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AUGUST 2024
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August 2024 Guest Editors

Advanced Functional and Structural Thin Films and Coatings

Thin Films and Interfaces Committee
Gerald Ferblantier, University of Strasbourg; **Adele Carrado**, University of Strasbourg; **Karine Mougin**, Mulhouse Materials Science Institute; **Nuggehalli Ravindra**, New Jersey Institute of Technology; and **Heinz Palkowski**, Clausthal University of Technology

Environmental Degradation of High Temperature Structural Materials

Corrosion and Environmental Effects Committee
Kinga Unocic, Oak Ridge National Laboratory

Interface Engineering and Property Functionalization

Chemistry and Physics of Materials Committee
Hesam Askari, University of Rochester; and **Eva Zarkadoula**, Oak Ridge National Laboratory

Microstructure and Defect Development During Rapid Solidification

Solidification Committee
Kara Luitjohan, Los Alamos National Laboratory; and **Catherine Tonry**, University of Greenwich

About the Cover
The five cover images represent the five technical divisions of The Minerals, Metals & Materials Society: Extraction & Processing, Functional Materials, Light Metals, Materials Processing & Manufacturing, and Structural Materials. In representing the five technical divisions, *JOM*: The Journal balances the interests of its members and authors in the monthly topics and articles it publishes.

About *JOM*:
The scope of *JOM* (ISSN 1047-4838) encompasses publicizing news about TMS and its members and stakeholder communities and publishing high-quality 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 application of materials.

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IN THE FINAL ANALYSIS

JOM THE MAGAZINE

""Decision making is easy when your values are clear."
—Attributed to Roy Disney

James J. Robinson
Executive Director

James Robinson

While not as universally known as younger brother Walt, Roy Disney is in many ways equally responsible for giving us the Disney corporate entertainment colossus that is globally enjoyed today. Walt, of course, was the creative visionary who became a global brand and ubiquitous icon of Americana. Roy attracted fewer spotlights but was equally crucial to the Disney enterprise succeeding by excelling in the role of business architect, empowering Walt's genius, and making sure that wishing upon stars was financially viable. For more than a century, Walt, Roy, and their various successors successfully cultivated a Disney brand that is wholesome, innovative, and optimistic . . . and very profitable.

It was hard to not think about the values of the Walt Disney Company leading up to TMS2024 in Florida last March. Florida, of course, is the home of Walt Disney World, arguably the planet's top tourist destination. During the run up to TMS2024, Disney was in a series of legal disputes with Florida. The thumbnail grievance: Disney felt that Florida was taking punitive action against it because Disney had criticized Florida legislative actions as harmful to diversity, equity, and inclusion initiatives. Espousing its corporate values created some significant financial downside and political and cultural heat for the company. Disney was unapologetic.

TMS articulated its own perspective about states engaged in anti-DEI legislation. 2023 TMS President Brad Boyce and I wrote an open letter presenting our perspectives on Florida's actions. More broadly, TMS issued a position statement, articulating "TMS implores governments to cultivate greater participation from marginalized and underrepresented groups, including Black and LGBTQIA+ individuals, in education, government, and business, in support of a more diverse workforce, and particularly to the benefit of the STEM community."

In part, we issued these statements because TMS leadership believes strongly in Goal One of our strategic plan: "TMS aspires to be a highly inclusive society where all materials students and professionals feel welcome, and diversity is celebrated." Leadership was also empathetic with the members who had expressed disquiet about going to Orlando for TMS2024 as well as two future Orlando meetings for which TMS is contractually obligated to hold: TMS2027 and TMS2029.

Voiding existing meeting contracts is not financially viable. So, we do our best with the circumstances we face, as we did in Orlando with TMS2024. The trick is to not add to existing challenges, but temptations do exist. Specifically, one of the biggest risks in running a meeting is failing to fulfill all contracted requirements with the hotel. For TMS2024, we experienced atypically high cancellations of hotel reservations at the last minute. This put the Society in a short fall against our sleeping room commitment. The long and the short, TMS owed our host hotel a penalty of roughly $44,000. The hotel was, however, willing to forgive this debt if TMS would agree to bring another significant meeting to the venue within the next few years. This is a common business practice and has helped absolve TMS of significant penalties at different times.

TMS leadership discussed the offer. There was effectively one pro and one con. **The pro?** Save $44,000 of needed TMS resources after two years of deficit operation. **The con?** Look like consummate hypocrites by paying lip service to our principles in order to avoid payment of a non-existential expense. **The outcome?** I authorized payment of the $44,000 penalty. **The "why"?** TMS must prioritize its core values with consistency, which affirms the trust and loyalty that our members, volunteers, and stakeholders place in the leadership.

Sometimes, doing the right thing can hurt. And sometimes, a hurt feels right.

TMS leadership believes strongly in Goal One of our strategic plan: "TMS aspires to be a highly inclusive society where all materials students and professionals feel welcome, and diversity is celebrated."

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JOM TECHNICAL TOPICS

JOM THE MAGAZINE

Find peer-reviewed technical articles covering the full range of minerals, metals, and materials science and engineering in the August issue of *JOM:* The Journal. Each issue features several technical topics presenting a series of related articles compiled by guest editors. A preview of August technical topics and articles are listed below. TMS members can log in to www.tms.org/Journals for full access to technical articles from *JOM:* The Journal and additional TMS journals.

Below is a sample of articles that will appear in the August issue, based on information available at press time. For the most up-to-date article listing, visit www.tms.org/JOM.

AUGUST 2024

Advanced Functional and Structural Thin Films and Coatings

Editors: **Gerald Ferblantier**, University of Strasbourg; **Adele Carrado**, University of Strasbourg; **Karine Mougin**, Mulhouse Materials Science Institute; **Nuggehalli Ravindra**, New Jersey Institute of Technology; and **Heinz Palkowski**, Clausthal University of Technology
Sponsor: Thin Films and Interfaces Committee

"Cathodic Synthesis of Strontium-Substituted Hydroxyapatite Coatings," **Ramaswamy Narayanan**, et al.

"Revealing Microstructure and Electrochemical Corrosion Behaviour of CoNiCrAlY Coatings Fabricated by Supersonic Plasma Spraying," **Muhammad Ilyas**, et al.

"Enhancement of Cobalt Bismuth Nano-Ferrite via Heat Treatment to be Applied in High-Frequency and Antimicrobial Applications," **Asmaa A.H. El-Bassuony**, et al.

"Laser Treatment of Electrospark-Deposited Ti0.8W0.25Cr0.5FeCo1.75Ni3AlB0.6 High-Entropy Coatings," **Oleksandr Myslyvchenko**, et al.

"Photoelectric Properties of SZO/p-GaAs Heterojunction Solar Cells," **M. Manoua**, et al.

"Corrosion Resistance Behavior of Zinc Substrate Treated with Rare Earth Salt Passivation," **Yanshaozuo Zhu**, et al.

"Construction and Electrochemical Properties of Preferred Crystal Face (002) on Zn Anode Surface," **Weishun Li**, et al.

"Degradation Processes of Two Compound Layers on Nitrided Surfaces During the Wear Test by 'Block on Hot Al Cylinder'," **Martin Lamut**, et al.

"Surface Modification of GO/TiO_2 Thin Film by Sodium Dodecyl Sulphate for Photocatalytic Applications," **Azliza Azani**, et al.

"Microwave Heating and Curing of Joined Carbon Fiber Composites," **Xiaobao Zhu**, et al.

"Electroplating of Refractory Metals in Molten Salts: A Review," **Zijian Wang**

Environmental Degradation of High Temperature Structural Materials

Editor: **Kinga Unocic**, Oak Ridge National Laboratory
Sponsor: Corrosion and Environmental Effects Committee

"The Corrosion and Mechanical Behavior of Zirconium Alloy for Alkali Fusion Process at High Temperature," **Resetiana D. Desiati**, et al.

"Oxidation Performance of CoCrCuFeMnNix High-Entropy Alloys Prepared via Vacuum Hot Pressing Sintering," **Baofeng Zhang**, et al.

"Optimization of Heat-Treatment Process for Corrosion Resistance of Ti600/TC18 Inertial Friction Welding Joint," **Yingying Liu**, et al.

"The Impact of Ni- and Cr-Containing Thermally Grown Oxides on the Intensity of Oxide and Sulfate Induced Hot Corrosion of an Alumina-Forming Alloy," **Atharva S. Chikhalikar**, et al.

"Enhanced Mechanical Properties and Wear Resistance of FeCrAl Alloys at ~300°C and Higher Temperatures," **Evan J. Dolley**, et al.

"Finite Element Modeling of the Phase Change in Thermally-Grown SiO_2 in SiC Systems for Gas Turbines," **Trevor G. Aguirre**, et al.

"Effect and Role of NaCl in Na_2SO_4 Deposits on the 900°C Hot Corrosion of a 2nd-Generation Ni-based Superalloy," **Preston Nguyen**, et al.

Interface Engineering and Property Functionalization

Editors: **Hesam Askari**, University of Rochester; and **Eva Zarkadoula**, Oak Ridge National Laboratory
Sponsor: Chemistry and Physics of Materials Committee

"High-Performance Fe-Al Double Hydroxide Prepared by Red Mud for Arsenic Removal," **Haonan Liu**, et al.

"Synthesis and Electrochemical Performance of Na and F Elements Co-doped $LiFePO_4$/C as a Cathode Material for High-Rate Lithium-Ion Batteries and the Mechanism of Modification," **Jie He**, et al.

"A Pathway to Optimal Multivariate Synthesis of Fe_2O_3-CuO Bimetal Oxide Hybrid Nanoparticles: Transformation Through Mathematical Modelling," **Ambreen Sarfraz**, et al.

"Li-doped P3-type Mn-Ni-Based Cathodes with Improved Electrochemical Performance for Na-ion Batteries," **Miao Wang**, et al.

"An Excellent Corrosion-Resistant Al-Si-Mg-Mn Hot-Dip Coating for Steel," **D. Pradhan**, et al.

"Thermal, Mechanical Properties and Finite Element Analysis of Polypropylene Hybrid Composites from Nonmetallic Fractions of Waste Printed Circuit Boards (WPCBs) and Shellfish Waste," **Jingjing Jiang**, et al.

"Adding WC Nano-Particles to Nickel-Based Coating Deposited by PTA Process: Microstructure and Nanoindentation Hardness Characteristics," **Mahmoud Abbasi**, et al.

Microstructure and Defect Development During Rapid Solidification

Editors: **Kara Luitjohan**, Los Alamos National Laboratory; and **Catherine Tonry**, University of Greenwich
Sponsor: Solidification Committee

"Microstructure and Mechanical Properties of MoNbTaW RHEA Fabricated by Laser Metal Deposition," **Hongzhong Liao**, et al.

"Microstructure Evolution and Compressive Property Variation of CoCrFeNiAlx High Entropy Alloys Produced by Directional Solidification," **Zhuhuan Yu**, et al.

"Refining Microstructures in Additively Manufactured Al/Cu Gradients Through TiB_2 Inclusions," **Michael J. Abere**, et al.

"Bonding Strength of 12Cr-0.4C/Low Carbon Steel (LCS) Weld Joint After Solid Solution Heat Treatment," **Wenjun Zhu**, et al.

"Numerical Simulation and Crack Suppression Study on High-Speed Laser Cladding of ZL101 Aluminum Alloy," **Chenjun Wei**, et al.

View More Technical Articles

JOM regularly publishes additional articles that fit within the scope of the journal, but not within the scope of a particular technical topic. Read these in the "Technical Articles" section of *JOM* on Springer.

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JOM: The Journal 2025–2026 Editorial Calendar Is Open for Submissions

Kelly Markel

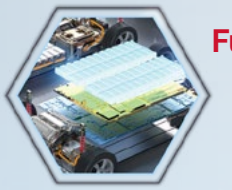
The 2025–2026 Editorial Calendar for *JOM*: The Journal is open for submissions. With 53 topics scheduled from January 2025 through March 2026, the Calendar offers potential authors a wealth of subject areas to showcase their work. And if none of those subject areas are a good fit, the popular "Technical Articles" section will accommodate manuscripts that meet *JOM*'s scope but not necessarily the scope of any planned topics. We at *JOM* look forward to collaborating with and supporting our volunteers in another successful publishing year.

JOM Editorial Calendar Highlights

The *JOM* Editorial Calendar typically includes topics planned by TMS technical committees, manuscript collections from symposia and conference organizers, and occasional topics developed by individual TMS members. Technical committee contributions, however, are essential to the success of the journal. At the time this article was prepared, 32 committees had planned topics for the coming year—a strong representation of the interests of TMS members, its committees, and the five technical divisions into which the committees are organized. The following topics are some examples from committees within each division. View the full calendar at www.tms.org/EditorialCalendar to search by topic, committee sponsor, or guest editor name.

Extraction & Processing Division

- ***Advances in Lithium Recovery from Primary and Secondary Sources***: Recycling and Environmental Technologies Committee; Hydrometallurgy and Electrometallurgy Committee
- ***Towards Zero Carbon and Zero Waste: Metals Extraction and Processing***: Energy Committee; Process Technology and Modeling Committee



Functional Materials Division

- ***Biological and Bio-Inspired Structural Materials***: Biomaterials Committee
- ***Advancements in Thin Films and Tailored Surfaces: Breaking Barriers in Sensing and Biomaterials***: Thin Films and Interfaces Committee

Light Metals Division

- ***Refining Techniques to Upgrade Aluminum Scrap***: Aluminum Committee; Recycling and Environmental Technologies Committee
- ***Annealing-Induced Phenomena of Mg Alloys***: Magnesium Committee

Materials Processing & Manufacturing Division

- ***Bridging Scale Gaps in Multiscale Materials Modeling in the Age of Artificial Intelligence***: Computational Materials Science and Engineering Committee; ICME Committee
- ***Recent Advances in the Development of Solid State Coatings and Applications***: Surface Engineering Committee

Structural Materials Division

- ***Microstructural Design and Optimization of Additively Manufactured Steels***: Steels Committee
- ***Ultra-High Temperature Refractory Metals and Alloys for Complex Environments***: Refractory Metals & Materials Committee

How to Publish in *JOM*

Visit the Editorial Calendar at **www.tms.org/EditorialCalendar**. There you can search by keyword for a topic that fits your expertise. The topic's "Details" page offers the full scope and other useful information. If no topics are appropriate and the work fits the broader scope of the journal, plan to submit as a Technical Article. Next, prepare your manuscript according to the *JOM* Instructions for Authors found at **www.tms.org/AuthorTools**. And finally, submit your manuscript through Editorial Manager at **www.editorialmanager.com/jomj**.

New Topics Invited for 2025–2026

Although the 2025–2026 Editorial Calendar offers a bounty of relevant, timely topics, there is always room for more. *JOM* is seeking TMS members to organize small collections of four to six articles, particularly in emerging and developing research areas. Consider developing a topic around your own work and inviting colleagues and other prominent researchers in this area to contribute.

Please keep the following in mind when planning a new topic:

- Topic organizers can submit their own work, but the review and decision process must be handled by another expert in the subject area.
- New topics should not conflict with any on the existing Editorial Calendar.
- Topics should be submitted via the Topic Submission Form at **www.tms.org/TopicSubmission**. This form includes the submission deadline for each month to help you set a realistic publication target.

Become a *JOM* Peer Reviewer

Get a look at the current work in your field while sharing your expertise with the materials community by becoming a peer reviewer. *JOM* is seeking reviewers who:

- Have published articles in their specialty areas
- Are currently practicing in the area(s) in which they would be reviewing manuscripts
- Have experience reviewing scientific manuscripts

If you are interested in becoming a peer reviewer, please send a brief description of your experience as a reviewer, along with a CV, to Kelly Markel, TMS Publications Managing Editor at **kmarkel@tms.org**.

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TMS Welcomes New Members in March 2024

Jillian Schultz

The TMS Board of Directors approved professional membership for the following individuals at its March 2024 meeting. Please join us in congratulating and welcoming them to all the privileges and benefits of TMS membership.

Approved March 2024

Agrawal, Priyanka; University of North Texas, United States

Alarcon-Furman, Philip; North Carolina State University, United States

Altenbaugh, Derek; Robindale Energy Services, United States

Anand, Rahul; Virginia Polytechnic Institute and State University, United States

Anantatamukala, Amrutha; University of North Texas, United States

Andreev Batat, Shir; Tel Aviv University, Israel

Aristeidakis, Ioannis; QuesTek Europe AB, Sweden

Arnold, Michael; University of Wisconsin-Madison, United States

Asfaw, Redae Fisseha; Italy

Astrom, Peter; Swedish Society for Materials Technology, Sweden

Asumadu, Tabiri; SUNY Polytechnic Institute, United States

Ayogu, Tobechukwu; Nigeria

Bair, Jacob; Oklahoma State University, United States

Balakrishna, Ananya; University of California, Santa Barbara, United States

Bang, Junhyeok; Chungbuk National University, Korea, South

Belyakov, Sergey; Tokamak Energy, United Kingdom

Beretta, Stefano; University of Milan, Italy

Bernhard, George; Consarc Corporation, United States

Birtch, Wallace; Metal Tech & Mgmt Inc., United States

Boakye-Yiadom, Solomon; York University, Canada

Bouzouni, Marianthi; Elkeme, Greece

Bucsek, Ashley; University of Michigan, United States

Buehler, Markus; Massachusetts Institute of Technology, United States

Buga, Yigit; TEI Tusas Engine Industries, Turkey

Carrere, Tristan; Tokai COBEX, France

Carver, Rodney; AMG Aluminum, United States

Castano Londono, Carlos; Virginia Commonwealth University, United States

Catledge, Katrina; Johns Hopkins University Applied Physics Laboratory, United States

Celli, Dino; Air Force Research Laboratory, United States

Chaithanya Kumar, Karnakanti Naga; University of North Texas, United States

Chakraborty, Supriyo; University of Michigan, United States

Chen, Xiaoming; Novelis, United States

Chen, Youping; University of Florida, United States

Choudhury, Samrat; University of Mississippi, United States

Conrad, Jacy; Idaho National Laboratory, United States

Cui, Shuang; The University of Texas at Dallas, United States

Cunnings, Jarrod; Real Alloy, United States

de Olivera, Jairo Vinicius; United States

DeCost, Brian; National Institute of Standards and Technology, United States

Doddapaneni, V. Vinay K.; Oregon State University, United States

Donaldson, Randy; Metso Corp, United States

Dong, Pei; George Mason University, United States

Dunlap, Bret; Woodward, United States

Dunne, Timothy; CNPC USA, United States

Edwards, Simon-Peter; Bridgnorth Aluminium, United Kingdom

Etinosa, Precious; Worcester Polytechnic Institute, United States

Fallah Fini, Mojtaba; Saskatchewan Research Council, Canada

Fan, Xianqiang; University College London, United Kingdom

Fei, Zhenyu; University of Michigan, United States

Fertig, Alex; Faraday Technology, United States

Flampouri, Athanasia; Greece

Francioni, Douglas; RHI Magnesita, United States

Fung, Victor; Georgia Institute of Technology, United States

Gao, Yashuang; EnPot, United States

Gervasio, Michelle; Sweet Briar College, United States

Girard, Guillaume; Pyrotek, Canada

Gogotsi, Yury; Drexel University, United States

Green, T.M. Kelsy; Los Alamos National Laboratory, United States

Gupta, Satyapriya; Indian Institute of Technology Dharwad, India

Gurcan Bayhrak, Kubra; Eskisehir Technical University, Turkey

Hammill, Kim; HATCH, United States

Handscombe, Michael; PhoenixTM LTD, United Kingdom

Hansen, Lars; Etex, Denmark

Hartmann, Josephine; North Carolina State University, United States

Hew, Nigel; Pennsylvania State University, United States

Hirotani, Rin; Japan

Hornbach, Doug; Lambda Research, United States

Hu, Bin; CSMET Group, China

Hu, Guoxiang (Emma); United States

Hudson, Dillon; United States

Hurst, Michael; Bush Combat Development Complex, United States

Iams, Andrew; National Institute of Standards and Technology, United States

Jemberu, Surafel Ashenafi; Ethiopian Quality Award Organization, Ethiopia

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Juniarsih, Andinnie; Sultan Ageng Tirtayasa University, Indonesia

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Kumar, Golden; The University of Texas at Dallas, United States

Lalpour, Abdollah; Iran, Islamic Republic of

Larsen, James; Air Force Research Laboratory, United States

Lawalin, Joshua; Commonwealth Rolled Products, United States

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Liang, Chien-Lung; National Taiwan University of Science and Technology, Taiwan

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Singh, Mahavir; Purdue University, United States

Smith, Thale; California Polytechnic Institute, San Luis Obispo, United States

Sobotka, James; Southwest Research Institute, United States

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Squire, Steven; Canada

Staggl, Simon; Hertwich Engineering, Austria

Stiehler, Martin; Cranfield University, United Kingdom

Sun, Xingsheng; University of Kentucky, United States

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Wang, Sicheng; The University of Queensland, Australia

Wani, Irfan; National Institute of Technology, Srinagar, India

Wanni, Janith; University of Wisconsin-Madison, United States

Waseem, Owais; KSM GIW, Inc., United States

Werner, Charlie; Stainless Foundry & Engineering, United States

Williams, Carson; Hobart Brothers, United States

Witman, Matthew; Sandia National Laboratories, United States

Wittenhagen, Ethan; Logan Aluminum, United States

Xiang, Fangming; National Energy Technology Laboratory, United States

Xu, Xiao; Tohoku University, Japan

Yamauchi, Akira; National Institute of Technology, Gunma College, Japan

Yan, Xinyan; Alcoa, United States

Yanikoski, Catherine; Engineering Systems Inc., United States

Yoneyama, Midori; Japan

Yu, Bosco; University of Victoria, Canada

Yumnam, George; Oak Ridge National Laboratory, United States

Zak, Laura; Fiven North America, Inc., United States

Zhang, Yanliang; University of Notre Dame, United States

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Discover **Early Career** and **Young Leader** Opportunities through TMS

Kelly Zappas

TMS offers a number of career development opportunities for members who are recent graduates and early career professionals. The awards and programs detailed in this article are designed to help recipients not only build a professional profile in the early stages of their career but to offer unique experiences that help develop leadership and presentation skills in the recipients.

Applications for several key awards are coming up fast, with applications due August 15, while other awards have spring deadlines. If you or a colleague could benefit from any of these opportunities, mark your calendars now, begin gathering application materials, and plan to submit an application by the deadlines listed below. Learn more about these programs at **www.tms.org/YoungProfessionals**.

TMS Young Leaders Professional Development Award

Application Deadline: August 15

This award was created to help early-career professionals to more fully participate in TMS activities, become better acquainted with their peers and the Society, make important contacts with TMS leaders, and network with prominent Society members. Specifically, this award provides recipients with funding to travel to the TMS Annual Meeting & Exhibition, where they are invited to participate in Society leadership activities, including an invitation to attend the TMS Board of Directors meeting as an observer.

Submit an application online by August 15, 2024, to be considered for the 2025 award, which will include funding to attend the TMS 2025 Annual Meeting & Exhibition in Las Vegas, Nevada, March 23–27.

Young Leaders International Scholar Program

Application Deadline: August 15

This exchange program is jointly operated by TMS, the Federation of European Materials Societies (FEMS), the Japan Institute of Metals and Materials (JIMM), and the Korean Institute of Metals and Materials (KIM). The selected TMS scholars will receive funding to travel to international conferences held by these three partnering societies to present their work.

Submit an application online by August 15, 2024, to be considered for the 2025 TMS Young Leaders International Scholar awards. In 2025, TMS will select a total of three award recipients to attend the FEMS, JIMM, and KIM conferences, respectively. You can read an account of the most recent award recipient's experiences in the October 2023 issue of *JOM: The Magazine.*

Early Career Faculty Fellow Award

Application Deadline: April 1

This award recognizes an assistant professor for accomplishments that have advanced their academic institution and for their ability to broaden the technological profile of TMS.

Applications will be accepted through April 1, 2025, for the 2026 award. The recipient of this award will make a broad-based, nontechnical presentation at the Emerging Professionals Tutorial Luncheon at the TMS 2026 Annual Meeting & Exhibition in San Diego, California, and program a symposium at the TMS 2027 Annual Meeting & Exhibition in Orlando, Florida.

Frontiers of Materials Award

Application Deadline: April 1

Top-performing early-career professionals can apply for this competitive award, which supports the recipient in organizing a symposium and delivering a keynote talk on a hot or emergent technical topic at the TMS Annual Meeting & Exhibition. Applicants from industry are especially encouraged to apply for this award, where potential topics of interest might include the circular economy, emerging needs, standards development, or other topics of interest to an industrial audience.

Applications will be accepted through April 1, 2025, for the 2026 award, and selected recipients would organize a symposium for the TMS 2026 Annual Meeting & Exhibition in San Diego, California.

TMS Young Innovator in the Materials Science of Additive Manufacturing Award

Application Deadline: April 1

This award recognizes an outstanding, early career individual who is performing innovative research in the area of the materials science of additive manufacturing. The recipient delivers an award lecture during the Additive Manufacturing Keynote Session held at the TMS Annual Meeting & Exhibition each year.

Applications will be accepted through April 1, 2025, for the 2026 award, and the selected recipient would deliver an award lecture at the TMS 2026 Annual Meeting & Exhibition in San Diego, California.

AIME Robert Lansing Hardy Award

Application Deadline: April 1

This award recognizes a young person in the broad fields of metallurgy and materials science for exceptional promise of a successful career, rather than for any specific accomplishment. The broad fields of metallurgy and materials science include minerals processing, extractive, physical or adaptive metallurgy, and metal processing. The award was established by The American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME), of which TMS is a member society.

Applications will be accepted through April 1, 2025, for the 2026 award. The recipient will be honored as part of the 2026 TMS-AIME Awards Ceremony at the TMS 2026 Annual Meeting & Exhibition in San Diego, California, where they will receive the Hardy Medal, an engraved plate in a walnut frame, and a $500 cash award donated by Ford Motor Company through the TMS Foundation. Applicants must be under the age of 35 as of December 31, 2025.

Emerging Leaders Alliance Program

Application Deadline: May 15

This unique leadership development program for scientists and engineers is designed for early-career professionals on track for leadership roles or upper-level management positions in their organizations. Selected individuals will receive funding to attend a training program that will help strengthen their nontechnical skills in a setting that allows them to interact across disciplines and obtain foundational, executive-level knowledge, while weaving themes of social responsibility and environmental stewardship throughout the training curriculum.

Applications will be accepted through May 15, 2025, for the 2025 Emerging Leaders Alliance Conference.

Get Started with the Emerging Professionals Committee

The TMS Emerging Professionals Committee is an excellent place to meet fellow early-career professionals, to learn more about opportunities available to members who are still establishing their careers, and to be a part of future activities planned for emerging professionals. In addition to applying for one of the above awards, TMS encourages members in the early stages of their careers to join the Emerging Professionals Committee. The committee is open to any TMS member who is less than ten years past their terminal degree or under 40 years of age, whichever comes later. To join the committee, contact Courtney Hammer, TMS Membership Program Manager, at **chammer@tms.org**, or attend a committee meeting held at the TMS Annual Meeting & Exhibition.

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ADDITIVE MANUFACTURING IN MATERIALS EDUCATION: AN INDUSTRY ROUNDTABLE

Kaitlin Tyler

Editor's Note: In this roundtable conversation, **Kaitlin Tyler,** *JOM* liaison for the TMS Education Committee, poses questions about the importance of the role of additive manufacturing (AM) education for students entering the workforce. Respondents are **Josh Cramer,** Director of Education and Workforce Development, America Makes; **Callie Higgins,** Project Leader, Photopolymer Additive Manufacturing, National Institute of Standards and Technology; and **Kristin Mulherin,** Director, Additive Manufacturing Technology, Hubbell Incorporated.

Kaitlin Tyler: In a few words, how would you describe additive manufacturing and its connection to materials?

Callie Higgins: Additive manufacturing enables the production of novel materials and structures otherwise impossible to create.

Josh Cramer: Additive manufacturing is inclusive to its need of materials and materials development.

Kristin Mulherin: Additive manufacturing, literally at its core, is all about materials science. It feeds the industry and is the key to its success.

Tyler: How do you currently use additive manufacturing in your job?

Mulherin: I lead the strategic direction for Additive Manufacturing across Hubbell, an international

company that designs and manufactures electronic products for construction, industrial, and utility applications.

Cramer: I lead education and workforce development for America Makes - the National Innovation Institute for Additive Manufacturing.

Higgins: I use AM every day through research efforts, engaging stakeholders to ensure we're pursuing relevant goals, and in developing standard reference materials and documentary standards for the field.

Tyler: How important do you view AM for the next generation of engineers?

Mulherin: Extremely. AM will never fully replace traditional manufacturing, but it offers unlimited opportunities to complement and support the manufacture of items across all major industrial verticals.

> "ADDITIVE MANUFACTURING IS CRITICAL IN ITS DEPLOYMENT AS AN AGILE AND IMMERSED TECHNOLOGY INTO THE CORE FUNCTION AND CAPABILITY OF MANUFACTURING."
>
> JOSH CRAMER

Cramer: Additive Manufacturing is critical in its deployment as an agile and immersed technology into the core function and capability of manufacturing.

Higgins: AM is an enabling technology for not only the expansion of existing fields but for the development of ones we cannot even dream of today, so I'd say it's very important.

Tyler: What are some challenges that AM is facing given the skillset of the current workforce?

Higgins: We as a community need to be better about educating industry/government/academia/consumers about the value and utility of AM. We also need to ensure proper regulations and standards are in place to set the field up for successful implementation by the requisite workforce.

Cramer: America Makes is dedicated to working diligently to solve the talent needs. We work K to Grey

> "AM IS AN ENABLING TECHNOLOGY FOR NOT ONLY THE EXPANSION OF EXISTING FIELDS BUT FOR THE DEVELOPMENT OF ONES WE CANNOT EVEN DREAM OF TODAY."
>
> CALLIE HIGGINS

on solutions for local partners. One of the largest gaps remains within design for additive manufacturing (DfAM) and DfAM tools and concepts. Near to the top of that list is also materials.

Mulherin: AM's biggest hurdle is getting people to think differently. From the design stage through post-processing, additively manufactured parts defy conventional wisdom. Once people are able to let go of doing things the traditional way, the true power of additive manufacturing will be realized. Those in traditional manufacturing are often surprised at how far the technologies have come—we are now able to produce highly technical and qualified end-use parts, and it's time we start implementing it across all major manufacturing sectors.

> "THOSE IN TRADITIONAL MANUFACTURING ARE OFTEN SURPRISED AT HOW FAR THE TECHNOLOGIES HAVE COME—WE ARE NOW ABLE TO PRODUCE HIGHLY TECHNICAL AND QUALIFIED END-USE PARTS, AND IT'S TIME WE START IMPLEMENTING IT ACROSS ALL MAJOR MANUFACTURING SECTORS."
>
> KRISTIN MULHERIN

Tyler: How important do you think incorporating AM into materials education is and why?

Cramer: It is absolutely critical. Like many findings we have had in our research and work, much of the education that is being done lacks rigor and aligns back to strong industry-relevant frameworks. Over the last several years, America Makes, with our members and partners, has been moving the needle in tackling this problem.

Mulherin: It's critical. One of the biggest issues with utilizing AM on a broader scale is a lack of breadth in the materials. We are still limited to a relatively small number of materials that are printable, especially when looking at the metals space. We need educational institutions to not only educate the emerging workforce on what is needed and how to address it but to also aid in this development directly.

Higgins: It is an essential addition as it allows our future innovators to learn and design beyond the current bounds of traditional manufacturing technologies

Tyler: If you could provide any tip to someone looking to add Additive Manufacturing to their curriculum, what would it be?

Mulherin: A fundamental background in traditional manufacturing is invaluable. Educate students on the fundamentals of traditional manufacturing and how AM supports and compliments it. This is critical to winning over the naysayers and gives students the tools needed to encourage adoption in general. With

an education in all manufacturing technologies, the emerging workforce will be better armed to identify the *best* technologies for any given application, not just the ones they are most familiar with.

Cramer: I'd recommend focusing on DfAM, materials, qualification-certification, process flow, and understanding of business case solutions for AM.

Higgins: I encourage anyone taking on this important role to speak to someone in the field—be it industry, academia, or government—to ensure they grasp and can relay the value of this technology in their curriculum.

MEET THE PANELISTS

Kaitlin Tyler is currently an academic content development lead in the Ansys Academic Development Team. Her role is focused on managing the development of educational content that supports the usage of Ansys products in the classroom. She received her Ph.D. in Materials Science and Engineering at the University of Illinois Urbana Champaign. Her research was split: focusing on manipulating eutectic material microstructures and engineering outreach. She is the *JOM* Liaison for the TMS Education Committee and a member of the TMS Diversity, Equity, and Inclusion committee.

Josh Cramer joined the National Center for Defense Manufacturing and Machining (NCDMM) in 2018 as the Education and Workforce Director for America Makes, providing overall program leadership responsibility for all America Makes Education and Workforce initiatives. He now leads all education and workforce development across NCDMM. Previously, Cramer served as the Director of Educational Programs at the Society of Manufacturing Engineers (SME) Education Foundation, monitoring, promoting, and evaluating all of its major programs. He holds a Master's in Education, a Bachelor of Science in Industrial Technology, and a Bachelor of Science in Education from California University of Pennsylvania, as well as an Associate Degree in Engineering Education from Penn State University.

Callie Higgins serves as the Material Measurement Laboratory Additive Manufacturing Program coordinator and co-project leader of the Photopolymer Additive Manufacturing (PAM) Project at the National Institute of Standards and Technology (NIST) in Boulder, Colorado. Additionally, she is an adjunct faculty member at the Colorado School of Mines. Recently, her collaborative work with co-project leader Jason Killgore investigating the fundamental properties of PAM systems received the Samuel J. Heyman Service to America Medal (SAMMIES) for Emerging Leaders, one of the federal government's highest honors. She earned her Ph.D. from University of Colorado Boulder's Department of Electrical Engineering, specializing in optics and material science, focusing on characterizing photopatterned hydrogels for use in regenerative medicine.

Kristin Mulherin is the director of Additive Manufacturing (AM) Technology at Hubbell Incorporated, where she leads the Center of Excellence for AM, driving AM development and adoption for end-used parts enterprise-wide. Mulherin is also president of Women in 3D Printing, a global non-profit with over 100 local chapters within 40 countries. Before joining Hubbell, she held leadership roles across the entire AM ecosystem, having worked with machine original equipment manufacturers (OEMs), contract manufacturers, software providers, materials suppliers, and end-users. Mulherin received her M.S. in Materials Science & Engineering from the University of California, Los Angeles, and an MBA from the University of Southern California.

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Invest in Yourself with the TMS Career Center

Kaitlin Calva

When it comes to investing, many place confidence in the words of Berkshire Hathaway CEO Warren Buffett. One popular nugget of advice can apply to anyone, at any stage of any profession: "The most important investment you can make is in yourself."[1]

While not exactly related to *financial* investments, this mantra encourages introspection: What are your strengths? Weaknesses? Where is there room for improvement? Confronting any potential knowledge gaps—be they in technical skills, professional certifications, or leadership training—is an effective strategy for long-term stability and success. Out of the many benefits of being a TMS member, one that can help you make a smart investment in yourself is the TMS Career Center.

More than just a job board, the TMS Career Center puts resources for investing in yourself right at your fingertips. Whether you want to brush up on your interviewing skills or are looking to make a major career move, you can find advice, industry insights, job coaching, and more at careercenter.tms.org.

CAREER ADVICE

If you are looking for a more casual way to enhance your career, the Career Advice section (see Figure 1) in the Career Planning Portal is a great place to start. Here, you can read articles written by experts on a variety of topics, including:

- Networking
- Resumes & Cover Letters
- Personal Branding
- Leadership
- Interviewing
- Career Growth
- Workplace & Health

Articles range from broad topics, such as empowerment or workplace wellness, to more detailed recommendations, such as ways to improve a LinkedIn profile or how to answer specific questions that may come up during an interview. With such a range of subjects, there is surely something new for everyone.

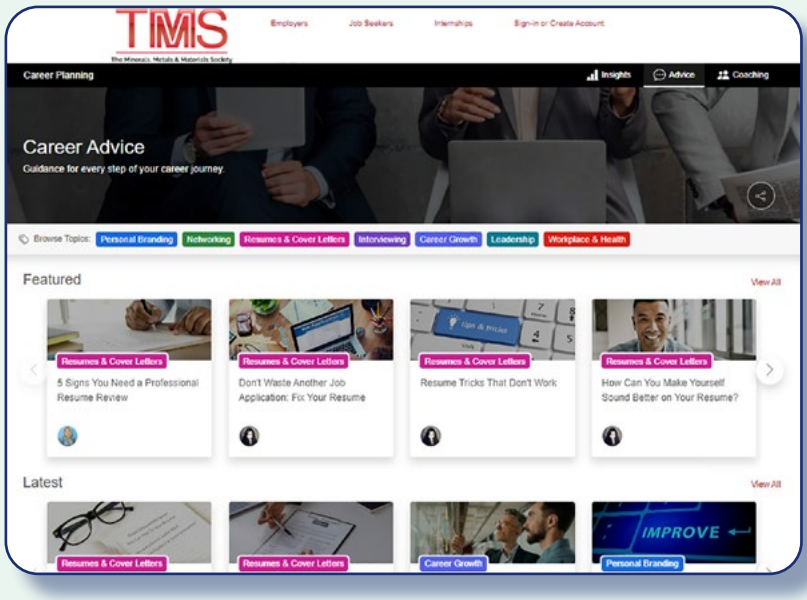

Figure 1. The Career Advice section of the TMS Career Center features a variety of advice articles for every step of your career journey.

Those who are looking for more personalized advice will find value in the Career Coaching section (see Figure 2) of the Career Center. With this offering, you can partner with employment professionals to receive expert advice based on your specific career goals. Here, you can browse a list of available coaches, read about their backgrounds, certifications, and affiliations, and learn about the types of services offered to find your best match.

Figure 2. TMS members can connect with employment experts in the Career Coaching section of the TMS Career Center.

INDUSTRY INSIGHTS

The Career Center offers more than advice with its Industry Insights feature (see Figure 3a). If you are just starting out after graduation, moving somewhere new, or looking to change career paths, this unique element can be a powerful ally in preparing for the job hunt. With the option to search by occupation or location, this tool provides in-depth data on job outlook, required education, and wages.

Additionally, the Activities tab (see Figure 3b) of this section provides a comprehensive list of tasks someone in this position might perform on an average day. The Knowledge tab outlines more specific subject areas you may need a thorough understanding of in this type of role, while the Skills tab details pertinent experience and abilities for individuals wanting to succeed in similar roles. If you are looking to advance into the next level of your career, you may want to peruse Industry Insights as a starting point to a more tangible step on your path, like attending a training or acquiring a certification.

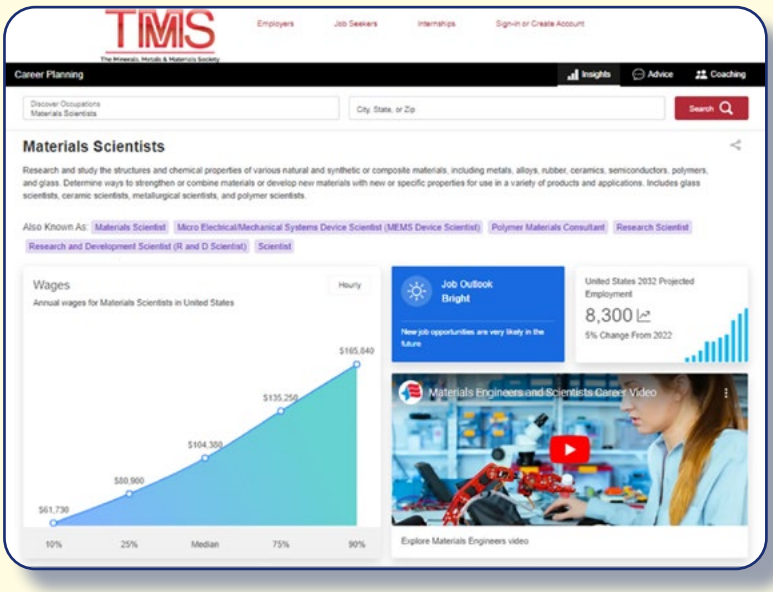

Figure 3a. The TMS Career Center provides employment data for specific jobs, as shown in this example search for "Materials Scientist," in the Industry Insights section.

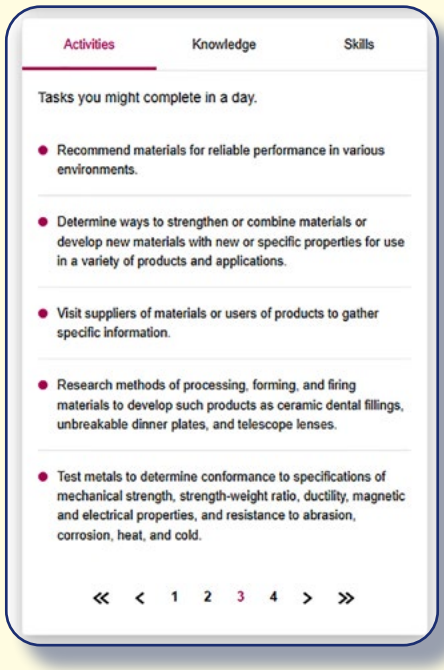

Figure 3b. Within Industry Insights, the Career Center offers lists of typical tasks performed, knowledge required, and valuable skills for specific job roles, as shown in this activities list for a sample search of "Materials Scientist."

FIND THE BEST CANDIDATE WITH TMS

Are you a recruiter or employer looking for the best fit for your organization? Post a job with the TMS Career Center to search the resume bank for great prospects in the materials science and engineering field. To see recruitment plans, advertising options, and pricing, visit the Products page of the Employers section of the Career Center at **careercenter.tms.org**.

PROFESSIONAL DEVELOPMENT WITH TMS

Looking for other ways to enhance your resume? Check out these professional development opportunities for TMS members:

1. For in-person and online courses and workshops, visit the Upcoming Professional Development Events Calendar: **www.tms.org/PDEvents**
2. If you are interested in securing your Professional Engineering License/Registration, see what TMS can offer you to help prepare for the exams: **www.tms.org/PE**
3. Expand your professional network with the new TMS Mentoring Program: **www.tms.org/Mentorship**
4. Explore the Webinar Library for free, at-home access to a variety of learning opportunities: **www.tms.org/WebinarLibrary**

Learn more about additional opportunities at **www.tms.org/PD**.

THE JOB SEARCH

Those who are ready to begin their job search will find many sources of support on writing cover letters and resumes. In addition to the above-mentioned advice articles, premium services are available* for those who are inclined to make a financial investment in their job search. Ranging from free resume reviews to interview preparation sessions to detailed, executive-level candidate support, there are options for all career stages.

At press time, the Career Center boasts more than 250 open positions at companies across the globe. Job seekers can filter their results by keyword, title, location, industry, or job function. The Company Directory feature also allows users to browse a list of nearly 500 organizations and easily research prospective employers with information like company overviews, benefits, and current openings. As an added bonus, users can sign up to receive job alerts related to specific areas of interest.

After utilizing these preparatory resources and when you feel ready to begin your job search, you can upload and manage resumes to your Career Center account. While browsing current openings, you can review and save jobs that you are interested in and easily send your application to prospective employers. The Career Center then connects anonymous resumes to interested employers, who can then send out contact requests to job seekers. While many of the resources listed in this article are free for TMS members, creating an account with the Career Center will ensure that you can make the most out of this resource. To create your free account or sign in as an existing user, follow one of these links:

- **Job Seekers:** **careercenter.tms.org/jobseeker/login/**
- **Employers:** **careercenter.tms.org/employer/login/**

Whether you opt in to a specialized service like career coaching, or simply take the time to read, practice, and improve your skills, it is never too late (or too early) to invest in yourself.

(*Editor's note: some services offered through the TMS Career Center are an additional cost, and not affiliated with TMS or TMS member benefits.)

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1. "Afternoon Session – 2008 Meeting" (CNBC LLC, Warren Buffett Archive, 2008), https://buffett.cnbc.com/video/2008/05/03/afternoon-session---2008-berkshire-hathaway-annual-meeting.html. Accessed 28 May 2024.

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TMS MEETING HEADLINES

JOM THE MAGAZINE

Meeting information is current as of May 30, 2024. For the most recent updates on TMS-sponsored events, visit **www.tms.org/Meetings**.

15th International Symposium on Superalloys (Superalloys 2024)

September 8–12, 2024
Champion, Pennsylvania, USA

Housing Deadline: August 8, 2024

As the longest-running symposium dedicated to superalloys, Superalloys 2024 offers a unique opportunity to engage with the global superalloy community, gain insights into cutting-edge technologies, and contribute to the advancement of this critical field.

www.tms.org/Superalloys2024

TMS Fall Meeting 2024 at Materials Science & Technology (MS&T24)

October 6–9, 2024
Pittsburgh, Pennsylvania, USA

Discount Registration Deadline: August 22, 2024

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

www.tms.org/TMSFall2024

TMS Specialty Congress 2025

June 15–19, 2025
Anaheim, California, USA

Abstract Submission Deadline: October 30, 2024

TMS Specialty Congress 2025 will feature the following three co-located events: the 3rd World Congress on Artificial Intelligence in Materials and Manufacturing (AIM 2025), the 8th World Congress on Integrated Computational Materials Engineering (ICME 2025), and the 7th International Congress on 3D Materials Science (3DMS 2025).

www.tms.org/SpecialtyCongress2025

OTHER MEETINGS OF NOTE

TMS 2025 Annual Meeting & Exhibition (TMS2025)

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

www.tms.org/TMS2025

TMS Fall Meeting 2025 at Materials Science & Technology (MS&T25)

September 28–October 1, 2025
Columbus, Ohio, USA

www.tms.org/TMSFall2025

Extraction 2025 Meeting & Exhibition (Extraction 2025)

November 16–22, 2025
Phoenix, Arizona, USA

www.extractionmeeting.org/Extraction2025

CO-SPONSORED MEETINGS

4th International Symposium on Electrometallurgy - part of the 63rd Conference of Metallurgists (COM 2024)
August 19–22, 2024
Halifax, Nova Scotia, Canada
Co-organized by TMS

Solidification and Casting of Aluminium Alloys: From Basics to Technology
September 2–6, 2024
Brunel University, London, United Kingdom
Co-sponsored by TMS

Offshore Technology Conference (OTC) 2025
May 5–8, 2025
Houston, Texas, USA
Co-sponsored by TMS

COPPER 2025

12th International COPPER CONFERENCE

November 16–22, 2025
Sheraton Grand at Wild Horse Pass
Phoenix, Arizona, USA
#Copper2025

SUBMIT AN ABSTRACT

BY NOVEMBER 1, 2024

Copper 2025—the largest copper technical conference with a tradition of more than 30 years—will once again feature sessions on mining, mineral processing, pyrometallurgy, hydrometallurgy, electrometallurgy, process control, and instrumentation. Co-located with the Extraction 2025 Meeting & Exhibition, Copper 2025 will feature cross-functional discussions from a societal perspective and multi-commodity dialogue to develop more critical thinking across all fields.

Proposed symposia include:

- Mining Projects
- Mineral Processing
- Pyrometallurgy
- Hydrometallurgy
- Electrowinning & Electrorefining
- Process Control & Optimization
- Recycling & Waste Management
- Economics & Markets
- Environmental Control, Safety & Hygiene
- Auxiliary Processes/Acid Plants

The Copper Conferences Series is a global effort involving the collaboration of:

TMS · SME · GDMB · Instituto de Ingenieros de Minas de Chile · MetSoc · MMIJ · NFSOC · SAIMM

Submit an abstract by November 1, 2024, to be part of this robust conference.

www.ExtractionMeeting.org/Copper2025

CO-LOCATED AT: EXTRACTION 2025

Ni-Co 2025

ALSO FEATURING:
6th International Symposium on
NICKEL AND COBALT

Ni-Co 2025

6th International Symposium on

NICKEL AND COBALT

November 16–22, 2025
Sheraton Grand at Wild Horse Pass
Phoenix, Arizona, USA
#NiCo2025

SUBMIT AN ABSTRACT

BY NOVEMBER 1, 2024

Ni-Co 2025—the largest technical conference series on the extraction and processing of nickel and cobalt—will feature operators, engineers, and researchers who will share information about all aspects of current processing technologies, as well as emerging technologies for both metals. Learn about the latest developments in this growing field with renewed focus on circular economy and battery materials at this must-attend event, co-located with the Extraction 2025 Meeting & Exhibition. Specific focus areas of the conference include mineral processing, metallurgy of nickel and cobalt ores, battery materials, recycling, recovery of valuable by-products, and sulphide and laterite processing.

PLANNED KEY TOPICS:

- Mineral Processing
- Hydrometallurgy
- Pyrometallurgy
- Recycling

KEY THEMES:

- Recovery of Valuable By-Products (PGMs, Sc, etc.)
- Environmental Improvements
- Process Optimization
- Operational Improvements
- Process Technology Development

The 6th International Symposium on Nickel And Cobalt, part of Extraction 2025, is organized by:

MET SOC CIM ICM

SME Society for Mining, Metallurgy & Exploration

TMS The Minerals, Metals & Materials Society

Submit an abstract by November 1, 2024, to be part of this robust conference.

www.ExtractionMeeting.org/NiCo2025

CO-LOCATED AT:

EXTRACTION 2025

COPPER 2025

ALSO FEATURING:

12th International COPPER CONFERENCE