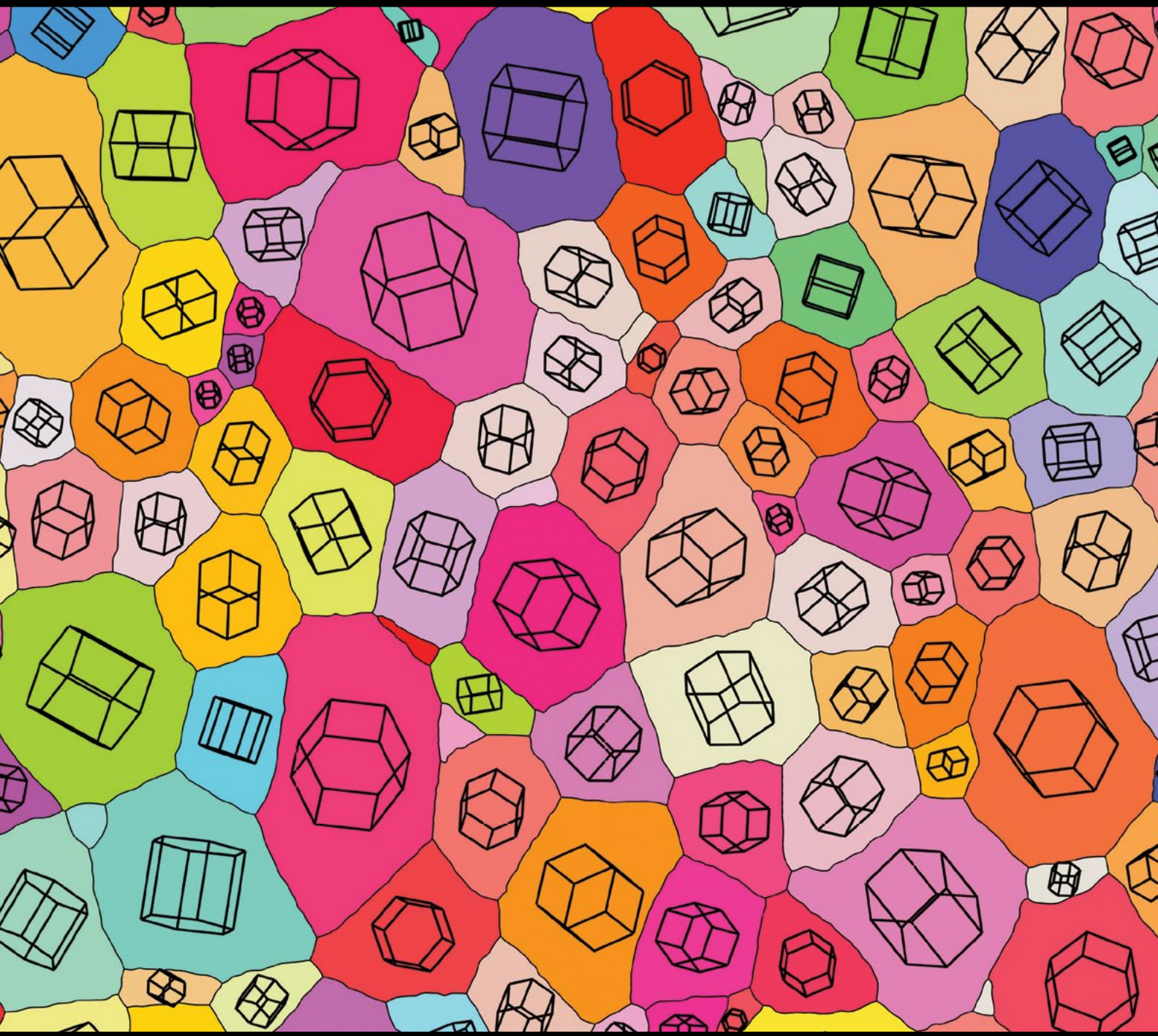
JOM

MAY 2021
jom.tms.org

An official publication of The Minerals, Metals & Materials Society

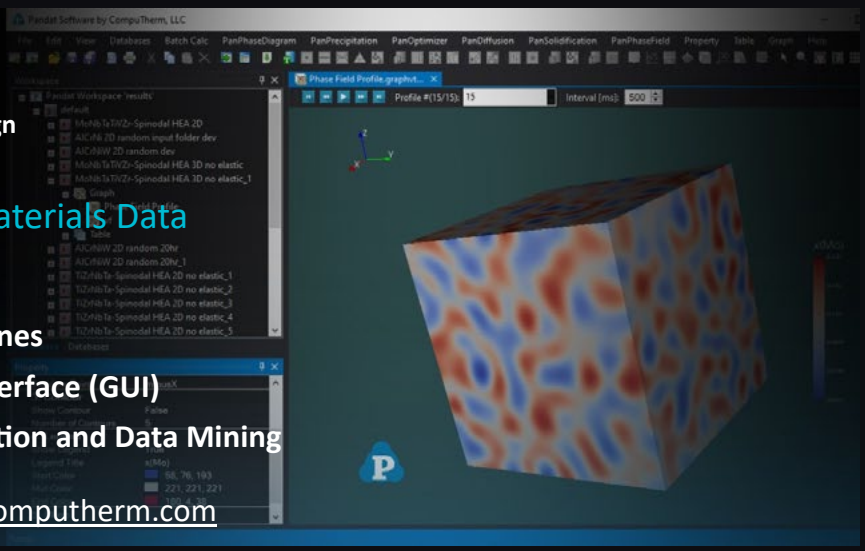


THE TMS FOUNDATION IN 2020: View the Honor Rolls and More

TMS
Springer

Pandat Software

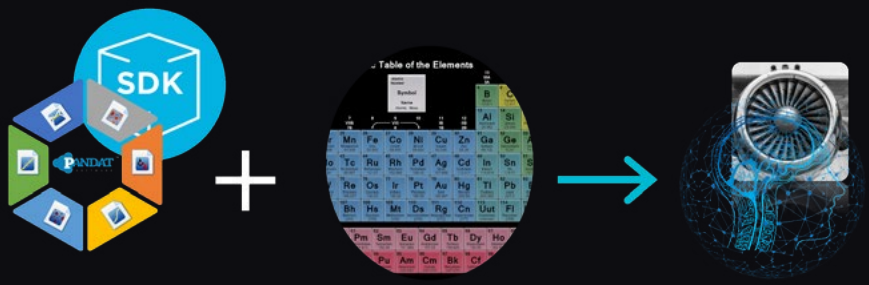
An Integrated Modeling Platform for Materials Design



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 Email: info@computherm.com

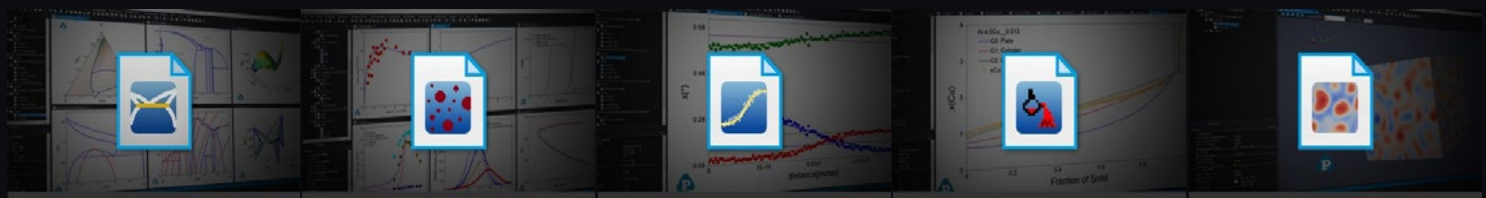


Pandat Software + PanDatabases → ICME & MGI Applications

- 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 nucle-ation, growth and coarsening
- particle size and size distribution
- multi-phase co-precipitation

PanDiffusion

- diffusion couple
- homogenization
- carburization and decarburization
- particle dissolu-tion

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

JOM

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TMS
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About the Cover

A representation of EBSD data from "Coupling thermomechanical processing and alloy design to improve textures in Mg-Zn-Ca sheet alloys," by Tracy Berman and John E. Allison, is shown on the cover. The effect of Ca and Zn additions on the microstructure and texture evolution during thermomechanical processing of Mg-Zn-Ca sheet alloys was systematically investigated and quantified in this investigation. Increasing Zn content resulted in more random grain orientations in the as-deformed state, as illustrated here in the ZX30 alloy.

May 2021 Guest Editors

8th European Conference on Renewable Energy Systems
Shadia Ikhmayies, Consultant
Hilal Kurt, Gazi University

Adaptive Metallurgical Processing Technologies for Strategic Metal Recycling
Recycling and Environmental Technologies Committee
Mingming Zhang, Wood Mackenzie

Developments in the Production of Magnesium Alloy Flat Products
Magnesium Committee
Jishnu J. Bhattacharyya, University of Virginia
Aeriel Murphy-Leonard, Ohio State University

Thermodynamic Considerations for Improved Renewable Energy Production
Process Technology and Modeling Committee; Recycling and Environmental Technologies Committee
Fiseha Tesfaye, Abo Akademi University

About JOM:

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

About TMS:

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

Publishing Information:

JOM is an official publication of The Minerals, Metals & Materials Society and is owned by the Society.

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Springer, 233 Spring Street, New York, NY, 10013-1578, USA

JOM articles from 1949 to the present are archived at http://link.springer.com/journal/volumesAndIssues/11837.

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Thermodynamic Considerations for Improved Renewable Energy Production

Technical Articles

AIME-TMS ANNIVERSARY

AIST SME AIME SPE TMS

1871 Celebrating 150 Years 2021

150 years ago on May 16, 1871, in Wilkes-Barre, Pennsylvania, 22 mining engineers came together to form the American Institute of Mining Engineers, now the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME). As AIME is our parent organization, TMS is celebrating this historic milestone, too!

HELP US CELEBRATE ALL YEAR LONG!

Learn more about TMS and our shared history with AIME:

- Discover the TMS History Timeline
- Download the digital AIME History Walk companion booklet
- Watch the AIME Oral Histories, featuring prominent TMS members
- Keep reading *JOM* for more historical content

EXPLORE 150 YEARS OF THE MINERALS, METALS, AND MATERIALS COMMUNITY.

www.tms.org/OurHistory

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04648-4

in the final analysis

"Ah, there you are! And just in time . . . there's a little matter I forgot to mention—beware of hitchhiking ghosts! They have selected you to fill our quota, and they'll haunt you until you return! Now I will raise the safety bar, and a ghost will follow you home!"

—"Ghost Host" of Disneyland's Haunted Mansion

JOM
Volume 73
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I have Disneyland on the mind as I am looking forward ten months to when TMS will (surely, oh surely) convene an in-person annual meeting in Anaheim, California. Our event site is literally across the street from Disneyland and Disney's California Adventure. So, if you missed pinning a trip to Disney World as part of your travel to TMS2021 after our switch from Orlando to virtual, the Anaheim event may present you with a similar opportunity. No secret revealed: I'm a Disney aficionado, so you can bet that I'll be tacking a Disney visit to the end of TMS2022.

My favorite Disney attraction is the Haunted Mansion. It is silly spooky, not scary spooky, and the effects are immersive and clever on a grand scale as only Disney can do it. While the attraction dates back to the 1960s, it is oddly prescient to our times with its promise that "a ghost will follow you home." Thanks to cookies, web targeting, ad trackers, and other coding tools, the ghosts that follow us home today are algorithm ghosts intent on narrowcasting news, ads, and other content centered on our specific interests.

A practical example: One of the professional societies to which I belong has a daily e-newsletter on association management. Finding more and more headlines worthy of a click, my curiosity led me to learn that an algorithm was custom-compiling articles for me based on my story clicks within past newsletters. I kind of like that, and I kind of don't like that. Reservations aside, is the algorithm ghost getting it right? Consider some recent articles presented in the customized-to-Jim newsletter:

- "Planning for an Uncertain Future Requires Open Ears, Communication, and Empathy"
- "What to Consider When Crafting COVID-19 Vaccine Policies"
- "Six Office Policies You Should Reconsider for a Hybrid Workplace"
- "How Associations Can Thrive in a 'Virtual Everything' World"
- "Apply Pandemic Lessons to Evolve and Improve Your Business Continuity Plan"
- "4 Guiding Principles for Virtual Events"
- "Hybrid Event Strategies: Get the Best of Both Worlds"
- "Six Ways to Make 2021 the Year of the Volunteer"
- "Are Your Member Perks Inviting Churn?"
- "Reap the Benefits of Identity-Based Member Communities"

Looks like the algorithm ghost thinks that I care about business management, events, workplace health and dynamics, member service, and leadership. I do, among many, many other things—whatever is necessary and honorable to benefit TMS while sustaining and growing it as a smooth-running, mission-focused organization with meaningful and well-received member services delivered with the support of an empowered and capable staff. I think that is what the TMS Board of Directors expects of me in service of the TMS membership and the greater materials science and engineering community. It is certainly what I expect of myself.

Toward that end, I enjoyed another story: "Tim Cook Says This is the Question Every Leader Should Ask." The question is not, "How much can we get away with?" but rather, "What are the consequences?" I respect the CEO of Apple, but I wonder if a better (unfortunately longer) question is, "What is the right thing on which to focus, and how can we be effective in directing our efforts?" Addressing this question leads us to consider ethics, tactics, metrics, and outcomes. The algorithm ghosts can serve me articles on those topics every day.

James J. Robinson
Executive Director
@JJRofTMS

"Looks like algorithm ghost thinks that I care about business management, events, workplace health and dynamics, member service, and leadership. I do, among many, many other things."

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04649-3

JOM themagazine

member news

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

AIME Founded 1871

TMS Receives AIME Grant; Material Advantage Member Bringing MSE to the Public

AIME Provides Support to TMS and Other Member Societies

The American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) approved a $1 million grant in February 2021 to its member societies, which include TMS, to mitigate the negative impact on society operations associated with the COVID-19 pandemic. AIME's member societies include TMS; the Association for Iron & Steel Technology (AIST); the Society for Mining, Metallurgy, and Exploration (SME); and the Society of Petroleum Engineers (SPE). The grant will be divided equally among the four groups.

"The COVID-19 pandemic has presented unprecedented challenges to the association community, including the disruption of convening people for knowledge sharing and networking," said George Luxbacher, AIME president. "All have had to pivot to new ways of delivering member value, some requiring significant new resources. AIME hopes that this increased support will ease the transition."

For TMS, delivering member value in the past year has included establishing the COVID-19 Resource Portal, providing meaningful virtual conference experiences, and engaging online professional development courses, and building a robust library of webinars that members can access at no charge.

"This grant will support TMS as we weather disruptions to many of our traditional activities and pivot toward new ways of better serving our members around the world during the pandemic," said James J. Robinson, TMS executive director. "We greatly appreciate the support of AIME in helping us meet these goals. I think it is fitting that, as we celebrate the 150th anniversary year of AIME, we are working together to develop new capabilities that will serve our members far into the future."

The American Institute of Mining, Metallurgical, and Petroleum Engineers was founded in 1871 by 22 mining engineers in Wilkes-Barre, Pennsylvania, USA, and celebrates its 150th anniversary in 2021. TMS will be celebrating the AIME anniversary year at the TMS 2021 Virtual Annual Meeting & Exhibition, March 15–18, 2021, and at the TMS 2022 Annual Meeting & Exhibition, February 27–March 3, 2021, in Anaheim, California, USA.

Paul Ohodnicki

Paul Ohodnicki Receives ARPA-E Grant

Paul Ohodnicki, associate professor of mechanical engineering and materials science at the University of Pittsburgh (Pitt), received $1 million from the U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E) Rapid Encapsulation of Pipelines Avoiding Intensive Replacement program.

Ohodnicki's lab at Pitt will collaborate with other research groups at Pitt and Pacific Northwest National Laboratory on their project, "'Innervated' Pipelines: A New Technology Platform for In-Situ Repair and Embedded Intelligence." The award was announced in November 2020, and work on the project began in January 2021.

The "innervated" pipelines will mimic the nervous system with optical fiber sensor technology embedded into the internal pipelines of critical infrastructure, such as natural gas pipelines. Through the combination of embedded sensors, artificial intelligence, and machine learning, this smart monitoring technology would allow for targeted repair of the "intelligent" pipelines with robotic crawlers, reducing both the time and cost of repairs.

Ohodnicki has been actively involved in several committees since becoming a TMS member in 2009. In 2010, he received the Functional Materials Division (FMD) Young Leaders Professional Development Award. He currently serves on the TMS Board of Directors as FMD Director/Chair. In 2016, he received a Presidential Early Career Award in Science and Engineering from the Department of Energy. And in 2019, his work on cobalt-based nanocrystalline alloys for gapless inductors earned him an R&D 100 Award.

Material Advantage Student Launches MSE Podcast

Material Advantage member Punith Upadhya and co-host Thomas Miller are bringing materials science and engineering (MSE) to a new audience through their podcast, *It's a Material World*.

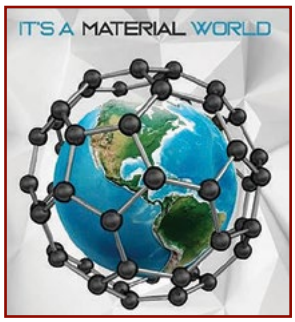
The podcast markets itself as "the show that uncovers why materials science will change the world," and it delivers on that promise through a series of episodes with guests who discuss "the secret interactions materials science has in our everyday lives." From using nanotechnology in the fight against COVID-19 to exploring how materials innovations help engineer better clothing, each episode gives listeners a glimpse into some of the ways that materials science influences the world around them.

Upadhya is currently pursuing his M.S. in MSE at Georgia Institute of Technology (Georgia Tech) with a focus on nanomaterials and biomaterials. Miller recently completed his B.S. in MSE at Georgia Tech where his primary interest was in functional materials. The pair conceived the idea for their podcast in the summer of 2020 when their internships transitioned to a virtual environment and were delayed due to COVID-19. They channeled their new-found free time into planning and launching the podcast and the first episodes were posted by August that year.

Miller notes that one goal for the podcast is to highlight MSE "as a lens to look at solutions to some of the biggest problems we're facing right now in the world" and "a discipline uniquely equipped to solve these problems." Upadhya has similar hopes for the podcast showing the general public how "materials science and engineering plays a role in our everyday lives, and how innovations in this field will dramatically change the world." Ultimately, the pair hopes the podcast will also encourage more students to pursue a career in MSE.

It isn't all work, though: both hosts set out to have a good time discussing MSE and their earnest interest in the topics ropes listeners in. "My favorite part about the podcast is the guests we get a chance to talk to," Upadhya says. "Each of our guests have an impressive foundation of knowledge, and we hope their passion for the field resonates with our listeners."

New episodes are uploaded every two weeks and can be accessed on your preferred podcast platform or at https://link.chtbl.com/ymvMBLjb?sid=tms.



Thomas Miller (left) and Punith Upadhya (right) are bringing materials science and engineering concepts to the public with their podcast, *It's a Material World.*

In Memoriam

TMS extends its condolences to the family, friends, and colleagues of Michael Loretto, emeritus professor at the University of Birmingham, who passed away in January 2021. He received his B.Met. in 1955 from Sheffield University and his D.Sc. in 1972 from the University of Birmingham.

Loretto's career spanned the globe and bridged sectors, as he held positions at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia, Battelle Memorial Institute in the United States, and the Cavendish Laboratory at the University of Cambridge and the Interdisciplinary Research Centre (IRC) in Materials for High Performance Applications at the University of Birmingham in the United Kingdom. He also published about 300 papers and conference presentations over the course of his career. In 2011, he retired from his role as director of the IRC but remained actively involved in the programs he established while there.

A longtime TMS member, he was recognized at TMS 2014 Annual Meeting & Exhibition with a special symposium, A Lifetime of Experience with Titanium Alloys: An SMD Symposium in Honor of Jim Williams, Mike Loretto, and Rod Boyer. In 2015, he received the TMS Cyril Stanley Smith Award.

Michael Loretto (right) receives the 2015 Cyril Stanley Smith Award from 2014 TMS President Hani Henein.

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04650-w

In Case You Missed It:

Business News from the Field

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

Zero-Gravity Printing Put to the Test

Munich, Germany: Researchers at the Munich University of Applied Sciences tested a new additive manufacturing process for orbiting spacecraft in collaboration with the European Space Agency. The team developed a 3D printer that extrudes liquid photopolymer, applies ultra-violet light to harden structures quickly, and moves the print head three-dimensionally rather than in a layer-by-layer traditional movement. Testing took place on parabolic flights. Components printed in spacecraft may be tailored to their purposes in comparison to Earth-made counterparts that must be oversized and built to withstand the forces of rocket launch.

EMX and Esan Partner in Turkish Mine

Vancouver, Canada: EMX Royalty Corporation with operating partner Esan Eczacibaşi Endüstriyel Hammaddeler San ve Tic AŞ began construction on a lead-zinc-silver royalty property in northwestern Turkey. Commercial production may start as early as the fourth quarter of 2021. EMX acquired the project's mineral rights via its exploration programs, and then sold the property while retaining a 4% net smelter return. The property is situated in Balya mining district where there are extensive zones of carbonate replacement style lead-zinc-silver mineralization in addition to skarn and more copper-rich styles of mineralization developed at depth.

Monterey, California, USA: Xerox Corporation deployed ElemX 3D printer for research activities at the U.S. Naval Postgraduate School. ElemX is one of the first products to employ a production methodology called liquid metal jet printing (LMJP). University trials found LMJP up to 10 times faster and one-tenth the cost of prevailing additive manufacturing methods. Liquid metal jet printing may also lead to a 30% or greater increase in overall tensile strength. The printer could facilitate the mass production of parts for defense, aerospace, heavy equipment, and oil and gas applications in the future. (Photo by Petty Officer 3rd Class Leonard Weston, Naval Postgraduate School.)

ARM Begins Platinum Project

Johannesburg, South Africa: African Rainbow Minerals (ARM), a diversified mining company, is moving forward on the Merensky reef project at the Two Rivers platinum group metals (PGM) mine, near Burgersfort, South Africa. The project will produce 182,000 six-element PGM ounces, 1,600 tonnes of nickel, and 1,300 tonnes of copper a year. Two Rivers is a joint venture between ARM, at 51%, and Impala Platinum Holdings Limited, at 49%.

Steel Dynamics Readies New Mill

Fort Wayne, Indiana, USA: Steel Dynamics Inc. (SDI) plans to begin operations this summer at its new $1.9 billion flat-rolled steel mill in Sinton, Texas, as the pandemic has not impacted construction. The new state-of-the-art electric-arc-furnace flat roll steel mill is expected to have an annual production capacity of approximately three million st and is strategically located within the southwestern U.S. and Mexican markets. At least three SDI customers have committed to locating operations on the mill's campus, representing one million tons of annual processing and consumption capacity.

New Magnesium Alloy Thwarts Corrosion

Geesthacht, Germany: Scientists at the Helmholtz-Zentrum Geesthacht Centre for Materials and Coastal Research created an alloy with pure magnesium and very small amounts of calcium that achieved an exceptionally low corrosion rate. The calcium reduces the cathodic water reduction kinetics, allows the development of a protective surface film, and stabilizes impurities within the alloy. The alloy was comparable to stainless magnesium in corrosion resistance. The discovery may impact the light metal's use in industry, where magnesium alloys are valued for automotive, aerospace, electronics, biomedical, and energy-storage applications.

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04651-9

The TMS Foundation: Standing Strong in 2020

Kaitlin Calva

"In a year full of challenges like no other, the TMS Foundation held tight to its mission and persevered…"

Coming out of a year of change for the TMS Foundation, 2020 began just as exciting as its predecessor. The TMS Foundation Board of Trustees and TMS Board of Directors met for a retreat at the TMS 2020 Annual Meeting & Exhibition in February 2020, at which members of both boards reaffirmed their commitment to the mission of the Foundation and made plans for engaging the Society in their philanthropic goals. The board members went forth, recognizing the challenge that lay ahead but nonetheless optimistic and enthusiastic about the future. Several weeks later, the challenge grew with the COVID-19 pandemic.

The pandemic, however, demonstrated just how great the need is to provide for students and young professionals, who are still facing unprecedented roadblocks to their career paths. In a year full of challenges like no other, the TMS Foundation held tight to its mission and persevered, continuing to raise funds to assist the next generation of materials science and engineering leaders.

In mid-October, the Foundation kicked off its year-end appeal, which ran through December 31 and raised $105,915 in this timeframe. Throughout the course of the entire year, a total of $172,308 was raised by 292 individuals—56 of whom were first-time donors. In recognition of their generosity, the TMS Foundation thanks the following TMS members and friends for their support in 2020 with its listing of the Annual Giving Honor Roll and Lifetime Giving Honorific Societies, also available at www.TMSFoundation.org/HonorRolls.

To secure your place on the 2021 Honor Roll and help continue the mission of the TMS Foundation, make a donation today at www.TMSFoundation.org/Contribute. You can also contact TMS Foundation staff directly at TMSFoundation@tms.org or 1-724-776-9000 for more information on donation options or to discuss your donation personally.

Samantha Schloder, University of Pittsburgh, received the 2020 Light Metals Division (LMD) Scholarship. This award, supported through the TMS Foundation, enabled her travel to the TMS 2020 Annual Meeting & Exhibition in San Diego, California, where she gave a presentation at the LMD Luncheon & Lecture. "Scholarships such as this one are the reason why I succeed at school," Schloder said about receiving the award. "Rather than worrying about money all the time, I can focus on my studies."

The TMS Foundation 2020 Honor Roll

1871 Legacy Circle

Lucinda and Martin Glicksman

Garry W. Warren and Larry Goldman

Lifetime Giving Honorific Societies

Diamond Society ($100,000 or more)

Lucinda and Martin Glicksman

Geraldine McCulley Wadsworth and Jeffrey Wadsworth

Robyn and Rob Wagoner

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

Future Members to Come

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

Seta and Diran Apelian

Om P. Arora (deceased)

Carl M. Cady

Joseph D. Defilippi

Linda and Lionel Kimerling

Kenneth R. Kinsman

Marc A. Meyers

Deepa and Brajendra Mishra

David Alan Shifler in Memory of Robert B. Pond Sr.

Garry W. Warren and Larry Goldman

Titanium Society ($10,000 to $19,999)

Viola L. Acoff

Cynthia Bognar

Joan and David DeYoung

James C. Foley

Gordon H. Geiger

Lorenzo Martinez Gomez

Maria Oliva and Kevin Hemker

Michelle A. and Edward D. Herderick

Elizabeth Holm and David Crockett

Carol and Stanley Howard

George T. Gray III

Diane and David Matlock

Tina and Daniel Miracle

Tai-Gang Nieh

Warren Oliver

Luis Ortiz

Sonia and Deepankar Pal

Lallie and Ray D. Peterson

Marilyn and George Pharr

Mary C. and Robert D. Shull

Michèle and Patrice Turchi

William G. Wagstaff (deceased)

Deborah L. Yaney

Joan and James Yurko

Silver Society ($5,000 to $9,999)

Antoine Allanore

Anonymous

Corbett C. Battaile

Cynthia K. Belt

Nancy and David Bourell

Brad L. Boyce

Amy J. and Kester D. Clarke

Ellen K. Cerreta and Carl Trujillo

Anne and Jonathan Dantzig

James Earthman

Carol and Kenneth Fuchs

Jeffery C. Gibeling

Stacy and Bob Gleixner

William C. Harrigan Jr.

Hani Henein

Joy and Gregory Hildeman

John Howarter

John Hryn

Cesar R. Inostroza

George Krauss

Diane and David Laughlin

Thaddeus B. Massalski

Ronald E. Miller

Michael J. Mills

Jean and William Nix

Leah and Paul R. Ohodinicki Jr.

Harold W. Paxton

Lynne and James Robinson

Wolfgang A. Schneider

Angela and Alexander Scott

Linda S. Schadler

Christopher Schuh

King-Ning Tu

Olivia D. Underwood

Frank E. Wagstaff

Robert B. Wagstaff

Leigh and Timothy Weihs

Ingo Wender

Wendelin J. Wright and John C. Bravman

2020 Annual Giving Honor Roll

Foundation Leader ($2,500 or more)

Antoine Allanore 40/40 CLUB

Cynthia Bognar

Carl M. Cady

Joseph D. Defilippi

James C. Foley

Yasuhiro Fukunaka

Cesar Inostroza

Kenneth R. Kinsman

Marc A. Meyers

Tina and Daniel Miracle

Luis Ortiz

David A. Shifler in Memory of Robert B. Pond Sr.

Mary and Robert Shull

Michèle and Patrice Turchi

Robyn and Rob Wagoner

Joan and James Yurko

Foundation Founder ($1,000 to $2,499)

Viola L. Acoff

American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME)

Anonymous

Corbett C. Battaile

Thomas P. Battle

Garth W. Billings

Nancy and David Bourell

Gerbrand Ceder

Amy and Kester Clarke

Joan and David DeYoung

George T. Gray III

Carol and Stanley Howard

The Charles and Esther Lee Kimerling Charitable Foundation

Halvor Kvande

Diane and David E. Laughlin

Alexis C. Lewis

Michele V. Manuel

Diane and David Matlock

Christina Elizabeth Meskers

Jean and William Nix

Toshiyuki Nohira

Leah and Paul Ohodnicki 40/40 CLUB

Lallie and Ray Peterson

Michel Rappaz

W. Jud Ready

Michel R. Reverdy

Rob Ritchie

David Sapiro 40/40 CLUB

Linda S. Schadler

James L. Smith

Ann and Dan Thoma

Brian and Sandi Thomas

Steven J. Zinkle

Foundation Builder ($500 to $999)

Nancy and Iver Anderson

Acta Materialia Inc.

Raymundo Arroyave

Brad L. Boyce

Eric N. Brown

M. Grace Burke

Carelyn E. Campbell and Mark R. Stoudt

Mary and Raymond Decker

Philip Giudice

Siegfried S. Hecker

Hani Henein

Maria Oliva and Kevin Hemker

John A. Howarter 40/40 CLUB

Enrique Lavernia and Julie Schoenung

Paul Mason

Dihua Wang

Adam C. Powell IV

Ramana G. Reddy

Lynne and James Robinson

Dongwon Shin

Victoria and Hong Yong Sohn

Thermo-Calc Software Inc.

Robert B. Wagstaff

Dihua Wang

Clarissa Yablinsky and Ben Morrow 40/40 CLUB

Huayi Yin

Foundation Provider ($250 to $499)

Anonymous

Kimberly and Patrick Cannon

Alfredo Oscar Del Campo

Joy H. Forsmark

Ronald Gibala

Andrew J. Gmitter

Michelle and Edward Herderick 40/40 CLUB

Michael E. Kassner

Douglas Kelley

Carlos G. Levi

Alan A. Luo

Robert Maass

Eric A. Nyberg

Elsa Olivetti

Robert A. Rapp

Martha and Robert Rose

Krishnan K. Sankaran

Judy Schneider

Justin A. Scott 40/40 CLUB

Kathy and George Spanos

Alex T. Vai

Charles H. Ward

Mark L. Weaver

Edward McRae Williams

Hongmin Zhu

Foundation Ambassador ($100 to $249)

Anonymous
David F. Bahr
William J. Boettinger
Ekkes Brueck
Daniel B. Bullen
Douglas Burkes
Indrajit Charit
Blythe Gore Clark
David S. Conochie
Jacob Crane
Subodh K. Das
Chanaka De Alwis
Marc J. De Graef
Sandy K. DeWeese
Jeffrey W. Fergus
John E. Flinn
David U. Furrer
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Jessica A. Krogstad 40/40 CLUB
Jamie J. Kruzic
Campbell Laird
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James Zuback

40/40 CLUB

This symbol after a name signifies members of the Foundation's 40/40 Club—donors age 40 or under who gave $40 or more in 2020.

JOM the magazine

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04652-8

Meet the New Members of the TMS Foundation Board of Trustees

Kaitlin Calva

Similar to the role of the TMS Board of Directors in setting strategic priorities and leading the Society into the future, the TMS Foundation Board of Trustees represents the Foundation's mission, provides strategic direction for programs and funds, and engages in effective fundraising. They are the philanthropic stewards of the Society. Their commitment to providing financial assistance and career-building experiences for students and young professionals helps to ensure a bright future for the minerals, metals, and materials professions.

The six individuals presented in the following pages were officially installed as the newest members of the TMS Foundation Board of Trustees at their March 2021 meeting. To find out how you can get involved with the TMS Foundation as a member of the Board of Trustees, contact Kimberly Cannon, Membership, Volunteerism & TMS Foundation Department Head, TMS, at kcannon@tms.org or 1-724-814-3118.

To learn more about the Foundation's mission, visit the About page at www.TMSFoundation.org

Brad Boyce

"I view my donation to the Foundation as a way to pay it forward," said Brad Boyce, distinguished member of the technical staff at Sandia National Laboratories. "As I have advanced in my career, each step has been facilitated by support from a network of colleagues, mentors, and advocates. TMS has provided a key role in helping me develop my network and learn about the advances across the world in materials research. By contributing to the Foundation, I am contributing to the development of the next generation of early-career researchers who are joining the TMS family and contributing in their own unique ways."

Boyce first became involved with the TMS Foundation when he received the Structural Materials Division (SMD) Young Leaders Professional Development Award in 2009. He attended the Emerging Leaders Alliance (ELA) program, supported through a registration grant from the Foundation, several years later and then became a donor as his engagement with TMS grew, from volunteering within the SMD to his most recent role as Programming Director on the TMS Board of Directors. "Not all professional societies have a philanthropic branch. I'm hopeful that I can help communicate the unique value of the Foundation as a sponsor for the development of early-career professionals. I'm also hopeful that we can expand the portfolio of services that the Foundation provides to enable a broader range of positive outcomes."

Though the COVID-19 pandemic has affected many aspects of TMS membership, such as the shared experience of attending in-person meetings, Boyce recognizes there is still a need to lift members up with the help of the Foundation. "Through this lens, we realize how fortunate we were to have the in-person TMS-facilitated meetings as forums for interaction. As we look to rebuild those connections, donations to the Foundation can help the Society continue to engage early members, who are especially isolated by the virus at a critical stage in their career and in need of that extra encouragement and support."

> *"I'm hopeful that I can help communicate the unique value of the Foundation as a sponsor for the development of early-career professionals."*
> **—Brad Boyce**

Amy J. Clarke

Currently an associate professor in the George S. Ansell Department of Metallurgical and Materials Engineering at the Colorado School of Mines, Amy Clarke notes that it's difficult to pinpoint her first involvement with the TMS Foundation. Receiving the 2008 Materials Processing & Manufacturing Division Young Leaders Professional Development Award and 2013 TMS/Federation of European Materials Societies (FEMS) Young Leaders International Scholar Award, followed by attending the ELA program in 2016, helped to springboard her involvement in TMS. "I give annually to the TMS Foundation to help ensure that opportunities such as these continue to exist for young professionals. This has kept me active and engaged over the years," Clarke said.

"I recognize the positive impacts the TMS Foundation has had on my own early-stage professional development. It is imperative that we continue to cultivate our future leaders by annual giving to the TMS Foundation," she continued. "We must also strive to be a highly inclusive society. The Ellen Swallow Richards Diversity Award and Frank Crossley Diversity Award, supported by the TMS Foundation, not only recognize established professionals, but also acknowledge the adversity experienced by some of our members. Their stories promote awareness and provide inspiration to the materials community."

While Clarke has been a member of many TMS committees and served as Membership & Student Development Director on the TMS Board of Directors, she steps into a new role with the Society as member of the TMS Foundation Board of Trustees. "What I am looking forward to the most is learning more about the positive impacts the TMS Foundation is having on our members! I hope to help communicate these stories, as I'm sure they will inspire others to give back to the Society and promote the development of our leaders at all levels. I also hope to help expand scholarship opportunities for students."

> *"It is imperative that we continue to cultivate our future leaders by annual giving to the TMS Foundation."*
> **—Amy J. Clarke**

John Howarter

John Howarter, associate professor of materials engineering and environmental & ecological engineering at Purdue University, is most looking forward to "meeting new people within TMS, both the donors and beneficiaries of the core Foundation programs." With the 2015 Extraction & Processing Division (EPD) Young Leaders Professional Development Award serving as his first introduction to the TMS Foundation, Howarter understands how support from the Foundation can make an impact.

"That was a transformational experience and it really opened up a lot of opportunities for me," he said. "As I continued to participate in TMS meetings and events, I began to notice that the TMS Foundation was behind some really great programs that were positively shaping our community of materials scientists and engineers."

"The TMS Foundation is central to our profession," he continued. "Its impact extends beyond a particular region or school and in that sense, we can have a very unique impact on young professionals in our field. I am drawn to my support of the Foundation because I have a certain amount of trust and familiarity with TMS through my participation in the annual meeting."

As a member of TMS for nearly 20 years, Howarter has been actively involved in several technical and functional committees. Most recently he served on the TMS Board of Directors as Public & Governmental Affairs Director.

> *"The TMS Foundation is central to our profession. Its impact extends beyond a particular region or school and in that sense, we can have a very unique impact on young professionals in our field."*
> **—John Howarter**

Linda Schadler

Linda Schadler, dean of the College of Engineering and Mathematical Science at the University of Vermont, first joined TMS at the encouragement of her professors after graduation. After beginning her academic career, she got involved with the TMS Education Committee through her department chair, Alan Lawley. "It all snowballed from there. The TMS leadership at the time was incredibly welcoming and I found colleagues that I learned a lot from, enjoyed hanging out with, and for whom I have tremendous respect."

"The TMS Foundation's commitment to supporting students is an important contribution to the materials community," Schadler remarked. In addition to these efforts, Schadler recognized the importance of promoting a more diverse and inclusive professional community through TMS's two diversity awards. "While the Foundation supports other programs, these are the ones I am most passionate about. I am hoping I can help the Foundation realize some of their fundraising goals in these two areas."

"There are only a few ways for the materials community to help support their own. One way is, of course, by spending time mentoring students and young professionals," she noted. "But just as impactful are the funds we can spend to relieve the financial burden for students and to recognize their efforts in research. We owe it to our community to give back with time, talent, and, as appropriate, treasure. This is true in our local communities, but also our professional communities."

> *"…just as impactful are the funds we can spend to relieve the financial burden for students and to recognize their efforts in research."*
> **—Linda Schadler**

Dan J. Thoma

"I look forward to promoting enthusiasm to engage impactful activities that advance the profession," said Dan Thoma, director of the Grainger Institute for Engineering and professor of materials science and engineering at the University of Wisconsin-Madison. "My service and past roles within TMS have provided a large network of interactions, and I hope to engage that community for the next generation of the materials community."

Thoma has been involved in TMS and the TMS Foundation since about 1992, holding many roles within the Society throughout his membership, including as 2003 TMS President. He has also served on the Board of Trustees for the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) and for the United Engineering Foundation (UEF), which has kept him actively involved over the years. "All of these organizations have strived to provide advancement for professionals in a materials and engineering career," he said. "In my opinion, the materials professions advance technology and increase quality of life. The TMS Foundation is one mechanism to sustain the future health of the professions."

Looking to the bylaws and mission of TMS, Thoma recognizes how the mission of the Foundation supports society at large by supporting the materials professions. "I think most of our current and future members want to make a positive impact on society. The belief that sustainable materials enable technology advancement for topics such as clean energy, transportation, communication, and safety is a powerful message."

> *"In my opinion, the materials professions advance technology and increase quality of life. The TMS Foundation is one mechanism to sustain the future health of the professions."*
> **—Dan J. Thoma**

Olivia D. Underwood Jackson

"TMS has helped me to grow professionally and as a leader. It has also provided a platform where I could share my research; therefore, it is important that I continue to pay it forward through my interactions and financial support to provide opportunities for students and young professionals," said Olivia Underwood Jackson, principal member of the technical staff at Sandia National Laboratories. Jackson notes that attending the ELA program in 2017 was her first involvement with the Foundation, which provided her with invaluable leadership skills that have helped accelerate her career. This chance to grow professionally and hone her abilities has kept her active in TMS and the Foundation over the years.

Jackson also received the 2019 Frank Crossley Diversity Award from TMS which, as a first-generation college graduate, has a special meaning for her. "After experiencing firsthand, while working on my Ph.D., what it feels like to be excluded and to be met with resistance because of the color of my skin, it warms my heart to see TMS celebrate and take an active interest in diversity and inclusion. The work of diversity, equity, and inclusion is far from being done and requires each one of us to do our part to make this Society more inclusive."

In this new leadership role with the Foundation, Jackson hopes to ensure the success of the next generation. "I am looking forward to helping expand and maintain the current and future TMS funding avenues to support students and young professionals to be able to attend conferences and to develop professionally."

She continued, noting that: "Representation matters. I will be actively looking for roles where I can advocate for equity in TMS actions, champion diversity and inclusion, and push TMS in taking a bolder leadership role in increasing the recruitment, retention, and participation of historically underrepresented groups in materials science and engineering."

> *"…it is important that I continue to pay it forward through my interactions and financial support to provide opportunities for students and young professionals."*
> **—Olivia D. Underwood Jackson**

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04657-3

Engaging with the Government and Public to Advance the Materials Science and Engineering Field and TMS Members

Members of the TMS Board of Directors, P&GA Committee, and staff at a Congressional Visits Day in July 2015.

Eric N. Brown, Emily Rinko, Richard Otis, Viola L. Acoff, and Natasha Vermaak

While most TMS members engage with the Society and other members of the field through TMS's many conferences, meetings, and journals, not all members are familiar with the important work the Society does in engaging with the public and U.S. government to advance the materials science and engineering disciplines on behalf of the TMS membership. Through its Public & Governmental Affairs (P&GA) Committee, TMS advocates for broad-based materials-related research and development, supports science, technology, engineering, and math (STEM) programs, and promotes the materials science and engineering profession. The P&GA Committee offers members the opportunity to educate themselves on public policy issues relevant to their careers and to provide their expert advice to legislators, policymakers, and the public. TMS welcomes the opportunity to work cohesively and purposefully with other organizations and professional societies to accomplish universal goals that support our mission to promote minerals, metals, and materials science and technology.

Iver Anderson (left, standing), TMS P&GA Committee member, gives a presentation for staff members of the U.S. Senate and House Congressional offices at the September 2015 Materials Information Luncheon: Building the STEM Workforce for a Robust Economy.

TMS participates in formal and informal visits to Capitol Hill to help Society members share their expertise with members of Congress and their staff. Periodically, TMS hosts Materials Information Luncheons, bringing representatives from the minerals, metals, and materials community to congressional

Eric N. Brown

Emily Rinko

Richard Otis

Viola L. Acoff

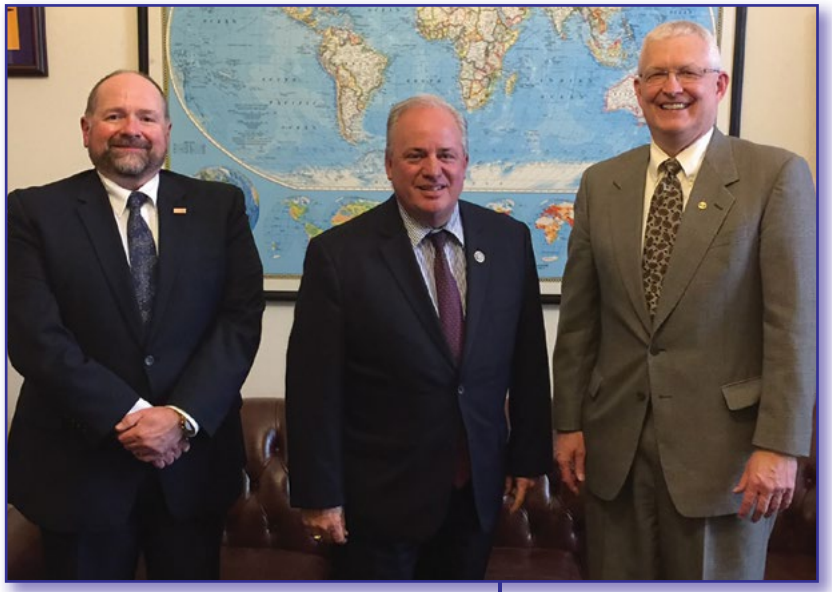
Natasha Vermaak

leaders to discuss topics of interest and concern in science and technology. We look forward to returning to hosting these Materials Information Luncheons once it becomes safe to do so. The Society has many advocacy interests for which it engages with federal policymakers, including:

- Manufacturing, Advanced Manufacturing, and Manufacturing USA
- No Institution of Unreasonable Barriers for U.S. Scientists and Engineers to Travel Freely or for International Scientists and Engineers to Enter the U.S. for the Purpose of Knowledge Exchange
- STEM Education for K–12 to Fuel Economic Growth and Innovation
- Diversity, Equity, and Inclusion in Science & Engineering
- Racial and Social Justice
- Scientific Conference Attendance and Participation for Federal Employees
- Energy and Environmental Sustainability
- Materials Innovation/Materials Genome Initiative
- Rare Earth/Critical Materials/Natural Resource Utilization
- Basic Research in Science and Engineering
- Federal Agency Funding of U.S. Department of Energy, National Science Foundation, National Institute of Standards and Technology, and National Laboratories

In the past year, TMS, as a member society, took public positions on several issues on behalf of the materials science and engineering community. TMS developed a position statement re-affirming the Society's commitment to advancing racial and gender inclusivity in science and engineering and called for the repeal of an Executive Order banning certain kinds of workplace diversity training. TMS sent a letter to the incoming Biden administration urging them to revoke this Executive Order, which they did on their first day in office, and was one of 50 organizations to sign a letter calling for the reversal of a ban on federal employee training programs related to diversity, equity, and inclusion. TMS submitted a letter to the Department of Homeland Security in opposition to a proposed strict two-year limit for international student visas and the proposal was withdrawn. TMS and more than 65 science and engineering organizations signed an open letter to the White House, Department of Homeland Security, and Department of State arguing for the continuation of COVID-19-related exemptions to in-person coursework ordinarily required for international student visa holders. TMS published a statement and took actions regarding racial justice, with TMS leaders committing to adding social justice for Black Americans, and underrepresented and underserved groups more broadly, to our official advocacy position when TMS leadership travels to Washington, D.C., to engage with federal officials and elected representatives.

All of TMS's letters and statements related to current issues are available on the TMS website at www.tms.org /CurrentIssues. Topics of outreach that are lead on behalf of the Society through P&GA can come from all parts of TMS, including topics raised by individual Society members; topics brought forward in collaboration with other committees within the Society, including the TMS Content Development and Dissemination Committee on proposed legislation around open access publishing and the TMS Diversity, Equity, and Inclusion (DEI) Committee on topics around diversity, equity, inclusion, and racial justice; and topics raised by the TMS Board of Directors. Proposed letters and statements



TMS Executive Director James J. Robinson (left) and 2017 TMS President David H. DeYoung (right), with U.S. Representative Mike Doyle (PA-18; center) during a busy day of Congressional visits in April 2017.

"As a community, we recognize that the technical achievements TMS members contribute to advancing the materials science and engineering field are incredibly powerful enablers in the technologies that define any nation's security, economic prosperity, and continued progress."

are elevated to the TMS Board of Directors to ensure they reflect the goals, values, and direction set forth by the breadth of the Society and ultimately released jointly by TMS Executive Director James J. Robinson and the current TMS President. We encourage all who are passionate about the topics mentioned to contact us about opportunities to get involved. Over the years, TMS has been proud of and sought to support our members who are actively working within the federal government, who served on the President's Council of Advisors on Science and Technology, and who represented the materials science and engineering community through testimony on Capitol Hill.

The P&GA Committee internally reorganized this year in support of TMS activities, launching two new subcommittees in the service of improved collaboration across the Society. To better support TMS's response to upcoming legislation and governmental advocacy opportunities, P&GA formed a new standing Legislative Affairs subcommittee. To support TMS in developing our advocacy position for social justice for Black Americans and underrepresented groups, P&GA formed a Racial Justice ad hoc subcommittee jointly with the TMS DEI Committee. This collaboration with DEI promotes the inclusion of voices from within the materials science and engineering community that are most impacted by racial inequities and is in alignment with the Society's broader DEI initiatives.

Materials Explorers™ has been the Society's program to directly engage with the broader public and support the education of future materials scientists and engineers. This free STEM educational outreach initiative was built on the premise that innovative teaching techniques can excite and inspire students about science and math concepts, while encouraging them to investigate these topics as potential career pathways. For more information about *Materials Explorers*™ or to access curriculum and resources, please visit www.materials-explorers.org.

As a community, we recognize that the technical achievements TMS members contribute to advancing the materials science and engineering field are incredibly powerful enablers in the technologies that define any nation's security, economic prosperity, and continued progress. Through TMS's engagement with the government and public, we work to ensure this is also known to the public leaders, stakeholders, and policymakers wielding influence over the future of the materials science and engineering field.

Glenn Daehn, TMS study team lead, *Metamorphic Manufacturing: Shaping the Future of On-Demand Components*, speaks about metamorphic manufacturing at a 2019 Congressional Briefing organized by TMS and hosted by the House Manufacturing Caucus. The event was part of an advanced manufacturing briefing series supported by the United Engineering Foundation.

Eric N. Brown is the Public & Governmental Affairs (P&GA) Director on the TMS Board of Directors. Emily Rinko is a member of the P&GA Committee and a Ph.D. candidate at Ames Laboratory and Iowa State University. Richard Otis is a member of the P&GA Committee and chair of the TMS Legislative Affairs Subcommittee. Viola L. Acoff is a member of the Diversity, Equity, and Inclusion (DEI) Committee, chair of the TMS Racial Justice ad hoc Committee, and Associate Dean Undergraduate and Graduate Programs, Professor in Metallurgical and Materials Engineering Department at The University of Alabama. Natasha Vermaak is chair of the DEI Committee and Associate Professor in Mechanical Engineering and Mechanics Department at Lehigh University.

JOM themagazine

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04653-7

DIGGING DEEP INTO THE HISTORY OF THE EXTRACTION & PROCESSING DIVISION

Kaitlin Calva

1988: it was "the year it all came together," according to a special edition of "TMS News" in *JOM*.[1] The Society implemented a name change, becoming The Minerals, Metals & Materials Society; a new mission statement was adopted; and the five TMS technical divisions were born.

"Digging Deep Into the History of the Extraction & Processing Division: A Look at the EPD" is the second article in a feature series highlighting the 150th anniversary of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) and TMS. The first article appeared in the March 2021 issue of *JOM*, with additional articles scheduled throughout 2021 and into 2022. For more information, contact Kaitlin Calva, *JOM* Magazine Managing Editor, at

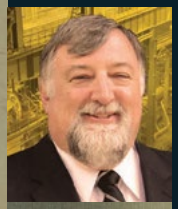
TMS marked the 30th anniversary of the technical divisions with a commemorative legacy pin and coin presented to attendees at the 2018 TMS Annual Meeting & Exhibition.

While technical committees existed previously, the context of a division allowed for greater authority and flexibility within the Society and the ability to share information and resources among the fields. "Further, responsibilities of programming, continuing education, and membership development shifted from the Society's administrative level to the newly formed divisions. This was done to promote a greater 'grass roots involvement' and to facilitate speedy action on developing opportunities."[1]

As TMS celebrates 150 years with the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME), its predecessor organization, in 2021, *JOM* takes a deeper look into the unique aspects of the TMS community, especially the five technical division homes within the Society– beginning with the Extraction & Processing Division (EPD).

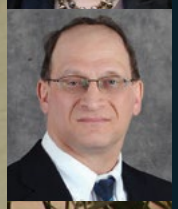
JOM invited several Society leaders and EPD members to reflect on both the broader impacts of the EPD as well as personal recollections of what the EPD has meant to them. Continue reading for a collection of memories on the EPD of TMS.

Meet the EPD Interviewees



Tom Battle
Extractive Metallurgy Consultant
2020 TMS President and past EPD Chair

Cynthia K. Belt
Retired
Past EPD Chair



Mark E. Schlesinger
Professor, Missouri University of Science & Technology
Past EPD Chair

Hong Yong Sohn
Distinguished Professor, University of Utah
2009 TMS Fellow and past member of the TMS Board of Directors

***JOM:* Can you share a few words about how you first got involved in TMS?**

Tom Battle: I got involved through my professors and fellow students at the University of Michigan. The Michigan Metallurgical Society was our student chapter and we were encouraged to get involved. Both of my thesis advisers (John Hager at the Colorado School of Mines and Robert Pehlke at the University of Michigan) were very active in their societies and recommended I attend meetings, present my research, and get involved with committees. Dr. Hager, in particular, was very active in TMS—and was a chair of the EPD.

Cynthia Belt: I joined my work colleagues at my first TMS annual meeting to learn more about the aluminum process and industry. This motivated me to later write my first TMS paper while my boss introduced me to the technical committees.

Mark Schlesinger: My first involvement with TMS was as an undergraduate student in the late 1970s. Going to an annual meeting and seeing what was happening in the field helped confirm my decision to make extractive metallurgy my career.

Hong Yong Sohn: I was educated as a chemical engineer, but after working as a postdoctoral associate with the late Julian Szekely, who was director of the Center for Process Metallurgy at the State University of New York at Buffalo, I joined the faculty of metallurgical engineering at the University of Utah and wanted to join the community of metallurgists.

> "...the extraction and processing of minerals and metals certainly hasn't disappeared worldwide, and now there's increasing interest in 'mining' and extracting value from materials at the end of their lives..."
>
> —Tom Battle

***JOM:* Can you briefly describe the value of the EPD to TMS members, or some of its key contributions to TMS and/or the materials community?**

Battle: At one time, the EPD was the largest of the technical divisions; now it's one of the smallest. This is partly due to a decrease in the number of mining and processing operations in the United States, but also the rapid growth of other divisions. However, the extraction and processing of minerals and metals certainly hasn't disappeared worldwide, and now there's increasing interest in "mining" and extracting value from materials at the end of their lives—from cars and washing machines to cellphones and other electronic gear.

Belt: Extraction starts the whole metals industry by getting metal out of an ore. We are trying to do this in the most sustainable way with more efficient processes, getting more metal out of old tailings, or using recycled materials like old batteries. Our division not only covers the extraction process but materials characterization, recycling, energy, and process modeling.

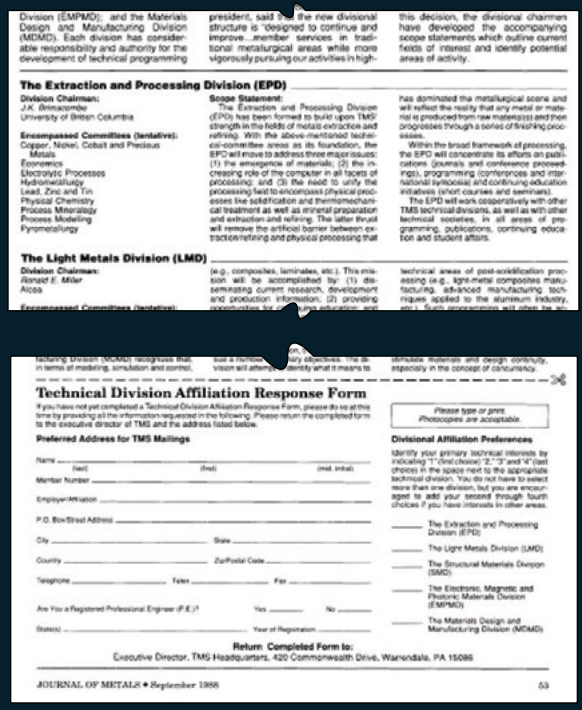
Schlesinger: More than any organization, the EPD is the venue where the global extractive community comes together. In collaboration with the Light Metals Division (LMD), the EPD organizes the activities that allow metals

> "Going to an annual meeting and seeing what was happening in the field helped confirm my decision to make extractive metallurgy my career."
>
> —Mark E. Schlesinger

AN EARLY LOOK AT THE EPD

Throughout 1988 and 1989, the divisions began to take shape as bylaws were written and officers were appointed, with J. Keith Brimacombe, 1993 TMS President, selected as the first EPD Chair. In a membership drive to register division preferences, each division included their proposed scope statements in *JOM* to help TMS members select the most appropriate affiliation. At the outset, the EPD focused on three major issues:

(1) the emergence of materials; (2) the increasing role of the computer in all facets of processing; and (3) the need to unify the processing field to encompass physical processes like solidification and thermomechanical treatment as well as mineral preparation and extraction and refining. The latter thrust will remove the artificial barrier between extraction/refining and physical processing that has dominated the metallurgical scene and will reflect the reality that any metal or material is produced from raw material(s) and then progresses through a series of finishing processes.[2]



Division (EMPMD); and the Materials Design and Manufacturing Division (MDMD). Each division has considerable responsibility and authority for the development of technical programming

president, said "The new divisional structure is 'designed to continue and improve...member services in traditional metallurgical areas while more vigorously pursuing our activities in high-

this decision, the divisional chairmen have developed the accompanying scope statements which outline current fields of interest and identify potential areas of activity.

The Extraction and Processing Division (EPD)

Division Chairman:
J.K. Brimacombe
University of British Columbia

Encompassed Committees (tentative):
Copper, Nickel, Cobalt and Precious Metals
Economics
Electrolytic Processes
Hydrometallurgy
Lead, Zinc and Tin
Physical Chemistry
Process Mineralogy
Process Modelling
Pyrometallurgy

Scope Statement:
The Extraction and Processing Division (EPD) has been formed to build upon TMS' strength in the fields of metals extraction and refining. With the above-mentioned technical-committee areas as its foundation, the EPD will move to address three major issues: (1) the emergence of materials; (2) the increasing role of the computer in all facets of processing; and (3) the need to unify the processing field to encompass physical processes like solidification and thermomechanical treatment as well as mineral preparation and extraction and refining. The latter thrust will remove the artificial barrier between extraction/refining and physical processing that has dominated the metallurgical scene and will reflect the reality that any metal or material is produced from raw material(s) and then progresses through a series of finishing processes.

Within the broad framework of processing, the EPD will concentrate its efforts on publications (journals and conference proceedings), programming (conferences and international symposia) and continuing education initiatives (short courses and seminars).

The EPD will work cooperatively with other TMS technical divisions, as well as with other technical societies, in all areas of programming, publications, continuing education and student affairs.

The Light Metals Division (LMD)

Division Chairman:
Ronald E. Miller
Alcoa

(e.g., composites, laminates, etc.). This mission will be accomplished by: (1) disseminating current research, development and production information; (2) providing

technical areas of post-solidification processing (e.g., light-metal composites manufacturing, advanced manufacturing techniques applied to the aluminum industry,

Technical Division Affiliation Response Form

If you have not yet completed a Technical Division Affiliation Response Form, please do so at this time by providing all the information requested in the following. Please return the completed form to the executive director of TMS and the address listed below.

Please type or print. Photocopies are acceptable.

Preferred Address for TMS Mailings

Name _____ (last) (first) (mid. initial)
Member Number _____
Employer/Affiliation _____
P.O. Box/Street Address _____
City _____ State _____
Country _____ Zip/Postal Code _____
Telephone _____ Telex _____ Fax _____
Are You a Registered Professional Engineer (P.E.)? Yes _____ No _____
State(s) _____ Year of Registration _____

Divisional Affiliation Preferences

Identify your primary technical interests by indicating "1" (first choice); "2," "3" and "4" (last choices in the space next to the appropriate technical division. You do not have to select more than one division, but you are encouraged to add your second through fourth choices if you have interests in other areas.

_____ The Extraction and Processing Division (EPD)
_____ The Light Metals Division (LMD)
_____ The Structural Materials Division (SMD)
_____ The Electronic, Magnetic and Photonic Materials Division (EMPMD)
_____ The Materials Design and Manufacturing Division (MDMD)

Return Completed Form to:
Executive Director, TMS Headquarters, 420 Commonwealth Drive, Warrendale, PA 15086

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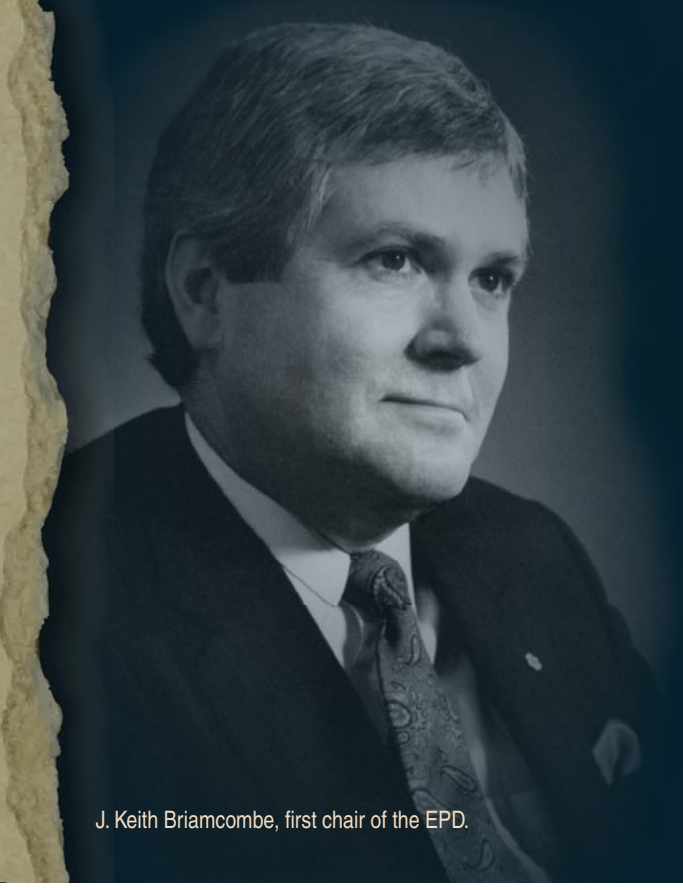
In this 1988 issue of *JOM*, TMS members are encouraged to select a first, second, third, and even fourth choice in their technical division affiliation.



J. Keith Briamcombe, first chair of the EPD.

The first technical committees of the EPD, as reported in the June 1988 issue of *JOM*, were:

- Copper, Nickel, Cobalt & Precious Metals
- Economics
- Electrolytic Processes
- Hydrometallurgy
- Lead, Zinc, Tin
- Physical Chemistry
- Process Metallurgy
- Pyrometallurgy

For a listing of the current EPD committees and to learn more about how you can get involved in the EPD, visit **www.tms.org/Committees**.

producers and refiners to collectively address problems of both technology and organization. The result is more efficient and environmentally compatible methods of metals production.

Sohn: Extraction and processing is but one of the subdisciplines of metallurgy, but it covers the beginning of all metallurgical processes as well as much of materials-related fields. Continued development of economically and technically advantageous processes for metal extraction is critical for the health of the rest of the metallurgical and materials disciplines and communities.

JOM: **In your opinion, what are some key events for the EPD over the years? What is the significance of these in relation to the EPD today?**

Battle: For a number of years, the EPD organized a Fall Extractive Meeting—the major reason you don't see extractive programming at the Materials Science & Technology Conferences. We moved away from this as the industry shrank and we realized that with fewer numbers of engineers and scientists in our field there were still many more meeting options than they could possibly attend. We also determined that our nearby sister societies in the field (particularly the Metallurgy & Materials Society [MetSoc] in Canada and the Society for Mining, Metallurgy & Exploration [SME] in the U.S.) also had valid reasons for programming in the extractive field, and we should cooperate, rather than compete. The result was the North American Extractive Metallurgy Council, the Extraction 2018 conference, and future Extraction conferences.

Belt: I was most excited about how the EPD was able to change a potential conflict in meetings into Extraction 2018, which brought together three societies in a joint meeting that was stronger than any one society could have organized. We were able to work with each other to set up the potential for future joint meetings that may grow and include more international societies.

Schlesinger: Key events in the EPD include the increased development of collaborative activities with other divisions of TMS and other societies around the world. Half of our

"...many of the technical concerns associated with metals production and refining are global in nature and require reaching across the curtains of organizational barriers."

—Mark E. Schlesinger

ON THIS DATE IN HISTORY

Did you know that **May 16, 2021**, is the official anniversary date of the founding of the American Institute of Mining Engineers (now the American Institute of Mining, Metallurgical, and Petroleum, AIME), the predecessor of TMS? In 2016, leadership from AIME; the Society for Mining, Metallurgy & Exploration (SME); the Society of Petroleum Engineers (SPE); and TMS commemorated the date with a roadside marker in Wilkes-Barre, Pennsylvania, that read:

> American Institute of Mining Engineers—Organization founded in 1871 by 22 mining professionals to promote safety, education, economics, and technology in mining. One of the first national engineering societies in the US, the institute and its 150,000+ members honor the group's legacy by providing education and upholding professional values. The founding meeting of AIME as well as that of the Pa. Anthracite Section of AIME were held here at the site of the former Wyoming Valley Hotel.

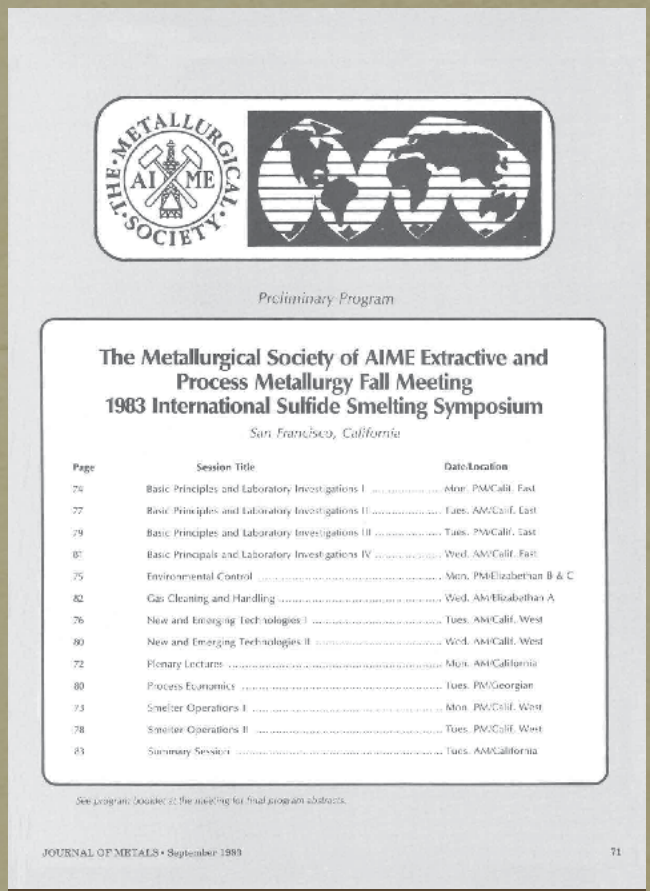
For more on the founding of AIME and the shared history between the Institute and TMS, read "Celebrating Our Common Legacy: 150 Years of AIME and TMS," in the March 2021 issue of *JOM* or view historical resources on the TMS website at **www.tms.org/OurHistory**.

For the first time, three leading metallurgical societies joined together to organize Extraction 2018, a global conference focused on extractive metallurgy. The all-conference plenary session, pictured above, explored the history and future of the field.

committees are now joint committees with other TMS divisions, and most of our specialty meetings are held jointly with other societies. This reflects the understanding that many of the technical concerns associated with metals production and refining are global in nature and require reaching across the curtains of organizational barriers.

Sohn: TMS has always had the distinction of being an excellent professional society in terms of scientific and technical programs and platforms, such as meetings and publications. A key event for the extraction and processing discipline within TMS, and thus for the EPD, occurred in 1983 when the first Fall Extraction and Processing Meeting was held as a stand-alone TMS meeting. Until then, the Fall TMS Meetings were limited to physical metallurgy. TMS requested that I, David B. George, and Alan D. Zunkel organize the first Fall Extraction and Processing meeting. We then selected advances in sulfide smelting as the theme of the meeting. It was held in San Francisco, California, and was well attended with large international participation and produced two-volume proceedings, which is cited frequently even to this date. These meetings have given TMS members involved in extraction and processing of metals an opportunity to separately gather and exchange information on their specialized field.

(Editor's Note: the two proceedings volumes are Advances in Sulfide Smelting: Vol. 1 Basic Principles and Advances in Sulfide Smelting: Vol. 2 Technology and Practice, H.Y. Sohn, D.B. George, and A.D. Zunkel, 1983).



THE METALLURGICAL SOCIETY · AIME

Preliminary Program

The Metallurgical Society of AIME Extractive and Process Metallurgy Fall Meeting
1983 International Sulfide Smelting Symposium

San Francisco, California

Page	Session Title	Date/Location
74	Basic Principles and Laboratory Investigations I	Mon. PM/Calif. East
77	Basic Principles and Laboratory Investigations II	Tues. AM/Calif. East
79	Basic Principles and Laboratory Investigations III	Tues. PM/Calif. East
81	Basic Principals and Laboratory Investigations IV	Wed. AM/Calif. East
75	Environmental Control	Mon. PM/Elizabethan B & C
82	Gas Cleaning and Handling	Wed. AM/Elizabethan A
76	New and Emerging Technologies I	Tues. AM/Calif. West
80	New and Emerging Technologies II	Wed. AM/Calif. West
72	Plenary Lectures	Mon. AM/California
80	Process Economics	Tues. PM/Georgian
73	Smelter Operations I	Mon. PM/Calif. West
78	Smelter Operations II	Tues. PM/Calif. West
83	Summary Session	Tues. AM/California

See program booklet at the meeting for final program abstracts.

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Shown here is the program cover for the 1983 International Sulfide Smelting Symposium, the first TMS Extractive and Process Metallurgy Fall Meeting, held in San Francisco, California.

***JOM:* Describe your favorite memory associated with TMS and/or the EPD.**

Battle: Probably the success of Extraction 2018 in Ottawa. We had been trying for ten years to coordinate extractive programming between the three societies to be able to schedule a must-attend meeting hosted equally by all three. The attendance was easily double what we expected. Also, the experiences working closely with a number of other EPD members to make change happen was enjoyable.
Belt: My favorite memory of TMS was being a part of the Board of Directors. I enjoyed the give and take in our discussions, as we each had a different point of view but worked to a common goal.
Schlesinger: My favorite TMS memories are associated with the people I've met, the friends I've made, and the stories I've shared.
Sohn: A hugely favorite memory associated with TMS and EPD for me was the occasion of the Sohn International Symposium in 2006 with TMS as the main organizer and SME as the co-organizer. This was the greatest professional honor bestowed upon me in my career. The co-chairs and organizing committee did such outstanding work and gathered such a huge collection of international researchers, authors, and industrial sponsors that the symposium generated nine proceeding volumes and one of the largest lists of participants of any stand-alone meeting of the kind. Because I was the lead organizer of the first TMS Fall Extraction and Processing Meeting, it is not surprising that some of my favorite memories are related to organizing and presiding at that meeting. It also gave me the opportunity to develop my network of researchers and engineers working on related subjects of metallurgy, which was instrumental in my personal development in the field. Other favorite memories of mine related to TMS have been on the occasions of my receiving a number of prestigious awards from TMS, which not only encouraged me to work harder to make greater contribution to the profession but also inspired my students and associates to make similar efforts.

> "The EPD's future follows the world's future."
>
> —Cindy Belt

***JOM:* What do you see as the future direction of the EPD in TMS?**

Battle: The need to continue to stress the relevance of upstream processing on the cost and value of the final metal products. In a sustainable economy, this is linked with the ability to recycle materials at end-of-life (and minimize waste production). Members of the EPD have the knowledge to help deal with these materials, which can be considered as very unusual ore bodies!
Belt: The EPD's future follows the world's future. We are working toward the most sustainable practices to extract and process metals. We are working to be more global by better communication with members and societies around the world. We also have strong younger leadership in our council and within our technical committees to move the

A meeting of the EPD Council during the TMS 2018 Annual Meeting & Exhibition, held in Phoenix, Arizona. The EPD Council is governed by the division chair, assisted by the vice chair and past chair, and is made up from the chairs of each of the technical committees within the EPD as well as division representatives from the functional committees and Young Leaders Professional Development Award Recipients. (Photo courtesy of Cynthia Belt.)

In 2006, the Sohn International Symposium on Advanced Processing of Metals and Materials: Principles, Technologies, and Industrial Practice was held in conjunction with the 2006 TMS Fall Extraction & Processing Meeting in San Diego, California. Sohn is pictured above, center, with several of his past students at the event. (Photo courtesy of Hong Yong Sohn.)

work forward.

Schlesinger: As the world increasingly orients itself to a low-carbon culture, the need for increased supplies of raw materials—copper, lithium, rare earths, and so many others—will mean that extractive metallurgy is an increasingly significant area of technology. TMS and the EPD offer a unique role to play in helping to see that these materials are obtained in a cost-effective, less-disruptive, and environmentally benign manner.

Sohn: I believe that the future of the EPD is bright and it must remain bright considering the many innovative technologies being developed and must continue to be developed in metal extraction and processing, especially in terms of efficiency, energy, and environmental protection.

> "Young members are the key to the continuation and growth of the community..."
>
> —Hong Yong Sohn

***JOM*: Is there anything else you would like to add?**

Battle: As this year progresses, we'll all need to work on integrating the best of the virtual world with the best of in-person events.

Belt: As a short, female mechanical engineer, I did not necessarily fit the old mold of TMS leadership. I am very proud of the work done within the EPD and TMS to improve the diversity of our committees and leadership. We need everyone's ideas and help.

Sohn: I would like to take this opportunity to express my heartfelt gratitude to TMS in general, and the EPD in particular, for providing me with a professional community to belong to and grow with. Young members are the key to the continuation and growth of the community and thus, TMS and the EPD must continue to provide young members with opportunities and support so that they may enjoy the benefits and professional growth that I have experienced in my own career by belonging to this great organization.

End Notes

1. "TMS News," *JOM*, 41, 49 (1989).
2. "News," *Journal of Metals*, 40, 49 (1988).

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04654-6

2020 Peer Reviewers: Thank You for Your Contributions

***JOM* extends a heartfelt thank-you to all volunteers who served as peer reviewers in 2020. This was a difficult year for many, as the Covid-19 virus wreaked havoc on daily life—health, family, work, and more—around the world. The audience and authors of *JOM* are indebted to these reviewers who, even during a pandemic, helped to ensure that only the highest-quality articles are published.**

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Liming Xiong
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Zhiping Xu
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Chao Yang
Congren Yang
Ge Yang
Hongying Yang
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Yifan Zhang
Yijie Zhang
Ying Zhang
Yingyan Zhang
Yingyi Zhang
Yuanbo Zhang
Yunhu Zhang
Zhiliang Zhang
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Hongliang Zhao
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Jie Zhou
Lejun Zhou
Qiang Zhu
Steven Zinkle
Olga Zinovieva
James Zuback

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04655-5

JOM themagazine

TMS meeting headlines

TMS is committed to your safety during the pandemic. Meeting dates and locations are current as of March 12, 2021. For the most recent updates on TMS-sponsored events, visit www.tms.org/Meetings.

Other Meetings of Note

13th International Conference on the Technology of Plasticity (ICTP 2021)
July 25–30, 2021
Virtual Event

14th International Symposium on Superalloys (Superalloys 2021)
September 12–16, 2021
Seven Springs, Pennsylvania, USA

Materials in Nuclear Energy Systems (MiNES 2021)
September 19–23, 2021
Pittsburgh, Pennsylvania, USA

Materials Science & Technology 2021 (MS&T21)
October 17–21, 2021
Columbus, Ohio, USA

Congress on Safety in Engineering and Industry 2021 (Safety Congress 2021)
November 1–3, 2021
Fort Worth, Texas, USA

2nd World Congress on High Entropy Alloys (HEA 2021)
December 5–8, 2021
Charlotte, North Carolina, USA

Additive Manufacturing Benchmarks (AM-Bench 2022)
August 15–18, 2022
Bethesda, Maryland, USA

Liquid Metal Processing and Casting Conference (LMPC 2022)
September 18–22, 2022
Philadelphia, Pennsylvania, USA

2021 Mg 12th International Conference on Magnesium Alloys and their Applications

June 15–18, 2021
Virtual Event
Register Today!
www.tms.org/Mg2021

- The 12th International Conference on Magnesium Alloys and their Applications (Mg 2021) is a fully virtual event, featuring a mix of live and pre-recorded sessions. Registration includes access to all recorded sessions and proceedings content until June 30, 2021.
- The plenary speakers will include ***John Allison***, University of Michigan; ***Michele Manuel***, University of Florida; and ***Anil Sachdev***, General Motors Company. The Mg 2021 program also includes a strong lineup of invited speakers and more than 140 contributed talks and posters scheduled during the event.

The 5th International Congress on 3DMS 3D Materials Science 2021

June 29–July 2, 2021
Register Today!
www.tms.org/3DMS2021

- Visit the 5th International Congress on 3D Materials Science (3DMS 2021) website for the confirmed slate of plenary and invited speakers at press time and to access the schedule-at-a-glance, session sheets, and more details on the technical program.
- The TMS journal *Integrating Materials and Manufacturing Innovation* will be publishing a topical collection dedicated to the meeting. This collection will take the place of a traditional conference proceedings publication.

CELEBRATION AIME–TMS 150th TMS 2022 Annual Meeting & Exhibition SINCE 1871

February 27–March 3, 2022
Anaheim, California, USA
Call for Abstracts Opens May 2021!
www.tms.org/TMS2022

- The Fourth Summit on Diversity in the Minerals, Metals, and Materials Professions (DMMM4) will be co-located with the TMS 2022 Annual Meeting & Exhibition (TMS2022). Access to this two-day event will be included with your TMS2022 registration.
- Make plans to join in the continued celebration of the 150th anniversary of TMS and the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME) at TMS2022.

TMS AIM First World Congress on Artificial Intelligence in Materials & Manufacturing 2022

April 3–6, 2022
Pittsburgh, Pennsylvania, USA
Submit an Abstract by September 3, 2021
www.tms.org/AIM2022

- The inaugural TMS World Congress on Artificial Intelligence in Materials and Manufacturing (AIM 2022) is the first event of its kind to focus on the role of artificial intelligence in materials science and engineering and related manufacturing processes.
- Abstracts are being considered now for inclusion in the technical program, including topics such as intelligent/robotic manufacturing; machine learning/deep learning in materials and manufacturing; AI-assisted development of new materials/alloys; and more. Visit the congress website for more topics and to submit your work.

JOM, Vol. 73, No. 5, 2021
https://doi.org/10.1007/s11837-021-04656-4

call for papers

JOM **is seeking contributions on the following topics for 2021 and 2022. For the full Editorial Calendar, along with author instructions, visit www.tms.org/EditorialCalendar.**

November 2021
Manuscript Deadline: June 1, 2021

Topic: Advanced High-Strength Steels

Scope: Advanced high-strength steels (AHSS) have been widely used in commercial vehicles for decades. New AHSS are being actively researched in academia and industry. This special topic focuses on the latest developments in AHSS, including high-strength low-alloy (HSLA), dual-phase (DP), transformation-induced plasticity (TRIP), complex phase (CP), martensitic, quenched & partitioned (Q&P), medium manganese, TRIP-assisted bainitic ferrite (TBF), press-hardened steel (PHS), twinning-induced plasticity (TWIP), and low density steels.
Editors: M.X. Huang and Ana Araujo
Sponsor: Steels Committee

Topic: Advances in Multi-modal Characterization of Structural Materials

Scope: Progress in the development of instrumentation and workflows that enable the collection of various data modalities have provided novel insights into material behavior. This special topic will focus on the application of varied characterization approaches in both 2D and 3D, across multiple length scales and/or imaging modalities, for structural materials. Papers that focus on the development and application of advanced segmentation and data fusion approaches for quantitative data analysis are also invited.
Editors: Andrew T. Polonsky and Amit Pandey
Sponsor: Advanced Characterization, Testing, and Simulation Committee

Topic: Latest Developments in Manufacturing and Recycling of Refractory Materials

Scope: Renowned for their unique properties, refractory materials have widespread applications in electronic, nuclear, and defense industries. Although powder metallurgy is still the only route for major commercial production, manufacturing and recycling technologies have made great strides in processing of refractory materials. The focus of this special topic includes recent advances in overcoming process challenges or improving material performances. Manuscripts covering the latest experimental and theoretical studies especially focusing on recycling of refractory metals are invited.
Editors: Chai Ren and Ravi Enneti
Sponsor: Refractory Metals and Materials Committee

December 2021
Manuscript Deadline: July 1, 2021

Topic: Advanced Casting and Melt Processing Technology for Light Alloys

Scope: This topic covers the newly developed or significantly improved casting and melt processing technologies applicable to light alloys. This may include advanced studies on the improvement of structure; optimization of phase composition, mitigation of casting defects as well as advances in casting and melt treatment technology. Also considered is the extension of the technology to recycled alloys. Both experimental and modelling studies will be considered, the latter requiring experimental validation.
Editor: Dmitry Eskin
Sponsor: Aluminum Committee

Topic: Advances in Processing, Manufacturing, and Applications of Magnetic Materials

Scope: We welcome the submission of papers on advances for synthesizing, processing, and characterization of magnetic materials including permanent and soft magnets, energy conversion, and multiferroic materials (such as magnetocaloric, magnetoelastic, magnetoelectric and magnetoresistive materials). Applications of interest include biological applications of magnetism, sensors and actuators, energy harvesting, motor-generators, transformers and inductors, and memory applications. Work on discovery, advanced manufacturing, processing and characterization techniques applied to the relevant magnetic materials and their applications, is strongly encouraged.
Editors: Scott McCall and Ikenna Nlebedim
Sponsors: Magnetic Materials Committee

Topic: Corrosion and Protection of Materials at High Temperatures

Scope: Papers on all aspects of high-temperature corrosion and protection of materials are invited. Examples of topics include oxidation in different atmospheres, molten salt corrosion, metal dusting, halogen attack, etc. Papers dealing with surface modification for high-temperature corrosion protection are also invited.
Editors: Vilupanur Ravi and Ramprashad Prabhakaran
Sponsor: Corrosion and Environmental Effects Committee

Topic: Surface Engineering for Improved Corrosion or Wear Resistance

Scope: Corrosion and wear are surface phenomena and therefore, surface engineering has been used to improve both properties. Coatings, surface alloying, gradient structures, nanocrystallization, and inhibitors have been applied to tailor the surfaces for improved corrosion and wear resistance. This special topic focuses on capturing recent advancements in: 1) surface engineering technologies to improve corrosion and/or wear resistance and 2) theoretical understanding of corrosion and/or wear behavior of the surfaces.
Editors: Tushar Borkar, Arif Mubarok, and Rajeev Gupta
Sponsor: Surface Engineering Committee

January 2022
Manuscript Deadline: August 1, 2021

Topic: 2D Materials – Preparation, Properties & Applications

Scope: Since the discovery of graphene, interest in basic and applied research in 2D materials is on the rise. Challenges and opportunities continue to grow in the areas of process-property-performance correlations in 2D materials. Efforts to transfer technology from fundamental R&D to prototyping to manufacturing are being pursued rigorously on a global scale. Studies on carbon nanotubes, graphene, hexagonal boron nitride, perovskites, phosphorene, transition metal dichalcogenides, xenes (germanene, silicene, stanene) are of interest for this topic.
Editors: Nuggehalli M. Ravindra, Ramana Chintalapalle, Gerald Ferblantier, Sufian M. Abedrabbo, and Amber Shrivastava
Sponsor: Thin Films and Interfaces Committee

Topic: 4IR in Extractive Metallurgy

Scope: With the advent of the fourth industrial revolution, advanced digital technologies that facilitate engineering, design, optimization, and management are becoming increasingly pervasive across a wide range of industries. In extractive metallurgy, large processing plants often combine many unit operations together into highly complex and interdependent flowsheets, making them a rich field for potential application of 4IR technologies. This topic will explore past, present, and future research and development into the use of 4IR in the extractive metallurgy.
Editors: Chris Aldrich, Quinn Reynolds, and M. Akbar Rhamdhani
Sponsor: Pyrometallurgy Committee

SAVE THE DATE

AIME–TMS 150th CELEBRATION

TMS 2022
Annual Meeting & Exhibition

SINCE 1871

FEBRUARY 27-MARCH 3, 2022

ANAHEIM, CALIFORNIA, USA

#TMSAnnualMeeting

Join us next year in Anaheim, California, for the TMS 2022 Annual Meeting & Exhibition (TMS2022) and continue the celebration of the 150th Anniversary year of TMS and the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME).

TMS2022 WILL FEATURE:

DIVERSITY (DMMM4) IN THE MINERALS, METALS, AND MATERIALS PROFESSIONS

REWAS 2022
Developing Tomorrow's Technical Cycles

CALL FOR ABSTRACTS OPENS IN MAY 2021

Learn more and sign up for updates at: www.tms.org/TMS2022

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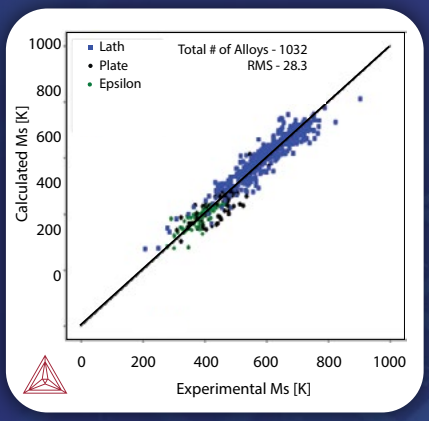
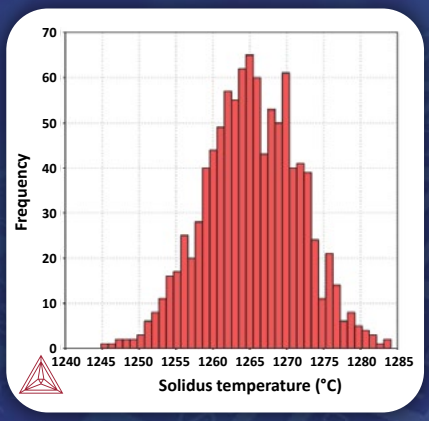
Steel and Fe-Alloys



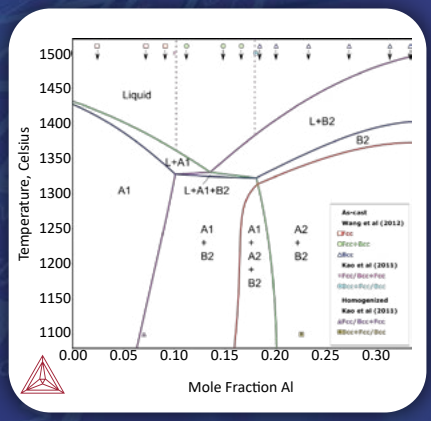
Comparison of calculated and experimental Ms temperatures for a wide range of steels

Nickel



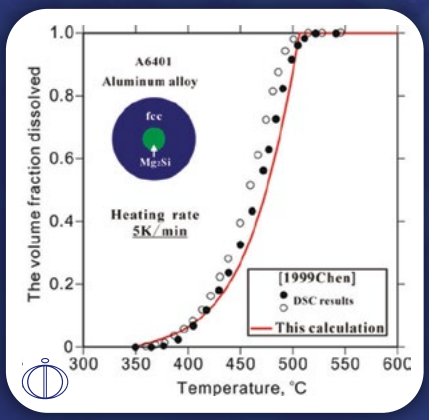
Variation in solidus temperature over 1000 compositions within alloy 718 specification

High Entropy Alloys



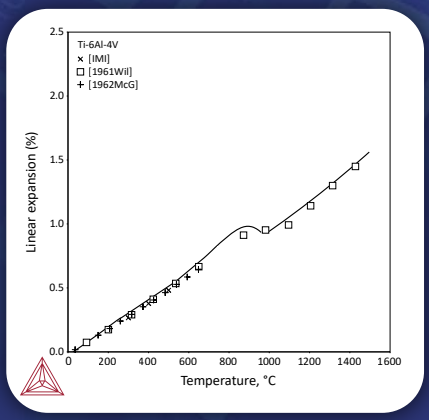
Calculated phase diagram along the composition line of CoCrFeNi-Al

Al Alloys



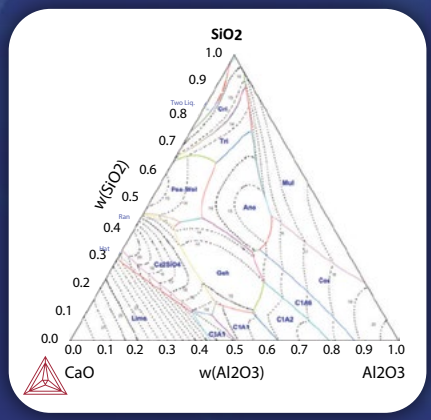
Dissolution of Mg2Si precipitate in Alloy A6401

Ti and TiAl Alloys



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

Oxides



Ternary liquidus projection in oxide systems

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