Total	
K-12 Outreach	32%	\$33,450
Materials Student Support	48%	\$49,596
Young Professional Support	12%	\$12,500
Career Awards	8%	\$8,594

## THANK YOU TO OUR 2021 DONORS

In addition to special donor groups like the **1871 Legacy Circle** for individuals who have provided for the TMS Foundation through planned giving, the TMS Foundation celebrates its donors through its **Lifetime Giving Honorable Societies** and the **Annual Giving Honor Roll**. With their generous contributions to the TMS Foundation, our donors are making a significant and permanent impact on the future of the minerals, metals, and materials professions.

To view current members of both honor rolls, visit [www.TMSFoundation.org/HonorRolls](http://www.TMSFoundation.org/HonorRolls).



“ You who are gathered here this evening are not only resilient in your own lives, but you also reached out to others in need in their lives with your financial generosity. Although the world changed, the need did not. The TMS Foundation and its many beneficiaries are deeply grateful to you. ”

—Garry Warren, 2021 Foundation Board of Trustees Chair, at the TMS2021 Virtual Donor Appreciation Event (photo taken in 2022)

### ORGANIZATIONAL GIVING



You can make a difference, too, by donating to the TMS Foundation online or mailing a check, payable to the TMS Foundation, to the address below.

[www.TMSFoundation.org](http://www.TMSFoundation.org)  
1-724-776-9000  
[TMSFoundation@tms.org](mailto:TMSFoundation@tms.org)

**TMS Foundation**  
5700 Corporate Drive Suite 750  
Pittsburgh, PA 15237



# Meet Abby Cisko, Home Renovator

Kelly Zappas

“Ever since I was young, I tagged along with dad a lot. He taught me everything that I know, from electrical to plumbing to structural.”

—Abby Cisko



By day, TMS Member Abby Cisko is a research mechanical engineer in the U.S. Army Corps of Engineers. But when she leaves the office, she typically begins a different kind of work—on her home renovation projects. In her free time, she remodels, rebuilds, and, more recently, builds houses from scratch.

Home renovation is something she first learned about from her father—who worked in construction—and she supplemented this knowledge with skills she picked up in her engineer training. It all started, however, because she needed a practical way to afford a house while going to graduate school.

## The Houses

When Cisko got accepted to the University of Alabama's (UA) Ph.D. program, she needed a place to stay—and she knew she didn't want to spend four years paying rent. Instead, she decided to invest in a house and renovate it. She found a local bank that was willing to give a loan to a student, bought her first house, and enlisted the help of her father to begin the renovation work.

“Ever since I was young, I tagged along with dad

a lot. He taught me everything that I know, from electrical to plumbing to structural,” said Cisko. “We spent one very hot summer in that house in Alabama, renovating it. We completely gutted it, took out the fireplace, opened up the kitchen, and remodeled the floor.”

Once the house was complete, she not only had a place to live, but a source of income, as well. Because Alabama is a big football school, she was able to rent the house to fans on weekends when the team played home games and made enough money from those seven or eight weekends to pay her mortgage for the



Abby Cisko works to clear the land for her latest project.

This article is part of an occasional feature series in which *JOM: The Magazine* shares stories about members and their hobbies, interests, and experiences outside of their TMS membership. To suggest a candidate for this feature, contact *JOM: The Magazine* Principal Editor Kaitlin Calva at [kcalva@tms.org](mailto:kcalva@tms.org).



year. Later, she got roommates whose rent helped cover expenses. When she finished grad school, she sold the house and was ready for a new project. She used some of the money from the sale of her first house and "impulse bought" a second house in Atlanta near where her parents live.

"It was completely fire damaged. There was soot everywhere, but it was very, very cheap and in a decent location," said Cisco. "I spent weekends going back to work on it while I was finishing my dissertation. Basically, I had to gut everything because of smoke damage and take it down to the studs. My dad and I rewired it, because that's where they think the issue started with the fire."

While she was still finishing the house in Atlanta, she found another house in Vicksburg, Mississippi, that was close to her new job.

"I found a house that had been built in the 1800s,

---

**"To be able to take what was abandoned and had a lot of issues and bring it back to what it previously was is exciting."**

**—Abby Cisco**

---

that had been foreclosed on, and that had been vacant for a year and a half," she said. "There was definitely a lot of work to be done."

When she started investigating the termite damage that would need to be fixed, she found that, for a little bit extra money, she could create an addition to the house.

"This was probably my favorite house that I've done," she said. "The craftsmanship in an 1800s house is just something you don't see in newer houses. When you're taking it apart, you find stamps from

**BEFORE AND AFTER:  
Tuscaloosa, Alabama**



Top: A kitchen from House #1 in Tuscaloosa, Alabama before remodel. Bottom: Kitchen after remodel.

With every project Cisco tackles she learns new skills and how to use a variety of construction equipment.







Abby Cisko is ready to take on any project with the help of her friends—like dismantling a fireplace, as shown here.

the 1800s and nails that were square and had been handmade. It's really cool to see that someone took the time and effort to do that. To be able to take what was abandoned and had a lot of issues and bring it back to what it previously was is exciting."

Remodeling the houses has kept her busy, but Cisko enjoys having a project to work on.

"After work, it's a good way to clear my head. I'm definitely a hands-on type of person," she said. "I find it relaxing, and I love seeing the before and after."

### A Learning Experience

Cisko has always been interested in things like architecture, modeling, and designing. She says that her engineering training in computer-aided design (CAD) has helped her in these respects.

"I can make a CAD or AutoCAD design of the current house and redesign it how it should be," she said. "That helps with layout—being able to see that this is going to go here and that is going to go there."

Cisko has gained experience in all aspects of building and remodeling over the years, having done most of the work on the houses herself—with help from her father and, on occasion, from friends, as well.

"Somehow my friends always get roped into helping," she said. "In the first house I bought, there was a huge fireplace in the center of everything,

**"I was one of the first girls to get her Ph.D. in mechanical engineering at UA. To me, it just shows that girls can do anything."**

**—Abby Cisko**

essentially blocking it from being open. So I paid for beers and food and gave all my friends sledge hammers to help me demolish it. I have great friends."

In the cases when she has needed to get quotes from contractors to help with a project, she said that they often assume that she doesn't understand anything about building.

"They're always a little taken aback when I start making suggestions," she said. "It's the same thing with engineering. I was one of the first girls to get her Ph.D. in mechanical engineering at UA. To me, it just shows that girls can do anything. It's been cool to do stuff that's been traditionally thought of as male dominated and show that I can do it, too."

### What Comes Next

Cisko is currently living in the third home from the 1800s, and her renovations there are nearly complete. That means it was time for a new challenge: building a house from the ground up.

### BEFORE AND AFTER: Flat Shoals, Georgia



Top: A kitchen from House #2 in Flat Shoals, Georgia before (showing fire damage) Bottom: Kitchen after remodel.

**BEFORE AND AFTER:  
Vicksburg, Mississippi**



Left: Outside view from House #3 in Vicksburg, Mississippi before remodel. Right: Outside view after remodel.

“Because I never like to have a break in between my projects, I just bought 45 acres,” she said.

This time, her fiancé is part of the team that is helping her. While he wasn’t terribly interested in home renovations before he met her, she and her father have been able to teach him a lot as they work on this new project. In turn, he taught her how to run the equipment to clear and level the land before building.

Once again, Cisko has been able to use her CAD

**“Each house has a special place with me and each one shows how I have grown as a person.”**  
—Abby Cisko

skills to draw out a design plan for the new house, but she has also had to learn a few more skills in building from scratch. Building walls, placing them, and anchoring them are all things you don’t have to do when you’re renovating an existing structure, but are key to building.

“It’s been really awesome to see it go from land with a bunch of stumps to being able to see where everything is going to be and how it’s going to look,” she said.

For now, the new house is occupying Cisko’s time. Once it’s finished, she may decide to build another house on the property. Or she might build her own wedding venue. She says she has a number of ideas, but one thing is certain: she’s not finished with building and renovations.

“I always tell people I’m going to take a break. I’m not going to buy another house, but then I see one and I need it,” she said.

With each house she’s worked on, Cisko has grown more confident and less reliant on help from her father.

“Each house has a special place with me and each one shows how I have grown as a person,” she said. “My style has changed, the things I feel comfortable doing has changed. In that first house, I was just trying to learn more from my dad. It was definitely a growing experience. At first, I was constantly checking in with my dad. Now, I feel way more comfortable doing things myself.”

**Meet Abby Cisko**

Abby Cisko graduated with a Ph.D. in mechanical engineering from the University of Alabama. She currently works as a research mechanical engineer in the U.S. Army Corps of Engineers, where she is with the Airfields and Pavements Branch at the U.S. Army Engineer Research and Development Center.

As part of her work, she helped to design a new airfield matting system—an interconnected system of panels that can be laid down and interlocked to create a temporary airfield where fighter jets can land. It was her work on this project, which required a building material that was strong enough to withstand the weight of massive planes but light enough to be portable, that led her to materials science and engineering.

During her Ph.D. work, she came across an aluminum lithium material that she researched for potential use in a matting system. Now, working full time with the U.S. Army Corps of Engineers, her team has extruded and made a mat out of the material that she researched for her Ph.D.

Cisko has been a TMS member since 2018 and has been active with the TMS Emerging Professionals Committee. She served first as secretary, then vice-chair, and then chair of the committee and organized the Student Career Forum event at past TMS Annual Meetings.

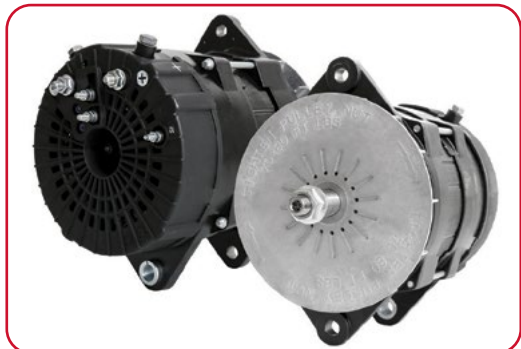


Abby Cisko first discovered her love of home renovation when she was earning her Ph.D. at the University of Alabama.



*In Case You Missed It:*

# BUSINESS NEWS FROM THE FIELD



**Novi, Michigan, USA:** Prestolite Electric, a leading global manufacturer of alternators and starters, has introduced a new extreme-use product lineup—the IdlePro Extreme M-Series alternators—that delivers industry-leading performance and extended protection against dust and particle infiltration for use in mining worksites around the world. The new product assortment includes a variety of voltage, amps, and mounting configurations for extended flexibility and coverage in the field. Assembled in the United States, the innovative new IdlePro Extreme M-Series high-efficiency/high-output alternators also include unique technologies that help extend service life and increase vehicle uptime by enhancing electrical system and engine performance. (Photo Credit: Prestolite Electric)

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.



**Coeur d'Alene, Idaho, USA:** Hecla Mining Company, the largest silver producer in the United States, plans to purchase Alexco Resource Corp., owner of the Keno Hill Silver District project in Yukon. With the purchase, Hecla would become the largest silver producer in Canada. Alexco's 242-square-kilometer (93 square miles) Keno Hill property covers one of the highest-grade silver districts in the world. According to the most recent calculation, Keno Hill hosts 1.44 million metric tons of probable reserves averaging 804 grams per metric ton (37.19 million ounces) silver, 3.84% (122 million pounds) zinc, and 2.64% (84 million pounds) lead in four deposits: Bellekeno, Lucky Queen, Flame & Moth, and Bermingham. (Photo Credit: Alexco Resource Corp.)

## Argentina Attracts Lithium Investment

**Buenos Aires, Argentina:** Miners Ultra Argentina SRL and China's Zangge Mining agreed to invest \$290 million to explore and develop lithium deposits in northwest Argentina and to build a plant. Zangge Mining will initially invest \$40 million in the exploration and development of the Laguna Verde lithium project in the province of Catamarca. A further investment of \$250 million is planned at a later stage for the construction of a lithium carbonate processing plant. Argentina's government has projected to receive a \$4.2 billion combined investment in its growing lithium market over the next five years, which would help the nation to double production in 2023, reaching 175,000 tonnes in 2025.

## NIST Awards AM Grants

**Gaithersburg, Maryland, USA:** The U.S. Department of Commerce's National Institute of Standards and Technology (NIST) has awarded \$3.7 million in grants to help address current and future barriers to widespread adoption of metals-based additive manufacturing (AM) through measurement science research. The following organizations will receive NIST Metals-Based Additive Manufacturing Grants Program funding to be spent over two years: The Research Foundation for the State

University of New York (\$957,706); Colorado School of Mines (\$956,888); Auburn University (\$949,075); and General Electric, GE Research (\$873,999). Through its own research and with these grants, NIST is addressing barriers to adoption of additive manufacturing, including measurement science to support equivalence-based qualification and model-based qualification, the characterization of AM materials, and standards to support consistent data exchange/characterizing new advances in AM production systems.

## Galileo Mining's Norseman Reveals Rhodium

**West Perth, Australia:** Galileo Mining Ltd. unearthed extensive continuity of rhodium mineralization at the Callisto palladium-platinum-gold-copper-nickel discovery at the Norseman project in Western Australia. Rhodium mineralization was discovered in the first four drill holes of the second reverse circulation (RC) drilling program. The occurrence of this rare metal, which is predominantly used in automotive catalysts for pollution control, has considerable potential to add value to the Callisto project and builds confidence in the interpreted mineralization model. Rhodium is produced as a by-product of platinum, palladium, copper, or nickel mining.

# TMS MEETING HEADLINES

TMS is committed to your safety during the pandemic. Meeting dates and locations are current as of August 31, 2022. For the most recent updates on TMS-sponsored events, visit [www.tms.org/Meetings](http://www.tms.org/Meetings).



## TMS 2023 Annual Meeting & Exhibition (TMS2023)

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

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

TMS2023 will feature high-quality technical programming, but the real reason that attendees keep coming back year after year is the valuable interactions with their fellow members. See what previous attendees have to say about the meeting in the Attendee Toolbox section of the TMS2023 website and make your plans to attend today.

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



## Superalloy 718 & Derivatives 2023

May 14–17, 2023  
Pittsburgh,  
Pennsylvania, USA

**Discount Registration  
Deadline:  
April 3, 2023**

Superalloy 718 & Derivatives 2023 will cover topics on broad industrial applications for a cross-section of industries, including supply chain, energy, and aerospace. Leading names in the field are involved as presenters or engaged in stringently curating presentations to ensure the highest quality programming. Start planning now to join colleagues and make new contacts.

[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 will convene leading researchers and practitioners to share the latest knowledge and advances in the discipline. This congress is the recognized hub of interaction among software developers and process engineers along the entire production chain, as well as for materials scientists and engineers developing new materials.

[www.tms.org/ICME2023](http://www.tms.org/ICME2023)



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

November 12–16, 2023  
Pittsburgh,  
Pennsylvania, USA

**Abstract Deadline:  
June 16, 2023**

HEA 2023 is a cross-disciplinary technical forum designed to share the latest research advances in single-phase and multiphase metallic, intermetallic, and ceramic high entropy materials for functional or structural applications. It will feature technical talks on topics including fundamental theory of alloy design, computational modeling and simulation, and more.

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

## Other Meetings of Note



## Materials Science & Technology 2023 (MS&T23)

October 1–5, 2023  
Columbus, Ohio, USA

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



## TMS 2024 Annual Meeting & Exhibition (TMS2024)

March 3–7, 2024  
Orlando, Florida, USA

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



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

September 8–12, 2024  
Champion, Pennsylvania, USA

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



## TMS 2025 Annual Meeting & Exhibition (TMS2025)

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

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





Join us as the TMS Foundation works to expand scholarships, Family Care Grants, and early career support in the materials science and engineering community.

*Support the TMS Foundation  
2022 Year-End Appeal.  
Donate Today!*

[www.TMSFoundation.org/  
Contribute](http://www.TMSFoundation.org/Contribute)

## **I'VE SPECIALIZED FOR 43 YEARS**

in the placement of Metallurgical, Materials, and Welding Engineers in the areas of R&D, Q.C. Production, Sales & Marketing, nationwide.

***My background as a  
Met. Eng. can help you!***

***Salaries to \$190K.***

***Fees paid by Company.***

**Michael Heineman,  
Meta-Find, Inc.**

Phone: (212) 867-8100

E-mail: [mikeh@meta-findny.com](mailto:mikeh@meta-findny.com)

Web: [www.meta-findny.com](http://www.meta-findny.com)

THE WORLD COMES HERE.

# **TMS 2023**

**152<sup>nd</sup> Annual Meeting & Exhibition**

**MARCH 19–23, 2023**

**SAN DIEGO, CALIFORNIA, USA**

**#TMSANNUALMEETING**

**MARK YOUR CALENDAR  
WITH THESE KEY DATES:**

**October 2022:** Registration Opens

**January 31, 2023:** Registration Deadline

**February 23, 2023:** Housing Deadline

**March 19–23, 2023:** Conference Dates

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





THE ADVANCED MATERIALS MANUFACTURER®

# Now Invent.™

The Next Generation of Material Science Catalogs

Over 35,000 certified high purity laboratory chemicals, metals, & advanced materials and a state-of-the-art Research Center. Printable GHS-compliant Safety Data Sheets. Thousands of new products. And much more. All on a secure multi-language "Mobile Responsive" platform.

**American Elements Opens a World of Possibilities.... Now Invent!**

[www.americanelements.com](http://www.americanelements.com)