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About the Cover

From "Manufacturability of Ti-Al-4V Hollow-Walled Lattice Struts by Laser Powder Bed Fusion" by Jordan Noronha et al., shown is the result of a successful fabrication of a vertically oriented, hollow-walled Ti-6Al-4V strut (0.42 mm inner diameter) by 3D printing. The results of the study demonstrate the potential for metal hollow-walled lattice materials to offer further weight reduction vs. dense-walled lattice materials.

December 2021 Guest Editors

2D Materials – Preparation, Properties & Applications Thin Films and Interfaces Committee

Nuggehalli M. Ravindra, New Jersey Institute of Technology Ramana Chintalapalle, University of Texas at El Paso

Gerald Ferblantier, Icube Laboratory - Strasbourg University

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Additive Manufacturing for Medical Applications

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Advanced Casting and Melt Processing Technology for Light Alloys

Aluminum Committee Dmitry Eskin, Brunel University

Advances in Processing, Manufacturing, and

Applications of Magnetic Materials Magnetic Materials Committee Scott McCall, Lawrence Livermore National Laboratory Ikenna Nlebedim, Ames Laboratory

Corrosion and Protection of Materials at High Temperatures

Corrosion and Environmental Effects Committee Vilupanur Ravi, California State Polytechnic University Pomona

Ramprashad Prabhakaran, Pacific Northwest National Laboratory

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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.

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Corrosion in Heavy Liquid Metals for Energy Systems

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Osman Anderoglu, University of New Mexico Alessandro Marino, Belgian Nuclear Research Centre Peter Hosemann, University of California, Berkeley

Energy Storage: Materials, Devices & Structures Invited

Nuggehalli M. Ravindra, New Jersey Institute of Technology

Micro-architectured Materials by Additive Manufacturing

Invited

Ma Qian, Royal Melbourne Institute of Technology Jonathan Tran, Royal Melbourne Institute of Technology

Short Pulsed Lasers for Materials Modification, Characterization and Synthesis

Peter Hosemann, University of California, Berkeley Jonathan Gregory Gigax, Los Alamos National Laboratory

Surface Engineering for Improved Corrosion or Wear Resistance

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JOM | table of contents

Volume 73 Number 12 December 2021

JOM: THE MAGAZINE

- 3669: In the Final Analysis: James J. Robinson
- 3670: <u>A Vision for an Innovative Society:</u> <u>Welcome the Incoming TMS Board</u> <u>Members: Kelly Zappas</u>
- 3674: Celebrating the Return of the In-Person Annual Meeting at TMS2022: Kelly Zappas
- 3679: Inaugural Congress to Focus on Artificial Intelligence: Taylor Sparks



JOM: THE JOURNAL

- **3681:** <u>The Second Decade of the Materials</u> <u>Genome Initiative: Julie Christodoulou,</u> <u>Lisa E. Friedersdorf, Linda Sapochak,</u> <u>and James A. Warren</u>
- 3684: <u>Showcasing the Strength of the Industry</u> with the Light Metals Division: Kaitlin Calva
- 3690: TMS Meeting Headlines
- 3691: JOM Call for Papers



2D Materials – Preparation, Properties & Applications

- **3693:** <u>Modeling of Stress Relaxation Modulus</u> <u>for a Nanocomposite Biosensor by</u> <u>Relaxation Time, Yield Stress, and Zero</u> <u>Complex Viscosity: Yasser Zare</u> <u>and Kyong Yop Rhee</u>
- **3702:** <u>Preparation and Magnetic Properties of</u> <u>NiFe₂O₄ Plate Nanoparticles: Feray Kocan</u>
- 3710: <u>Heating Induced Self-Healing of Tin</u> <u>Incorporated Copper Microfiber Network</u> <u>for Recoverable Transparent Conductive</u> <u>Electrodes: Sanyuan Hu, Youwei Yan,</u> Zheng Zhou, Jianquan Lu, and Guoming Chi
- **3718:** Fabrication of CNT-Reinforced 6061 Aluminium Alloy Surface Composites by Friction Stir Processing: Ali Ajani, Hussain Gilani, Sumaiya Islam, Neamul Khandoker, and Abdul Md Mazid
- 3727: Electrochemical Reduction of Silicon Oxide and Codeposition of Al-Si Alloy from Cryolite Molten Salt: Jiaxin Yang, Wenju Tao, Liyu Chen, Jingui He, Yifan Zhang, Jiangyu Yu, and Zhaowen Wang

- **3734:** <u>Towards Extended Morphological,</u> <u>Thermal and Mechanical Analysis</u> <u>of Multicomponent Polymer</u> <u>Nanocomposites Based on PP/EPDM/</u> <u>EPDM-g-MA/PA6: Sahar Hosseini,</u> <u>Shirin Shokoohi, Ghasem Naderi,</u> <u>and Mir Hamidreza Ghoreishy</u>
- **3745:** Effect of Temperature and Acoustic <u>Pressure During Ultrasound Liquid-Phase</u> <u>Processing of Graphite in Water:</u> Justin A. Morton, Dmitry G. Eskin, <u>Nicole Grobert, Jiawei Mi,</u> <u>Kyriakos Porfyrakis, Paul Prentice,</u> and Iakovos Tzanakis
- 3753: <u>Microstructure, Thermal Insulation, and</u> <u>High-Temperature Mechanical Properties</u> <u>of Layered Porous High Nb-TiAI</u> <u>Composite Sheets: Xuchen Jin, Peihao Ye,</u> <u>Wenbin Fang, Wei Sun, Zhuanxia Suo,</u> <u>Boxin Wei, and Xuewen Li</u>



Additive Manufacturing for Medical Applications

- **3761:** <u>Printability Assessment of Ethyl</u> <u>Cellulose Biopolymer Using Direct Ink</u> <u>Writing: Dungan Adams, Zoubeida Ounaies,</u> <u>and Amrita Basak</u>
- 3771: Additive Manufacturing of NiTi Shape Memory Alloy for Biomedical Applications: Review of the LPBF Process Ecosystem: Keyvan Safaei, Hossein Abedi, Mohammadreza Nematollahi, Fatemeh Kordizadeh, Hediyeh Dabbaghi, Parisa Bayati, Reza Javanbakht, Ahmadreza Jahadakbar, Mohammad Elahinia, and Behrang Poorganji
- **3787:** PLA/HA Multiscale Nano-/Micro-Hybrid 3D <u>Scaffolds Provide Inductive Cues</u> to Stems Cells to Differentiate into an Osteogenic Lineage: Joseph A. Ayariga, Morgan Dean, Elijah Nyairo, Vinoy Thomas, and Derrick Dean
- **3798:** <u>3D Printing of Polytetrafluoroethylene</u> <u>Hollow Needles for Medical Applications:</u> <u>Roger Sachan, Andrew Sachan, Junqi Lu,</u> <u>Detlev Erdmann, Jennifer Y. Zhang,</u> <u>and Roger J. Narayan</u>

Advanced Casting and Melt Processing Technology for Light Alloys

- **3804:** <u>Anisotropic Study of Ti6Al4V Alloy</u> <u>Formed by Selective Laser Melting:</u> <u>Weidong Huang, Xiayu Chen, Xu Huang,</u> <u>Hui Wang, and Yitao Zhu</u>
- 3812: Effects of Internal Electromagnetic Stirring on the Microstructure Refinement and Composition Homogenization of Large-Scale 7075 Aluminum Alloy Billet: Yang Qiu and Zhifeng Zhang
- **3819:** Effect of Mn on Microstructure and Mechanical Properties of Al-4Ni Alloy: Jiao Fang, Xixi Dong, and Shouxun Ji
- 3827: Effect of Fe and Si on the Phase Composition and Microstructure Evolution in Al-2 wt.% Cu-2 wt.% Mn Alloy During Solidification, Cold Rolling and Annealing: N. A. Belov, T. K. Akopyan, N. O. Korotkova, S. O. Cherkasov, and A. O. Yakovleva
- 3838: Investigation on Three-Dimensional Morphology of Channel-Type Macrosegregation in DC Cast Al-Mg Billets Through Numerical Simulation: Takuya Yamamoto, Keisuke Kamiya, Takashi Kubo, Masanori Tsunekawa, and Sergey V. Komarov

- **3848:** On the Role of Stirring on Microstructure and Ductility of Rheocast Al Alloys: Qing Zhang, Stefan Jonsson, and Anders E. W. Jarfors
- 3858: Effect of Al₃Er Particles on the Structure, <u>Mechanical Properties, and Fracture</u> of AA5056 Alloy After Casting and <u>Deformation Treatment:</u> Anton P. Khrustalyov, Alexander A. Kozulin, Ilya A. Zhukov, Pavel Yu. Nikitin, Victor I. Sachkov, and Alexander B. Vorozhtsov
- **3866:** <u>X-ray Computed Tomography Studies on</u> <u>Porosity Distribution in Vacuum Induction</u> <u>Cast AI-7Si Alloys: James Mathew,</u> <u>Mark A. Williams, and Prakash Srirangam</u>
- 3873: Investigating the Grain Refinement Mechanisms of Pulsed Electric Current, Ultrasonic and Melt Stirring Solidification of Pure Aluminium: Nagasivamuni Balasubramani, Yanyi Xu, Yunhu Zhang, Qijie Zhai, Gui Wang, David StJohn, and Matthew Dargusch

Advances in Processing, Manufacturing, and Applications of Magnetic Materials

- 3883: Advances in Processing, Manufacturing, and Applications of Magnetic Materials: S. K. McCall and I. C. Nlebedim
- 3885: Preparation and Magnetic Properties of 2:17-Type SmCo Alloy by Transition Metal-Induced Calciothermic Reduction: Donghui Liu, Qiaofa Lan, Xiaolin Zhang, Fei Niu, and Youming Yang
- 3894: Unraveling Site Selective Magnetic Properties of Cobalt Sites in Critical Elements Lean RE(TM)₅ Magnet Materials: Huseyin Ucar and Durga Paudyal
- 3901: Field-Assisted Sintering of FeCo/MnZn Ferrite Core-Shell Structured Particles: Bowen Dong, Haobo Wang, Gabriel Santillan, Andrew Sherman, and Matthew A. Willard



Corrosion and Protection of Materials at High Temperatures

- 3910: Intervening Interfacial Reaction Between Refractory and Rare Earth-Bearing Molten Steel by Pulsed Electric Current to Inhibit the Clogging of Submerged Entry Nozzle: Longge Yan, Liang Chen, Changhao Liu, Chengbao Liu, Song Pang, Xinfang Zhang, and Lifeng Zhang
- **3920:** Effects of S²⁻- and S₂O₃²⁻-Containing</sup> Bayer Solutions on Corrosion of 16Mn Low-Alloy Steel at Elevated Temperatures: Saikui Wang, Fei Niu, Yilin Wang, Tiangui Qi, Guihua Liu, Qiusheng Zhou, Zhihong Peng, and Xiaobin Li
- 3928: Improving the Intergranular Corrosion Resistance of Aged 316L Stainless Steel Heat Affected Zone by Electropulsing Beneath the Critical Temperature: Shengli Ding, Longge Yan, Xuehao Cheng, and Xinfang Zhang
- **3941:** <u>Surface Modification and Refinement of</u> <u>Nd–Fe–B Magnetic Powder Using ITDT</u> <u>and Phosphoric Acid: Haibo Chen, Jingwu</u> <u>Zheng, Xiaotian Cheng, Wei Cai, Liang Qiao,</u> <u>and Shenglei Che</u>

- **3950:** <u>High-Temperature Fatigue Crack</u> <u>Growth Study of P91 Steel Using</u> <u>Acoustic Emission: M. Nani Babu,</u> C. K. Mukhopadhyay, and G. Sasikala
- **3959:** <u>Corrosion Behavior of Titanium Alloy</u> <u>Ti6Al4V in Supercritical Carbon Dioxide</u> <u>at 600°C: Liang Zhiyuan, Guo Tingshan,</u> <u>and Zhao Qinxin</u>
- 3965: High-Temperature Oxidation of Steels in Direct-Fired CO₂ Power Cycle Environments: Richard P. Oleksak, Joseph H. Tylczak, and Ömer N. Doğan
- **3974:** Oxide Scale Development in a Ni-16 Cr-4.5 Al Alloy for Short Exposure Times: Nicholas Ury, Annette Wagner, Vinay Deodeshmukh, Shigenari Hayashi, and Vilupanur Ravi
- 3988: The Role of Oxidation Resistance in High Temperature Alloy Selection for a Future with Green Hydrogen: R. Pillai and B.A. Pint

Corrosion in Heavy Liquid Metals for Energy Systems

- **3998:** Corrosion in Heavy Liquid Metals for Energy Systems: Osman Anderoglu, Alessandro Marino, and Peter Hosemann
- 4000: Dissimilar Metal Solution from Solid Alloys as Observed for Steels and Nickel-Based Alloys in the Presence of Lead-Based Liquid Alloys or Liquid Tin: Carsten Schroer
- 4009: <u>Corrosion Testing of Additively</u> <u>Manufactured FeCrAl Alloy in LBE:</u> <u>P. Hosemann, Shuang Bai, J. Bickel,</u> and J. Qiu
- 4016: <u>Compatibility of Alumina-Forming</u> <u>Austenitic Steels in Static and Flowing</u> <u>Pb: Bruce A. Pint, Yi-Feng Su,</u> <u>Michael P. Brady, Yukinori Yamamoto,</u> <u>Jiheon Jun, and Michael R. Ickes</u>
- 4023: <u>Solubility of Oxygen and Metastable Limit</u> for PbO Nucleation in Liquid Pb: Jun Lim, Kristof Gladinez, Alessandro Marino, Kris Rosseel, and Alexander Aerts
- 4030: Flow Accelerated Corrosion of Stainless Steel 316L by a Rotating Disk in Lead-Bismuth Eutectic Melt: Jaewon Choi, Ilsoon Hwang, and Youho Lee

- 4041: Continuous Monitoring of Pure Fe Corrosion in Lead-Bismuth Eutectic Under Irradiation with Proton-Induced X-ray Emission Spectroscopy: Franziska Schmidt, Matthew Chancey, Hyosim Kim, Yongqiang Wang, and Peter Hosemann
- 4051: Leveraging Neutronics to Monitor Mass Transfer Corrosion in Lead and Lead-Bismuth Cooled Reactors: Khaled Talaat and Osman Anderoglu
- 4062: Influence of Phase-Structural State on Corrosion Behavior of Chromium Steels in Static Liquid Lead under Loads: V. M. Fedirko, I. S. Kukhar, I. M. Pohrelyuk, and Kh. R. Melnyk



Energy Storage: Materials, Devices & Structures

- 4070: <u>The Quest for High-Efficiency</u> <u>Thermoelectric Generators for Extracting</u> <u>Electricity from Waste Heat: Yogesh Singh,</u> <u>Satyendra Kumar Singh, and Purnima Hazra</u>
- 4085: Estimating State of Charge and State of Health of Vented NiCd Batteries with Evolution of Electrochemical Parameters: Javier Olarte, Jaione Martínez de Ilarduya, Ekaitz Zulueta, Raquel Ferret, Erol Kurt, and Jose Manuel Lopez-Guede
- 4091: Nitrogen/Boron-Codoped Porous Carbon Derived from Poplar Powder–Graphene Oxide Composites as Electrode Material for Supercapacitors: Xiaoyu Ren, Zhe Yuan, Zitong Lin, Xinying Lv, Chuanli Qin, and Xiankai Jiang
- **4103:** <u>Preparation and Electrochemical</u> <u>Performance of a S-Se-Ti₃C₂T_x/TiO₂</u> <u>Cathode: Ying Wang, Jiyue Hou, Xue Li,</u> Xiuqiong Hu, Yanjie Wang, Zhengwu Yang, <u>Rui Ai, and Yiyong Zhang</u>
- 4112: <u>Microstructure and Hydrogen Storage</u> <u>Characteristics of Rhodium Substituted</u> <u>Ti-V-Cr Alloys: Jimoh Mohammed Abdul,</u> <u>Sharafadeen Kunle Kolawole,</u> <u>and Ganiyat Abiodun Salawu</u>

Micro-architectured Materials by Additive Manufacturing

- 4119: <u>The Effect of PostProcessing on the</u> <u>Ductility and Strength of Ti-6AI-4V Lattice</u> <u>Materials: X. Z. Zhang, J. Wang, L. Jia,</u> <u>H. P. Tang, and M. Qian</u>
- **4130:** <u>Crushing Behavior of Functionally</u> <u>Graded Lattice: Chamini Rodrigo, Shanqing</u> <u>Xu, Yvonne Durandet, Darren Fraser,</u> <u>and Dong Ruan</u>
- 4141: <u>Multiscale Topology Optimization of</u> <u>Lattice Structure Using 3D Moving Hollow</u> <u>Morphable Bars: Tian Lan and Phuong Tran</u>
- 4154: Compression Behavior of Graded NiTi Gyroid-Structures Fabricated by Laser Power Bed Fusion Additive Manufacturing Under Monotonic and Cyclic Loading: Wenliang Chen, Qin Yang, Shuke Huang, Jamie J. Kruzic, and Xiaopeng Li
- 4166: Additive Manufacturing and Characterization of High Strength Ti-Zr Gyroid Scaffolds Using Pre-Mixed Ti-ZrH₂ Powders: Ammarueda Issariyapat, Shota Kariya, Abdulaziz Alhazaa, Junko Umeda, and Katsuyoshi Kondoh
- 4177: Quasi-Static Energy Absorption of Miura-Ori Metamaterials: Wei Qiang, Jianjun Zhang, Dora Karagiozova, Phuong Tran, and Guoxing Lu
- 4188: Improving the Mechanical Properties of Additively Manufactured Micro-Architected Biodegradable Metals: Yageng Li, Jirong Shi, Holger Jahr, Jie Zhou, Amir A. Zadpoor, and Luning Wang
- 4199: <u>Manufacturability of Ti-AI-4V Hollow-</u> <u>Walled Lattice Struts by Laser Powder</u> <u>Bed Fusion: J. Noronha, M. Qian, M. Leary,</u> <u>E. Kyriakou, S. Brudler, and M. Brandt</u>

Short Pulsed Lasers for Materials Modification, Characterization and Synthesis

- 4209: <u>Short-Pulsed Laser Techniques for</u> <u>Materials Modification, Characterization,</u> <u>and Synthesis: Peter Hosemann and Jonathan G. Gigax</u>
- 4211: Precision Modification of Microstructure and Properties Through Laser Engraving: Kathryn A. Small, Ian D. McCue, Katrina S. Johnston, Ian Donaldson, and Mitra L. Taheri
- 4221: Defect Characterization Using Positron Annihilation Spectroscopy on Laser-Ablated Surfaces: P. Hosemann, R. Auguste, S. Lam, M. Butterling, M. O. Liedke, A. G. Attallah, E. Hirschmann, A. Wagner, C. P. Grigoropoulos, F. Selim, and B. P. Uberuaga
- **4231:** Femtosecond Laser Machining of Micromechanical Tensile Test Specimens: A. Dong, J. Duckering, J. Peterson, S. Lam, D. Routledge, and P. Hosemann



4240: Demonstration of a High-Throughput Tensile Testing Technique Using Femtosecond Laser-Fabricated Tensile Bars in AISI 316 and Additively Manufactured Grade 91 Steel: Cayla Harvey, Avery J. Torrez, Sebastian Lam, Hyosim Kim, Stuart A. Maloy, and Jonathan G. Gigax

- 4248: A Perspective to Control Laser-Induced Periodic Surface Structure Formation at Glancing-Incident Femtosecond Laser-Processed Surfaces: Alexander Jelinek, Manuel J. Pfeifenberger, Reinhard Pippan, and Daniel Kiener
- 4258: Recent Developments in Femtosecond Laser-Enabled TriBeam Systems: McLean P. Echlin, Andrew T. Polonsky, James Lamb, Remco Geurts, Steven J. Randolph, Aurélien Botman, and Tresa M. Pollock

Surface Engineering for Improved Corrosion or Wear Resistance

- 4270: Facile and Scalable Co-deposition of Anti-bacterial Zn-GNS Nanocomposite Coatings for Hospital Facilities: Tribo-Mechanical and Anti-corrosion Properties: Ayush Owhal, Ajay D. Pingale, Shahid Khan, Sachin U. Belgamwar, Prabhat Nath Jha, and Jitendra S. Rathore
- 4279: Microstructure Evolution and Wear Resistance of Laser-Clad M2 High-Speed Steel Coatings: Deli Tian, Xue Liu, Liwei Hu, Fengsheng Qu, Jinfeng Li, Guomin Le, Xiaoshan Yang, Yuzhao Zhou, Li Qi, and Dou Wang
- 4289: <u>The Forming Control Method of Double-Layer and Multi-Track Stacking Laser</u> <u>Cladding Applied on Crankshafts</u> <u>Restoration: Chenmin Zhao, Guofu Lian, Yang Zhang, and Haiyan Hua</u>
- 4299: Effect of Current on the Characteristics of CuNi-G Nanocomposite Coatings Developed by DC, PC and PRC Electrodeposition: Ajay D. Pingale, Ayush Owhal, Sachin U. Belgamwar, and Jitendra S. Rathore
- 4309: Influence of Treatment Time and Temperature on Surface Property of Active Screen Plasma-Nitrided EN41B Low Alloy Steel: Nand Kumar, B. Ganguli, Bidesh Roy, and Bachu Deb
- **4319:** Forming Control in Single-Track Laser Cladding on Crankshaft Based on Multiobjective Optimization: Guofu Lian, Chenmin Zhao, Yang Zhang, and Haiyan Hua
- **4328:** <u>Microstructure and Wear Behaviour of a</u> <u>Novel Fe-Cr-V-C Plasma Transferred Arc</u> <u>Coating: Abhay Ranjan, Kaushal Kishore,</u> <u>Varinder Pal, Manashi Adhikary,</u> <u>Anup Kumar, Chandra Sekhar Tiwary,</u> <u>and Manas Paliwal</u>

- 4338: <u>The Effectiveness of Incorporating</u> <u>Hybrid Reinforcement Nanoparticles</u> <u>in the Enhancement of the Tribological</u> <u>Behaviour of Aluminium Metal Matrix</u> <u>Composites: Essam B. Moustafa,</u> <u>Waheed Sami Abushanab, A. Melaibari,</u> <u>Olga Yakovtseva, and Ahmed O. Mosleh</u>
- 4349: <u>A Review on Surface Engineering</u> <u>Perspective of Metallic Implants for</u> <u>Orthopaedic Applications:</u> <u>Sudhakar C. Jambagi and Vinayak R. Malik</u>
- **4365:** <u>Processing, Characterization, and</u> <u>Properties of a-Al₂O₃-AA2900 Composites</u> <u>for Aerospace Brake Pad Applications:</u> <u>P. Ashwath, M. Anthony Xavior, and</u> <u>Andre DL Batako</u>
- **4376:** Effect of Nd-Rich Phases on the Corrosion Behavior of AZ80 Magnesium Alloy in Alkaline Solution: Qi Zou, Qichi Le, Xingrui Chen, Chunyan Ban, Yonghui Jia, Ruizhen Guo, and An Wang
- **4387:** <u>Corrosion, Wear and In-vitro</u> <u>Biocompatibility Property of Surface</u> <u>Mechanical Attrition Treatment Processed</u> <u>Ti-6AI-4V Alloy: Swarnima Singh,</u> <u>Krishna Kant Pandey, Vamsi Krishna Balla,</u> <u>Mitun Das, and Anup Kumar Keshri</u>
- 4397: Wear and Corrosion Behavior of Al7075 <u>Matrix Hybrid Composites Produced by</u> <u>Friction Stir Processing: Optimization of</u> <u>Process Parameters: Pabitra Maji,</u> <u>Rahul Kanti Nath, Ranit Karmakar,</u> <u>Dileep Madapana, R. K. Bhogendro Meitei,</u> <u>and Subrata Kumar Ghosh</u>

Technical Article

4410: <u>Bacteriostatic Polylactic Acid Coatings</u> <u>Enriched with Zinc Oxide and Silica</u> <u>Nanoparticles for Titanium Pedicle Screws:</u> <u>Didem Şen Karaman, Mehmet Baran Karakaplan,</u> <u>and Nursu Erdoğan</u>

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Table of Contents

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in the final analysis

"Organization of the new TMS Technical Divisions is progressing extremely well, thanks to the hard work and dedication of the technical division chairpersons (TDCs) and the TMS staff. I met with them on 23 March to outline the concept, purposes, and responsibilities of the technical divisions and to develop a timetable of activities that will lead to the first formal meeting of the divisions at the 1989 Annual Meeting in Las Vegas."

-1988 TMS President Frank V. Nolfi Jr.

The mid-1980s were a period of transition within TMS. My general hubris would like me to point out that I joined TMS in 1984, but my grounding diffidence will point to genuine game changers like the Society separately incorporating as an organization independent of its founder, AIME (the American Institute of Mining, Metallurgical, and Petroleum Engineering); the name change from The Metallurgical Society to The Minerals, Metals & Materials Society; the expansion of the annual meeting to include an exhibition; the renaming of *Journal of Metals* as *JOM*; and, most importantly, the establishment of the Society's modern technical division structure. As you've been reading in this year's excellent series of divisional history articles by Magazine Managing Editor Kaitlin Calva, the development of the divisions has had significant and lasting impact on TMS. I don't think it too bold to posit that the technical divisions are the defining heartbeat of the Society.

The work to establish the divisions began in earnest with Board of Directors discussions in 1987, TMS members voting on a modification to the Society's Bylaws to incorporate the divisions in 1988, and the convening of face-to-face council meetings at TMS1989. The divisional structure as originally debuted looked very much as it does now. There were (and are) five divisions: Extraction & Processing Division; Light Metals Division; Materials Design & Manufacturing Division (now Materials Processing & Manufacturing Division); Structural Materials Division; and Electronic, Magnetic & Photonic Materials Division (now Functional Materials Division).* While the division structure has been relatively constant, there has been much fluidity in the organization of the technical committees within the divisions. We didn't stand up technical committees on additive manufacturing, biomaterials, or integrated computational materials engineering by eschewing innovation and progress.

Lesson: Times change, technologies change, and technical committees change. Question: Should the technical divisions themselves engage in more change as well? Answer: Maybe.

Venerable is a good thing, rigidity not so much. Knowing this, the Technical Division Council (i.e., the chairs of the technical divisions) are asking whether we should undertake modifications or improvements to the current divisional structure and what form those improvements might take. This is being done by commissioning an ad hoc committee to execute a specific charge:

This committee will consider the question of whether the current TMS Technical Division structure remains adequate to position TMS to address the needs and opportunities associated with the rapid evolution that is occurring within the materials technologies that already call TMS "home" and that could call TMS "home."

The committee report should contain recommendations built around the questions: (1) At an operational level, is the current TMS Technical Division scope and structure adequate to responsively position TMS to address the needs and opportunities associated with the current domains/interests of the technical divisions as well as emergent science and technology? (2) At the applied level, how can the response to Question 1 be used to assure that TMS is recognized as the "home of the materials aspects" of emergent technologies that already have some presence within the technical divisions? (3) At the strategic level, how can the response to Question 1 be used to make TMS an appealing and nurturing destination for materials science and technologies that have no or only a nominal presence within TMS?

What will be the recommendations and how will they be handled? Will the divisions adopt big changes, little changes, or no changes at all? The answers will surely shape the prospects and practices of TMS for decades to come.



Number 12

December 2021



James J. Robinson Executive Director

<u> @JJRofTMS</u>

"I don't think it too bold to posit that the technical divisions are the defining heartbeat of the Society."

* Trivia: The Board of Director's original wish was to have the divisions listed in this order to reflect a notional journey from upstream to down. That stylistic construct never caught on as everyone quickly defaulted to the easier rigor of alphabetical order. Table of Contents

JOM, Vol. 73, No. 12, 2021 https://doi.org/10.1007/s11837-021-05005-1 © 2021 The Minerals, Metals & Materials Society

A Vision for an Innovative Society: Welcome the Incoming TMS Board Members

Kelly Zappas

In 2022, five new members will join the TMS Board of Directors for three-year terms. This month, *JOM* talks with each of our new leaders about their past experiences as TMS members and active volunteers and their hopes for



Brad L. Boyce Vice President

Brad Boyce of Sandia National Laboratories will serve one year as TMS vice president before becoming TMS President in 2023, but when he first joined the organization, it was as a graduate student presenting his work at his first TMS annual meeting.

His early experience with TMS not only provided him

with a forum as an emerging researcher, he said, it also provided him with opportunities, early in his career, to organize symposia with other researchers from around the world on topics of mutual interest.

"I have stayed active in the Society because TMS provides a global community of materials professionals who share interests and vision that are in common with my own," said Boyce.

Through TMS conferences and publications, Boyce has been able to share his own research and learn about other cutting-edge ideas in the field of materials. the Society's future. Each of these individuals will begin their term at the end of the TMS 2022 Annual Meeting & Exhibition (TMS2022) in Anaheim, California, February 27–March 3, 2022.

"This form of professional development allows me to stay current in my field and challenges me to innovate," he said. "In addition to the technical knowledge I gain through participating in TMS activities, I have also broadened my network of materials practitioners, educators, and students."

When he begins his term as vice president, Boyce will bring with him the experience he gained as a member of the TMS Board of Directors and leading the Society's Programming Committee and Mechanical Behavior of Materials Committee.

"In my past activities, I have engaged with thoughtleaders from around the world who all come together to make a positive impact on the world we live in through materials innovation," he said. "It is a Society that I am proud to call my home."

In his new role, Boyce said that he is looking forward to learning more about the diverse membership of TMS and growing TMS's portfolio of services to help members in their careers.

"I hope that I can contribute my energy and passion for our field to help our Society not only recover from the pandemic but grow stronger by employing a broader palette of engagement opportunities," he said.

"I hope that I can contribute my energy and passion for our field to help our Society not only recover from the pandemic but grow stronger by employing a broader palette of engagement opportunities." —Brad L. Boyce A Vision for an Innovative Society: Welcome the Incoming TMS Board Members

ble of Contents



Viola L. Acoff Membership & Student Development Director

Viola Acoff also became involved with TMS as a student, taking on an early leadership role as vice president of her TMS/ASM Student Chapter (now Material Advantage). Then, as a young professional, she started serving TMS in other volunteer roles, primarily as a member of TMS technical committees.

"When I was selected as a recipient of the TMS Young Leader Intern Award (now called the TMS Young Leaders Professional Development Award) in 1998, that was my formal introduction to the functional committees of TMS," said Acoff, who is now associate dean for undergraduate and graduate programs in the College of Engineering at The University of Alabama. "I also had the opportunity to attend the Board of Directors meeting as an observer. This experience gave me my first glimpse of the opportunity to advance and promote the field of metallurgical and materials engineering to groups traditionally underrepresented in the field from a larger platform."

When she began her career in academia, the first professional conference she attended was a TMS annual meeting.

"At that meeting, I was able to network and make

connections with colleagues from industry, academia, and national labs who were instrumental in my early career development," said Acoff. "Those networking and professional development experiences have been the most valuable to me."

Since those early years with the Society, Acoff's involvement with TMS has grown and included serving on the Membership Development Committee and the Student Affairs Committee. When those two committees merged to form the Membership & Student Development Committee, Acoff was selected as the Structural Materials Division representative to the committee and served two terms in this capacity, providing valuable preparation for her role as Membership & Student Development Director.

"My vision for TMS is for the Society to enhance the programs and activities that are currently in place for membership and student development with emphasis on groups that are underrepresented in our field," said Acoff. "TMS has made significant progress over the years in this area through programming and training and is commended for this effort. However, I would like to see TMS increase these efforts and be prepared to address the changing demographics that lie ahead in the U.S."

Acoff plans to use her experience and background in diversity, equity, and inclusion (which was recognized by TMS with the inaugural Ellen Swallow Richards Diversity Award) to assist in realizing this vision, saying, "I would like to focus on developing innovative ways to get students and young professionals engaged with TMS early in their careers and stress the benefits of staying engaged throughout their career."

"My vision for TMS is for the Society to enhance the programs and activities that are currently in place for membership and student development with emphasis on groups that are underrepresented in our field."

-Viola L. Acoff

Nominations Now Open for 2023–2026 TMS Board of Directors

TMS is now accepting nominations for five positions on the 2023–2026 TMS Board of Directors. The open positions are the Presidential Rotation, Financial Planning Officer, Content Development & Dissemination Director/Chair, Professional Development Director, and Public & Governmental Affairs Director/Chair. Nominations will be accepted until January 15, 2022.

Additionally, positions for Extraction & Processing Division Chair and Functional Materials Division Chair are open on the 2023–2026 Board of Directors, but nominations for these positions are being developed directly through the technical divisions. Applicants' packages for these positions will be considered by the Society's Nominating Committee, which will then recommend a candidate for each position to the Board of Directors. If approved by the Board of Directors, these endorsed candidates will be presented to the general membership for approval by July 2022.

To access complete job descriptions and qualifications for each office, as well as the Nominee Statement Form and nomination instructions, visit www.tms.org/BoardNominations. For additional information, contact Deborah Hixon, TMS Awards Program Administrator, at hixon@tms.org.

my company meant a lot to me," said Williams. "More recently, getting the opportunity to help organize and improve the conference was a great experience for me, in an environment where I was working with no direct

One of the highlights of his career, Williams said, was serving as editor of Light Metals 2016, the distinguished proceedings volume published each year by the TMS Aluminum Committee.

"I was happy to continue to volunteer in the role of Light Metals Division (LMD) Chair to support the organization that has been very meaningful to my career," said Williams of his new position on the TMS Board of Directors. In his role as LMD Chair, Williams looks forward to continuing to help TMS in its push to increase diversity and inclusion in the materials industry and to continue to bring new faces into the organization.

"In particular, I would like to be a representative for the industrial side of the materials world and make sure that TMS continues to be a place that is relevant to them," said Williams.

"...I would like to be a representative for the industrial side of the materials world and make sure that TMS continues to be a place that is relevant to them." -Edward Williams

ble of Contents

authority."

Paul Mason Materials Processing & Manufacturing **Division Chair**

Eddie Williams began his

"I really enjoy the

Williams, who is now manager of the Molten Metal Group

at the Arconic Technology Center. "Getting involved on the

His involvement with TMS has changed over the years, shifting to accommodate the different phases of his career.

organizing side of TMS has helped keep me engaged and

"Early on, getting the chance to present some of my

work and feel like it was appreciated by people outside

academia and industry," said

Paul Mason has attended every TMS Annual Meeting & Exhibition since 2003 and every Materials Science & Technology (MS&T) technical meeting and exhibition since 2004. Mason is president of Thermo-Calc Software Inc., and his initial involvement was as an exhibitor.

"What impressed me initially about the TMS annual meeting was the scale," said Mason. "Coming from Europe, at that time, I had never attended a materials meeting that was so large."

As he went to more meetings, he began giving presentations, then joining technical committee meetings, and then organizing symposia.

"The people I met, the members involved within the Society, were welcoming and encouraging and made it easy to get more involved," he said. "I cannot begin to express how much of a positive, long-lasting impact

TMS has had on my career, as both an exhibitor and in my professional development. TMS has enabled me to establish a professional network across a range of disciplines, spanning all five divisions, that has broadened my perspective and deepened my knowledge."

Mason has served as chair of the Integrated Computational Materials Engineering (ICME) Committee, as a member of the Public & Governmental Affairs Committee and the Industrial Advisory Committee, and as a member of the editorial board of the TMS journal Integrating Materials & Manufacturing Innovation. He has participated in a TMS congressional visit and instructed short courses. One of the most rewarding roles, he said, was acting as chair of the organizing committee for the 4th ICME World Congress.

"As I transition into the role of serving as chair of the Materials Processing & Manufacturing Division on the Board of TMS, I hope to bring some of the experience that I have gained, having been involved with the Society in many different capacities over the last 18 years," he said. "I also hope to encourage others to get involved."

Mason believes that his background working for a small business, exhibiting at TMS meetings, and developing technical programming gives him a unique



active over the past few years."





A Vision for an Innovative Society: Welcome the Incoming TMS Board Members

perspective. He would like to help TMS expand its engagement with industry and with small businesses in particular.

"Over the last 18 months, COVID-19 has disrupted the ways we engage and interact with each other as a Society, and even as we look to the near future with optimism for returning to in-person meetings, there remain fundamental shifts related to hybrid work and disruptions to supply chains," said Mason. "Where there are challenges, there are also opportunities, and I look forward to working with the other members of the Board in helping TMS navigate these unsettled times."

"The people I met, the members involved within the Society, were welcoming and encouraging and made it easy to get more involved." —Paul Mason



Suveen N. Mathaudhu Structural Materials Division Chair

Suveen Mathaudhu first became involved in TMS as a graduate student at Texas A&M University.

"I was encouraged to give a talk by my advisor, and...I totally bombed the talk," said Mathaudhu, who is now professor in the Metallurgical and Materials Engineering

Department at the Colorado School of Mines. "One of the more senior members in the field took me aside and provided me with guidance and mentoring that set the tone for my continued involvement. Our members care about each other at every level, and having that support structure and the ability to give back has kept me engaged."

In March, Mathaudhu will take on the role of Structural

Materials Division Chair, a decision that was partly motivated by his desire to give back to this community some of what it has offered him, especially to early career and new members looking to be engaged.

Outside of broadening his technical opportunities, Mathaudhu said, TMS has enabled consistent pathways to meet new people and engage with friends and colleagues in the discipline. "I wholly attribute my career success to my wonderful colleagues and collaborators," he said. "The best experiences have been the spontaneous side conversations and interactions that take place 'in the hallways' or other non-programmed venues of meetings."

As a member of the TMS Board of Directors, Mathaudhu looks forward to being part of a team that will address complex problems and challenges brought about by the pandemic, but will also look at emerging ideas and movements from the current generation.

"My personal goals are to champion ideas that create a culture of broader inclusivity and accessibility to the benefits of being in TMS," said Mathaudhu.

"Our members care about each other at every level, and having that support structure and the ability to give back has kept me engaged." —Suveen N. Mathaudhu



Table of Contents

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Celebrating the Return of the In-Person Annual Meeting at TMS2022



TMS is an organization with a long and distinguished history, but it is also one that enables innovative partnerships among its members and provides a forum for developing emerging technologies.



ally Zappas





After holding a fully virtual edition of the TMS Annual Meeting in 2021, TMS is pleased to convene our community in person once more with the TMS 2022 Annual Meeting & Exhibition (TMS2022), to be held February 27–March 3, 2022, at the Anaheim Convention Center and the Anaheim Marriott in Anaheim, California. This event will mark the comeback of our most popular meeting format, as well as a return to a host city that TMS has not visited since 1996.

TMS is an organization with a long and distinguished history, but it is also one that enables innovative partnerships among its members and provides a forum for developing emerging technologies. Nowhere is this blend of the classic and the innovative more clear than in the plans for TMS2022.

Classic: Meeting in Person. After last year's fully virtual annual meeting—necessitated by a global pandemic—TMS2022 is being planned primarily as an in-person event, offering a more conventional TMS annual meeting experience for attendees that includes networking events and social activities. TMS is committed to the well-being of its attendees and is taking steps to ensure that all health and safety recommendations are followed and additional services provided to help attendees feel comfortable during this transition back to in-person events.

Innovative: Adding a Virtual Option. Because meeting in person will still not be an option for some attendees, TMS2022 will also offer a virtual registration option. Virtual attendees will receive access to recorded on-demand presentations and the complete published conference proceedings from TMS2022, as well as select live-streamed featured sessions and a virtual poster session. This option results in a bonus benefit for in-person attendees, who will also receive access to on-demand presentations. **Classic: An Expansive Technical Program.** More than 90 symposia are planned in 14 topic areas organized by the five TMS technical divisions and developed by TMS committees and volunteer members. Session hopping to sample all that TMS has to offer and to gain a broad overview of topics has always been encouraged.

Innovative: Live Streaming of Select Featured Sessions. To enhance the experience for virtual attendees, TMS will, for the first time, stream several selected keynote or featured sessions for remote participants to view in real time. Plans are still being finalized to determine which sessions will be live streamed and when; visit the TMS2022 website for updates.

Classic: Celebrating 150 Years of the TMS Annual Meeting. TMS celebrates its 150th Anniversary Year in 2021–2022, which will conclude with a selection of special features at TMS2022. These events recognize the long history of TMS and its parent organization, the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME), which was founded when it held its first meeting to share and discuss research in 1871.

Innovative: New Events and Activities. The TMS annual meeting has evolved significantly over the years, and it continues to grow and adapt in both big ways and small. This year's new events include a Sunday night opening reception and a Monday morning breakfast for attendees, as well as an updated Celebration Dinner to follow the TMS-AIME Awards Ceremony, to name a few.

No matter how you choose to participate—whether inperson or virtual—registration is now open for TMS2022. Discounted registration rates will be available through January 18, 2022. Visit www.tms.org/TMS2022 to register today.



Celebrating the Return of the In-Person Annual Meeting at $\ensuremath{\mathsf{TMS2022}}$

TMS2022 Welcomes Co-Located Events

Three co-located events are planned as part of TMS2022, and all meeting registrants will have full access to the technical programming for these conferences.



The Fourth Summit on Diversity in the Minerals, Metals, and Materials Profession (DMMM4) will be co-located with TMS2022, March 2–3, with all programming included as part of TMS2022 registration. Participants will learn novel, actionable, and measurable approaches to improving diversity, equity, and inclusion (DEI) in the workplace and profession, while also gaining the skills, knowledge, and inspiration needed to implement them.

The event begins with the DMMM4 Preview and Networking Mixer on Tuesday evening, March 1. The next morning, participants can attend the Fresh Coffee, Fresh Ideas: Diversity and Inclusion Breakfast before programming begins with an interactive, opening keynote session. Concurrent sessions will take place on Wednesday afternoon and Thursday morning on the following topics:

- Career Development Tools and Strategies
- STEM Outreach Case Studies and Best Practices
- The Invisible Pipeline: Recruitment/Retention of Underrepresented Minorities
- Combating Biases in STEM

In addition to a selection of inspiring speakers, DMMM4 sessions will also feature small group activities and engaging, hands-on learning experiences.

On Thursday, the event ends with the DMMM4 Celebrate Diversity Luncheon at noon, followed by the closing plenary session, Engaging Those with Physical, Cognitive, or Sensory Challenges.

Visit www.tms.org/TMS2022/DMMM4 for more details.



DMMM4 Keynotes

Opening Keynote Date: Wednesday, March 2, 2022 Time: 8:30 a.m. "The Marathon Mindset: DEI at the Core of Everything" Sumun L. Pendakur, Diversity, Equity, and Inclusion Strategist

Closing Keynote Date: Thursday, March 3, 2022 Time: 2:00 p.m. "Maximizing the Potential of Neurodiversity in the Employment and Educational Settings" Lawrence Fung, Director, Stanford Neurodiversity Project, Stanford University



No pyrometallurgical smelter can operate without some form of tapping system. It is the one thing all smelters have in common: a meeting point of science, technology, and skill. Furnace Tapping 2022 provides a forum to discuss topics related to this subject. This symposium will feature technical programming, a social event, and its own published conference proceedings, which are included in the TMS2022 registration fee. Learn more about this sumposium at www.tms.org/TMS2022/FurnaceTapping.

Furnace Tapping 2022 is sponsored by TMS and The Southern African Institute of Mining and Metallurgy.

PubZone Networking Reception

Participants in both Furnace Tapping 2022 and REWAS 2022 are invited to meet up for a social evening at the **PubZone Networking Reception** on Monday, February 28, at a local Anaheim restaurant (location to be announced).



The 7th installment of the REWAS conference series will focus on Developing Tomorrow's Technical Cycles. This unique, transdisciplinary conference covers the latest technical and societal developments enabling sustainability

> within our global economy with a special focus on **Re**cycling and **Was**te management. It will feature a plenary session, several technical symposia, a social event, and a twovolume proceedings publication.

Planned symposia within REWAS 2022 include:

- Diran Apelian Honorary Symposium
- Cast Shop Technologies: Recycling and Sustainability Session
- Sustainable Production and Development Perspectives
- Recovering the Unrecoverable
- Automation and Digitalization for Advanced Manufacturing
- Decarbonizing the Materials Industry
- A detailed look at these symposia can be found at www.tms.org/TMS2022/REWAS.

Table of Contents

Zappas

Featured Sessions at TMS2022

Throughout the week at TMS2022, the Society will hold the following sessions and events to honor colleagues and hear from invited lecturers.



Honorary Symposia

Distinguished members of the TMS community will be honored at four symposia planned during TMS2022. The TMS Light Metals

Division (LMD) will honor J. Wayne Jones, professor emeritus at the University

of Michigan, at a symposium entitled, Failure, and a Career That is Anything But. Throughout his career, Jones has been a devoted teacher. Just as he has helped to develop alloy systems toward maturity, he has helped many generations of students and researchers to achieve academic maturity.

The LMD will also honor **Halvor Kvande**, professor emeritus at the Norwegian University of Science & Technology, with the session, Primary Aluminum Industry—Energy and Emission Reductions, part of the Aluminum Reduction Technology symposium. This session highlights both Kvande's contributions to the industry and improvements and challenges related to energy and emissions in primary aluminum production.

The TMS Structural Materials Division (SMD) is planning the symposium Seeing is Believing— Understanding Environmental Degradation and Mechanical Response Using Advanced Characterization Techniques to honor **Ian M. Robertson**, professor and dean of the College of Engineering at the University of Wisconsin-Madison.

Finally, Magnetics and the Critical Materials Challenge, sponsored by the TMS Functional Materials Division (FMD), will honor **Matthew J. Kramer**, who is division director for Materials Sciences and Engineering at Ames Laboratory. The symposium will cover all aspects of advanced synthesis and characterization of highperformance functional materials.

Luncheon Lectures at TMS2022

The TMS technical division luncheon events allow division members to network, honor outstanding members, and hear from an invited speaker selected by division



Kevin Hemker

leadership. Anyone can listen to the lecture portion of these events, but tickets are required to receive a lunch and can be purchased for \$40 through the registration form.

Kevin Hemker will deliver the featured presentation at the SMD Luncheon on Monday, February 28. Hemker is the Alonzo G. Decker Chair and professor of mechanical engineering at Johns Hopkins University, known for his work explaining the underlying, atomic-level details that govern the mechanical response, performance, and reliability of disparate material systems. He served as TMS president in 2018 and is a Fellow of the Society.



Paul E. Krajewski, General Motors Global Research and Development Center, will headline the Extraction & Processing Division (EPD)/ Materials Processing & Manufacturing Division (MPMD) luncheon on Tuesday afternoon with his talk, "An Automotive View of Sustainability." As the automotive industry shifts to an

Paul E. Krajewski

electric and autonomous future, materials will be a key part of that transformation. This talk will establish the framework for thinking about sustainability from initial material production, through vehicle applications, and finally to post-vehicle use or re-use.



On Wednesday afternoon **Markus A. Reuter,** SMS Group, will deliver the talk, "Light Metals: Key Enabler of the Circular Economy," at the LMD Luncheon. This lecture will discuss the key enabling role that light metals (aluminum, magnesium, titanium, silicon, and lithium, for example) have in a circular economy.

Markus A. Reuter

Award Lectures

The following award recipients will be honored with featured lectures at TMS2022:



David Dreisinger

David Dreisinger, University of British Columbia, will be the EPD Distinguished Lecturer. His presentation is titled, "Rare Earth and Critical Material Recovery from Peralkaline Volcanic Ores: Minerals Processing, Hydrometallurgy and Solvent Extraction Separation."

Anton Van der Ven, University of California, Santa

Barbara, will deliver the William Hume-Rothery Award lecture, "Study of Ferroelectricity and Phase Transitions in Hafnia," as part of the Hume-Rothery Symposium on Connecting Macroscopic Materials Properties to Their Underlying Electronic Structure: The Role of Theory,



Celebrating the Return of the In-Person Annual Meeting at TMS2022



K. Lu



Huajian Gao

Computation, and Experiment.

K. Lu, Chinese Academy of Sciences, will deliver the Institute of Metals/Robert Franklin Mehl Award lecture, "Schwarz Crystal Structures in Extremely Fine-Grained Metals," as part of the Ultrafine-grained and Heterostructured Materials symposium.

Huajian Gao, Nanyang Technological University, and George Pharr, Texas A&M University, will be the William D. Nix Award Lecturers at TMS2022. Gao's research has been focused on the understanding of basic principles that control mechanical properties and behaviors of materials in both engineering



George Pharr



Tao Sun

and biological systems. Pharr will deliver the talk, "Nanoindentation—The Next Generation," which will focus on new and emerging nanoindentation measurement tools and techniques.

Tao Sun, University of Virginia, has been named 2022 Young Innovator in the Materials Science of Additive Manufacturing Award recipient. As part of his award, he will deliver the talk, "The Critical Roles of Keyhole in Laser Powder Bed Fusion," during the Additive Manufacturing Keynote Session.

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Exhibit and Networking Events

The TMS2022 Exhibit Hall will be open for three days: Monday, February 28, through Wednesday, March 2. During this time, all TMS2022 attendees are invited to browse displays and meet with exhibitors throughout the day and then join colleagues in the exhibit hall for social and networking events in the evenings.



Bladesmithing and Networking Opportunities

A highlight of the TMS2022 Exhibit will be the **2022 TMS Bladesmithing Competition**, a display of blades forged by student teams with behind-the-scenes videos showing how the entries were made. Attendees will have the chance to browse the display and competition winners will be announced at a special ceremony later in the week.

On Monday evening, attendees can celebrate the opening of the TMS2022 exhibit at the Exhibit Opening Reception and Poster Session. On Tuesday, the Exhibit Hall Happy Hour and Poster Session will draw attendees back to view new posters, speak with exhibitors, and interact with colleagues. Both events will feature appetizers, beverages, and networking opportunities.

To learn more about which exhibitors you will meet and to view an interactive floor plan, visit www.tms.org /TMS2022/Exhibit. If you would like your company to be represented at TMS2022, please contact Gavin McAuliffe, TMS2022 Exhibit Manager, Corcoran Expositions, at gavin@corcexpo.com. Sponsorship opportunities are also available. Contact Mary Michalik, TMS2022 Sponsorship Manager, Corcoran Expositions, at mary@corcexpo.com.

Proceedings Publications

All virtual and full-conference registrants will receive electronic access to the complete published conference proceedings, which include the following volumes:

• 12th International Symposium on High-Temperature Metallurgical Processing



- Characterization of Minerals, Metals, and Materials 2022
- Furnace Tapping 2022
- Light Metals 2022
- Magnesium Technology 2022
- Metal-Matrix Composites: Advances in Processing, Characterization, Performance, and Analysis
- Rare Metal Technology 2022
- *REWAS 2022: Developing Tomorrow's Technical Cycles (Volume I)*
- REWAS 2022: Energy Technologies and CO₂ Management (Volume II)
- TMS2022 151st Annual Meeting & Exhibition Supplemental Proceedings

Hard copy editions of these books will also be available for sale through the TMS Bookstore and onsite at TMS2022.

New Networking Events for 2022

For 2022, TMS will add two new all-conference networking events to the annual meeting. First, on Sunday evening, the conference will open with a Welcome Reception. Attendees can come together to socialize and share refreshments before technical programming begins on Monday. Plan to arrive early on Sunday, so that you'll have time to settle in, visit Registration to pick up your badge and meeting materials, and meet attendees you'll be seeing throughout the week at the welcome reception. The next morning, attendees are invited to a Welcome Breakfast, prior to the start of technical programming. It's another

chance to interact with your fellow attendees and start your morning off right.

Planning Your Travel

In 2022, the TMS Annual Meeting & Exhibition will return to Anaheim, California, for the first time since 1996. This southern California city is part of the Los Angeles metropolitan area and home to a number of theme parks, including Disneyland, making it an accessible location for travelers. To join your colleagues in Anaheim, begin your planning today at www.tms.org/TMS2022.

Book Housing

Deadline: February 11, 2022

Attendees are strongly encouraged to book hotel rooms through the TMS website to benefit both themselves and the conference. TMS reserves discounted rooms at hotels convenient to the convention center for meeting attendees. When attendees book rooms in these room blocks, they are supporting TMS and helping to offset the costs of the conference, while securing the best rates on rooms.

The Anaheim Marriott will serve as the headquarters hotel for TMS2022 and will be the location for committee meetings, social events like the TMS-AIME Awards Ceremony & Celebration Dinner, and other key meeting activities, including all of the DMMM4 programming and events. Book your room through the TMS2022 website for the best rate and stay where the meeting happens.

Apply for Family Care Grants

Deadline: January 18, 2022

The TMS Family Care Grant Program is designed to help individuals who are incurring extra family-care expenses (e.g., childcare, eldercare, or care of a family member with disabilities) as a result of attending TMS2022. The program can also apply to attendees who require personal assistance at the meeting due to a disability.

A limited number of grants—up to \$500 each—will be available to help offset expenses. The deadline to submit an application is January 18, 2022, but grants are assigned on a first-come, first-served basis, so applicants are encouraged to apply early.

Register Today

Discounted Registration Deadline: January 18, 2022

Register for the conference and purchase tickets for any additional social and networking events by January 18, 2022, to receive the best rate on registration. Discounted rates are also available for current TMS members, so be sure to update your TMS membership before you register.

Make your plans today and join us—in person or virtually—at TMS2022.



Table of Contents

JOM, Vol. 73, No. 12, 2021 https://doi.org/10.1007/s11837-021-05007-z © 2021 The Minerals, Metals & Materials Society

Inaugural Congress to Focus on Artificial Intelligence

Taylor Sparks



Taylor Sparks

"The field is on its way toward the goal of developing materials faster and cheaper. The time is right for the first World Congress on Artificial Intelligence in Materials and Manufacturing!"

Ten years have passed since the Materials Genome Initiative provided the jolt the materials community needed to begin exploring how data science techniques could disrupt and revolutionize the traditional materials science paradigm. Artificial intelligence techniques, including machine learning, have proven to be tremendously powerful in complementing the traditional suite of tools used to establish relationships between material structure and properties. The field is on its way toward the goal of developing materials faster and cheaper.

The time is right for the first World Congress on Artificial Intelligence in Materials and Manufacturing (AIM 2022)!

First World Congress on RTIFICIAL INTELLIGENCE IN MATERIALS & MANUFACTURING 2022 Now Is the Best Time to Register

Discounted registration rates end on February 11, 2022

A block of rooms has been reserved at the Pittsburgh Marriott City Center at a special rate for your convenience. Accommodations must be secured by March 11, 2022. Learn more about the technical program, registration, and hotel arrangements at www.tms.org/AIM2022. Over the last decade a growing number of symposia have been directed at artificial intelligence for materials and manufacturing, but this meeting will be the first full conference on the topic sponsored by TMS.

What can you expect to see at AIM 2022? For one thing you'll find an excellent conference venue in beautiful Pittsburgh, Pennsylvania. The Pittsburgh Marriott City Center is a premier hotel located downtown near all the top attractions in the city, including PPG Paints Arena, home of the National Hockey League's Pittsburgh Penguins; the Cultural District, the central hub of downtown's theater and arts scene; and the Strip District, a boutique shopper's paradise filled with a variety of dining options.

Next, you'll find an intimate, dedicated meeting with narrowed focus allowing for a deep dive into the current state of the art for artificial intelligence in materials and manufacturing. As opposed to much larger meetings, like the TMS Annual Meeting & Exhibition, with thousands of participants, in this smaller setting, a few hundred meeting attendees from industry, national labs, academia, and government will be able to focus in on the specific challenges and research areas in this field. The format is conducive to discussions and dialogue that sometimes get lost in large meetings with numerous parallel symposia.

In terms of materials informatics success stories, you'll see presentations where machine learning has enabled discoveries and learning across all classes of materials, ranging from ceramics to metals to semiconductors to polymers and even composites. The diversity of talks also ranges from property prediction to structure classification, algorithm development, and autonomous experimentation and characterization.

In addition to success stories, research in artificial intelligence has also opened up a slew of new questions and challenges. For instance, how can researchers develop features or descriptors to best represent materials effectively at the crystal, micro-, and meso-scale using domain knowledge? Similarly, how should we encode

Leadership in an Emerging Field

TMS offers valuable new learning opportunities related to artificial intelligence. Check out the following resources to stay informed:

Webinars

Artificial Intelligence in Materials: Research, Design, and Manufacturing Webinar Series

Ankit Agrawal, Northwestern University; David Blondheim Jr., Mercury Marine; Benji Maruyama, Air Force Research Laboratory; and Marius Stan, Argonne National Laboratory *Free for TMS members, \$100 for nonmembers*

Bring Artificial Intelligence to Your Materials Organization

Adam Kopper, Mercury Marine; and James Warren, National Institute of Standards and Technology

Free for TMS members, \$50 for nonmembers Watch both programs at: www.tms.org/WebinarLibrary

Online Course

Artificial Intelligence in Materials Science and Engineering Recordings of the modules delivered November 2–4, 2021 Register at: www.tms.org/Alcourse

New Science and Technology Accelerator Report

Employing Artificial Intelligence to Accelerate Development and Implementation of Materials and Manufacturing Innovations

Publication Date: April 2022 Sign up to receive an alert when the free report is available at: www.tms.org/Alstudy processing details for subsequent analysis? Which algorithms should be utilized for pattern recognition within data sets and do different algorithms offer advantages for different tasks or conditions? What additional data and information exists in industry related to manufacturing? Are complete structure-property-processing linkages possible by using artificial intelligence in manufacturing of advanced materials?

A key aspect of this conference is industrial participation and involvement in order to advance artificial intelligence in manufacturing. Whereas academics tend to focus on structure-property relationships and, at times, pay attention to processing relationships, they do not always have access to the large-scale manufacturing facilities needed to develop industrially relevant structure-property-processing relationships. At the same time, advances in Internet-of-Things have led to the ability to capture data from manufacturing processes in ways never before thought possible. Attendees will hear talks on additive manufacturing, extrusion, photolithography, thin film deposition, crystal growth, casting, annealing, and more.

As I am writing this article, the organizing committee is in the process of confirming speakers and planning technical sessions. The plan accommodates three plenary speakers, a roundtable, 18 invited speakers, and a robust set of contributed talks and posters, on topics of interest to industry, government, and academia that will engage attendees at every stage of their careers. Keep an eye on the Technical Program page of the congress website for program and speaker updates as they are announced.

I hope you'll join me in attending AIM 2022 this spring. Register and learn more about the artificial intelligence revolution that's transforming mateirals science at www.tms.org/AIM2022.

Taylor Sparks is an associate professor and associate chair of the University of Utah's

Materials Science and Engineering Department. A TMS member since 2014, Sparks is the chair of the AIM 2022 organizing committee.



Table of Contents

JOM, Vol. 73, No. 12, 2021 https://doi.org/10.1007/s11837-021-05008-y © 2021 The Minerals, Metals & Materials Society



The Second Decade of the Materials Genome Initiative

Julie Christodoulou, Lisa E. Friedersdorf, Linda Sapochak, and James A. Warren

Julie Christodoulou



Lisa E. Friedersdorf



Linda Sapochak



James A. Warren

Ten years ago, the Materials Genome Initiative (MGI), a cross-government effort to accelerate the discovery, design, development, and deployment of new materials into manufactured products, was launched. The core objective of the MGI is to accelerate materials R&D via a materials innovation infrastructure (MII), a tightly integrated fusion of experiment, computation, and data that fosters intentional design and reduces trial-and-error experimentation. Since the 2014 MGI strategic plan was released, the initiative has developed numerous complementary programs at the National Science Foundation (NSF), Department of Energy (DOE), Department of Defense (DOD), the National Institute of Standards and Technology (NIST), and the National Aeronautics and Space Administration (NASA).^{1,2} In this brief article, we introduce a strategy for the next decade that fosters the cutting-edge R&D and infrastructures necessary to address many of the challenges facing humanity.

Federal Efforts over the Last Decade

Federal initiatives like the MGI are established to address a specific set of challenges where the scope is larger than any single agency's mission, and where concerted action will yield results larger than the sum of the pieces. The cross-agency collaboration of the MGI is coordinated through the Office of Science and Technology Policy's (OSTP's) National Science and Technology Council (NSTC), with a subcommittee on the MGI (SMGI). The SMGI acts as a forum for the agencies to discuss priorities and plans and formulate collaborative strategies. Agency efforts that support the goals of the initiative can be found on the MGI website.³ Often programs in support of the MGI may not be explicitly labeled as such, yet, through the actions of the SMGI, these efforts are fully leveraged and advance the mission of accelerating materials R&D.

These collaborative efforts have established a strong foundation of understanding as well as the infrastructure of models, computational and experimental tools, and data that make up the Materials Innovation Infrastructure (MII). The MGI approach has led to the accelerated deployment of advanced materials in numerous applications and provides a springboard for future advances to help the nation build back better.

A Strategy for the Next Decade

While the MGI has been successful in developing the computational, experimental, and data infrastructures required to achieve many of the initial goals and strategies laid out in the founding MGI white paper, there remains much work to do.¹ The MII is ever expanding to encompass new tools and data, and continued efforts are required to integrate them into a seamless toolset and lower the barriers for people who wish to access MGI tools. The ultimate success of the MGI will be measured in how efficiently industry is able to employ the MII to develop new materials with



"The ultimate success of the MGI will be measured in how efficiently industry is able to employ the MII to develop new materials with targeted properties." targeted properties. Sustained engagement across the entire materials R&D enterprise is necessary to ensure that the evolving tools and data resources are well aligned with industries' needs. Outreach to and engagement with industry consortia like the Manufacturing USA Institutes will be essential.⁴

Additionally, new tools and methods are increasingly available, especially as artificial intelligence (AI) approaches become mainstream. Autonomous systems for materials discovery are now possible with application of powerful AI algorithms. These trends will likely be transformative over the next decade but require significant recalibration of the materials R&D curriculum and constant communication and knowledge sharing with associated disciplines.

In light of these opportunities, the OSTP only recently released the 2021 Materials Genome Initiative Strategic Plan.³ This plan builds upon the prior success of the MGI and the current state of the art in MGI



As released in the 2021 Materials Genome Initiative Strategic Plan, the MGI paradigm, shown above, promotes integration and iteration of knoweldge across the entire materials continuum. Unification of the MII will provide a framework for seamless, convective flow of information and a weaving of knowledge among all stakeholders contributing to the materials R&D enterprise, accelerating the deployment of new materials.³

approaches to chart the next decade of the MGI vision and addresses the pressing challenges faced by the nation and the world. The plan has three main goals:

- Unify the Materials Innovation Infrastructure
- Harness the power of materials data
- Educate, train, and connect the materials R&D workforce

The expansion and full unification of the MII called for in Goal 1 has several components, including the requirements for the next generation of computational, experimental, and data infrastructures. Given the relative newness of data infrastructures and the challenges in building these capabilities, the strategic plan explicitly calls for the creation of a National Materials Data Network (NMDN). The NMDN is a coordinated, community-led alliance to drive the creation and integration of the materials data infrastructure. Human Genome Project-style efforts are introduced to focus the MGI around "moonshots" that are technically daunting but can address pressing national grand challenges. For example, these efforts will accelerate the deployment of materials to help mitigate climate change, promote human health, provide clean energy, create non-polluting plastics, and establish robust and resilient supply chains.

To achieve the MGI vision, the community must harness the power of materials data. Goal 2 recognizes the profound changes and challenges that AI and machine learning are bringing to materials R&D. While the successes of the MGI are founded on the tight integration of computational modeling and experiment, AI introduces a completely new modeling approach to the MGI toolkit. Additionally, AI approaches are allowing for "self-driving" or autonomous laboratories, enabling vast explorations of processing and compositional parameters far more quickly and at lower cost. While it is essential for long-term competitiveness, many barriers exist before adoption of AI-driven materials R&D is transitioned to U.S. manufacturing, including issues around trust, uncertainty, access, and intellectual property protection.

Goal 3 focuses on the development

The Second Decade of the Materials Genome Initiative

of the MGI-savvy workforce across the entire materials continuum, from educating the next generation of MGI researchers to introducing existing practitioners to the newest best practices. Efforts in Goal 3 include updating the curriculum to include a combination of computation, experiment, and data science from K-12 through post-graduate work. Opportunities for mid-career professionals to benefit from programs that foster cross-training in research translation, entrepreneurship, technology transfer, and commercialization are presented. Additionally, this plan emphasizes the need to establish new efforts, and deepen existing ones, to maximize the diversity of practitioners in these techniques, who can, in turn, help to increase the impact of the MGI in communities and industries that have yet to adopt these methods.

The Role of Professional Societies

Professional societies have played an important role during the past decade of the MGI and will be critical for its success in years to come. In the early years of the MGI, a number of professional societies "stepped up."⁵ The MGI relies on an "all hands on deck" engagement from the community, with events, publications, and special sessions devoted to the MGI across the materials, biomaterials, chemistry, physics, and engineering disciplines. The MGI benefits greatly from the efforts of professional societies to rally the community and clarify their needs.

Call to Action

The MGI will continue to accelerate materials discovery to deployment well into the coming decades as the MII expands and incorporates new methods and approaches as they arise and is used by an ever-more data-savvy workforce. As the MGI enters its next decade, all are welcome to participate in and grow the MGI community to realize its bold vision.

ble of Contents

Julie Christodoulou is the recently retired director of the Naval Materials and Manufacturing S&T Division at the Office of Naval Research. She has been a TMS member since 1996.

Lisa E. Friedersdorf is assistant director for Microelectronics, Materials, and Nanotechnology in the White House Office of Science and Technology Policy.

Linda Sapochak is the division director for the Division of Materials Research at the National Science Foundation. She has been a TMS member since 2019.

James A. Warren is the director of the Materials Genome Program in the Material Measurement Laboratory of the National Institute of Standards and Technology. He has been a TMS member since 1997.

End Notes

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"Professional societies have played an important role during the past decade of the MGI and will be critical for its success in years to come."

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SHOWCASING THE STRENGTH OF THE INDUSTRY WITH THE LIGHT METALS DIVISION

Kaitlin Calva

its original 1988 scope statement, the Light Metals Division (LMD) decided that the "primary thrust" of its activities would be "in identifying and satisfying the continuing education needs of its membership."1 Over the years, the division has sponsored a number of workshops and short courses to that end, as well as published many of the papers presented at TMS Annual Meetings in the proceedings volumes Light Metals and Magnesium Technology.

CARACTER IN ARTICLE

"Showcasing the Strength of the Industry with the Light Metals Division." is the sixth 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 2022. For more information, contact Kaitlin Calva. JOM Magazine Managing Editor, at kcalva@tms.org.

Meet the LMD Interviewees

Donna Post Guillen

Distinguished Researcher, Idaho National Laboratory 2020 LMD Distinguished Service Award

Halvor Kvande

Professor Emeritus, Norwegian University of Science and Technology 2011 LMD Distinguished Service Award

Ray D. Peterson



Director of Technology, Real Alloy Past LMD Chair, 1992 Light Metals Award, 2009 TMS President, 2009 LMD Distinguished Service Award, 2011–2015 AIME Trustee, 2018 TMS Fellow



Robert B. Wagstaff Founding Partner, Oculatus Consulting 2017 Application to Practice

Award

Additionally, the LMD's strong presence at TMS Annual Meetings went beyond the session rooms and into the exhibit hall, providing a forum for members from all over the world to connect and exchange knowledge and ideas, and spark collaboration. the division's Noting heavy participation both internationally and from the industry sector, past LMD chair and 1998 TMS President Euel Cutshall wrote about the LMD's activities and goals in a November 1994 issue of JOM: "...members are examining how to improve efficiency, how to be more profitable, how to use the latest technology, and how to maintain competitiveness. It can become a challenge to keep that competitiveness while still sharing a common ground within the division-being competitors outside the division, yet colleagues within the division....There is, however, a wealth of nonproprietary information that can be shared within the division to help individuals in the light metals industry as a whole."2

In the rest of this article, JOM shares interviews from members and leaders of the Society about their

Wagstaff (right) receives the Application to Practice Award (now named the Research to Industrial Practice Award) from 2016 TMS President Stanley M. Howard at the TMS 2017 Annual Meeting & Exhibition in San Diego, California.

personal experiences of the LMD, as we continue the 150th anniversary celebration of TMS and the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME).

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

Donna Post Guillen: I attended my first TMS meeting over a decade ago. At the TMS 2011 Annual Meeting, Cindy Belt introduced herself as the chair of the Energy Committee and invited me to attend the committee meeting. Cindy was certainly a spark plug that made things happen and had a knack for getting people involved in TMS.

Halvor Kvande: I took part in my first TMS Annual Meeting in New York City in 1975, and since then I have participated in about 20 of these TMS conferences. In total, I have authored and co-authored about 40 papers published in the annual *Light Metals* volumes.

Ray D. Peterson: During my college years, my classmates and I would attend the local AIME chapter meetings where we received a heavily subsidized meal and listened to various speakers in the mining and metallurgy fields. I attended my first AIME-TMS Annual Conference in the early 1980s as a graduate student. I was amazed at the number of technical presentations and the many conference activities. I even worked as a session monitor to help pay for my travel expenses. In 1985, I participated in the TMS annual meeting as a professional where I presented a paper on my Ph.D. work. It was a daunting and exciting experience to give a presentation in front of so many knowledgeable individuals. **Robert B. Wagstaff:** In my comments upon receiving the 2017 TMS Application to Practice Award (now named the Research to Industrial Practice Award), I noted that: "In my early years with TMS, the annual meeting was a remarkable opportunity to gain a better understanding of the current industry practices and to meet with my mentors. A group of us would arrive early on Sunday to purchase the proceedings and then dedicate the remainder of the evening

"The strength of LMD is the rich diversity of people that it brings together."

-Donna Post Guillen

reading each paper in detail so that we were prepared to participate in the sessions that intrigued us most. With the mentors of my youth absent at the sessions of today, I still find myself excited on the Sunday evenings prior to the conference. These days, however, I am increasingly excited by the prospects of introducing and adopting new concepts and technology on a large scale while helping mentor others, as others helped me."

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

Guillen: The strength of LMD is the rich diversity of people that it brings together. There are experienced professionals interacting with students and recent graduates, industrial practitioners rubbing elbows with academia, people from



Donna Post Guillen (right), past chair of the TMS Energy Committee, presents the 2015 LMD/Extraction & Processing Division (EPD) Best Paper Award – Professional to Liu Yan of Northeastern University, China.



different countries and cultures socializing together, and people from different types of industries discussing their tools of the trade.

Kvande: The LMD serves professionals in the field of light metals. It is involved in academic research and operational activities toward practical and technological applications. For me the Light Metals Division and the TMS Aluminum Committee have been particularly valuable for the various

"Developing technical programming, publications content, and professional development events within the LMD's scope of activities are important today and will continue to be important also in the future."

-Halvor Kvande

aluminum courses they have sponsored.

Peterson: The Light Metals Division has long been the home of the world's technical practitioners and researchers in the field of light metals, especially aluminum and magnesium. In the 1970s the leadership of the Aluminum Committee decided it was important to document and archive the research and engineering work being performed in the aluminum industry. They created the Light Metals series of books which has become the depository of a great deal of the practical knowledge and scientific insight related to the production of aluminum and its transformation into useful products. Later the Magnesium Committee followed the same path with the Magnesium Technology book series. The annual meeting has provided a home and continuity for light metal researchers to present their work. This constancy has led to synergistic interactions between researchers and organizations and propelled our industry forward.

Wagstaff: The value of the Light Metals Division is only found and realized by adopting and integrating the ideas and concepts introduced at LMD. For me? I owe much of my success to LMD and the contributions of my mentors in the industry.

JOM: In your opinion, what are some key events of the LMD over the years? What is the significance of this in relation to the LMD today?

Guillen: The TMS annual meetings have been so packed with events and information that it is like drinking from a fire hose! I always returned to the office refreshed and invigorated about the new research areas I had learned about and the new contacts I had made. The students' entries in the Bladesmithing Competition are always very impressive.

Kvande: Developing technical programming, publications content, and professional development events within the LMD's scope of activities are important today and will continue to be important also in the future.

Peterson: The creation of *Light Metals* and later *Magnesium Technology* are among the great achievements of our division. These collections of books are an invaluable resource to engineers and scientist in our field and directly impact the companies in the aluminum and magnesium industries. By perusing older books in the series, you can clearly see how new concepts are devised and developed over a period of time. I truly believe the sharing of knowledge from these books has greatly advanced our industry and society.

Wagstaff: Publications, presentations, and exhibits. TMS and AIME exhibits have evolved from a series of smaller booths sponsored by suppliers in the early-to-mid-1980s. Booth sponsors were in the conference exhibit area to meet interested participants and discuss their technology and the corresponding equipment they were introducing. During the late 1980s to early 1990s, attendance increased at the conference and exhibit, and potential attendees were forced to jockey their carefully allocated time among multiple suppliers offering similar technology and equipment. The mid-1990s to the early 2000s was certainly the zenith of this activity. During this time, the exhibits grew, and some exhibitors populated their booth with real production

"...if economic trends continue, and we overcome this pandemic, we should be able to realize a new, likely greater pinnacle than the zenith of the earlier generation."

—Robert B. Wagstaff

equipment, which took a detour en route to the customer, to be shown to the world at TMS.

The mid-2000s were difficult for conferences and exhibits as the industry participants went through an integration cycle, reducing the number of attendees, papers, and cash available to suppliers to continue the trajectory of the earlier era. This period concluded with the worldwide financial challenges of the late 2000s where only a very few of the surviving suppliers could afford exhibit space. At the same time, smaller regional

SHOWCASING THE STRENGTH OF THE INDUSTRY WITH THE LIGHT METALS DIVISION

able of Contents

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AN EARLY LOOK AT THE LMD

In addition to designating its focus on continuing education through workshops and programming, the Light Metals Division (LMD) was originally "organized to serve the professional needs of the men and women in the light metals industries, both traditional (e.g., aluminum, beryllium, titanium, lithium, etc.), and emerging (e.g., composites, laminates, etc.).1 The first committees under the LMD, as reported in the June 1988 issue of JOM, were:

- Aluminum
- Reactive Metals

For a look at the current LMD committees and to get involved in the division's activities, visit www.tms.org/Committees.



Ronald E. Miller, pictured here, was selected to serve as the first LMD Chair in 1988. He later served as TMS President in 1991.

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The Light Metals Division (LMD)

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This excerpt from the 1988 issue of JOM, shown above, describes the initial plan and direction for the LMD.1

Divisional Attiliation Preferences



Calva



Left, a mariachi band captures the excitement of the TMS 1998 Annual Meeting & Exhibition opening, held in San Antonio, Texas.³ Right, the exhibit hall provides an active networking space for attendees at the TMS 2003 Annual Meeting & Exhibition, held in San Diego, California.⁴

conferences began to emerge, tailored to the needs of the industry of that region. TMS took an active role in sponsoring education sessions to help develop the bench strength of the industry using the TMS short courses as a foundation.

Today, we see a renaissance of the exhibit area with a healthy mixture of mature exhibitors comfortably balanced with academic, institutional, and supplier entities showing their new wares. This indicates that if economic trends continue, and we overcome this pandemic, we should be able to realize a new, likely greater pinnacle than the zenith of the earlier generation.



This photo from November 1996 *JOM* shows participants of the April 1996 Industrial Aluminum Electrolysis Course, sponsored by the LMD of TMS. Halvor Kvande, longtime organizer and instructor of the course, is pictured in the front row, far left.⁵

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

Guillen: Receiving the 2020 LMD Distinguished Service Award was truly an honor. It was the last in-person conference that I've attended since the COVID-19 pandemic.

Kvande: The TMS Industrial Aluminum Electrolysis (IAE) Course on Theory and Practice has been held 16 times from 1996 to 2017, and I have been the lead organizer for the last 13 of these courses. To pull together a training staff, promote the course effectively, and to deliver a high-quality product has not only been an essential function, but an honest pleasure as well. These courses are my favorite memories associated with TMS. It is acknowledged that this series of courses has received sponsorship from the TMS Light Metals Division and the TMS Aluminum Committee. I can add that I have co-authored a paper called "The TMS Industrial Aluminum Electrolysis Course – History, Development of Contents and Future" for the TMS 2022 Annual Meeting & Exhibition.

Peterson: There are two things I cherish about TMS and LMD. I've learned so much about my areas of professional interest over the years from more senior colleagues as well as my current colleagues. By reading their papers, asking them questions, and in some cases, collaborating with them on new projects, I have learned more than I could ever have done on my own. Secondly, I have made acquaintances and friends all over the world. I have found that not only do we share common interests in research fields, but most of the people I meet through LMD and TMS activities are truly interesting and exceptional people.



SHOWCASING THE STRENGTH OF THE INDUSTRY WITH THE LIGHT METALS DIVISION



Ray Peterson (second from right) is part of the featured speaker lineup at the 2018 Light Metals Keynote Session, a staple of the TMS Annual Meeting & Exhibition each year.

Wagstaff: Meeting my mentor, John Jacoby, and enjoying dinner together are some of my favorite memories.

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

Guillen: The work the Energy Committee has been doing to promote decarbonization and energy efficiency is now front and center of the clean energy transformation. There are many challenges in our net zero energy future that make this an exciting time to work in the field of materials science.

Kvande: I hope that the LMD will continue its work for the benefit of the light metals industry, and also for R&D in this field. The keynote sessions at the opening of the TMS annual meeting have been popular and should continue. In the future, the LMD should be heavily concerned and involved in the decarbonization of the light metals industry!

Peterson: I believe that the LMD and TMS will continue to produce the premier symposia and books concerning the production and use of light metals. The annual meeting will continue to be "the place" to present your work and to interact with your professional colleagues from around the world.

Wagstaff: The LMD is key to the advancement of the light metals industry. We need to go out, pounding the pavement soliciting their support.

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

Guillen: As the vice chair of the Energy Committee, we are

witnessing a tremendous engagement in novel technologies that reduce pollution and waste yet improve energy security. Clean energy can make a meaningful contribution to an environmentally sustainable future.

Kvande: The participation in the TMS annual meetings and the TMS Aluminum Courses have been very important for my career, both for my personal professional development, and for the opportunity of networking with an international group of aluminum experts, highly qualified people with extensive expertise and a passion for the aluminum industry.

Peterson: It has been an honor and point of pride for me to be involved and lead various groups within LMD and TMS. I hope that everyone can be involved in TMS and their technical division as much as their time permits. I assure you that you will receive much more from the organization than you put in.

Wagstaff: As leaders today, we need to continue building on the foundations set by our metalurgical-materials science fathers of the past and continue to set new foundations in emerging fields for other builders who follow in the future.

End Notes

- 1. "News," Journal of Metals, 40, 49 (1988).
- 2. "LMD Edition," JOM, 46, A80 (1994).
- 3. "TMS News," *JOM*, 50, 53 (1998).
- 4. "News & Update," JOM, 55, 6 (2003).
- 5. "LMD Edition," *JOM*, 48, vi (1996).



able of Contents

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TMS meeting headlines

TMS is committed to your safety during the pandemic. Meeting dates and locations are current as of October 5, 2021. For the most recent updates on TMS-sponsored events. visit www.tms.org/Meetings.



February 27–March 3, 2022 **Anaheim Convention Center &** Anaheim Marriott Anaheim, California, USA **Register and Book Hotels Today** www.tms.org/TMS2022

- Register now to attend the TMS2022 Annual Meeting & Exhibition (TMS2022) and celebrate the return of the in-person exhibit, the continuation of the TMS-AIME 150th Anniversary Year, and the excitement of the TMS Bladesmithing Competition.
- All attendees are encouraged to stay at the Anaheim Marriott for convenience to technical sessions at the convention center and networking events mainly at the hotel. The discounted room rate is available on a first-come, first-served basis, so don't delay!

The 6th International Congress on



3D Materials Science 2022 June 26-29, 2022 Hyatt Regency Washington on **Capitol Hill** Washington, D.C., USA Submit an Abstract by January 21, 2022 www.tms.org/3DMS2022

- The 6th International Conference on 3D Materials Science (3DMS 2022) will keep pace with new developments, strengthen learning and networking opportunities, and build upon the progress of the 2021 virtual meeting.
- Technical topics covered at 3DMS 2022 will include new 3D characterization methods, automated and autonomous 3D materials research, 3D data processing and reconstruction algorithms, materials dynamics in 3D, and other topics.



ADDITIVE MANUFACTURING

August 15-18, 2022 Hyatt Regency Bethesda, Bethesda, Maryland, USA Submit an Abstract by January 7, 2022 www.tms.org/AMBench2022

- The Additive Manufacturing Benchmarks (AM-Bench) conference is the home for presenting the findings and results associated with a continuing series of controlled benchmark tests from the AM-Bench committee. To receive benchmark information. complete the form on the website to sign up for updates.
- The conference will also include technical sessions with a focus on additive manufacturing modeling, measurement, and characterization.



September 18-21, 2022 **Bellevue Hotel** Philadelphia, Pennsylvania, USA Submit an Abstract by January 7, 2022 www.tms.org/LMPC2022

- The Liquid Metal Processing & Casting Conference (LMPC) conference series convenes experts from both industry and academia to specifically discuss the latest advances in primary and secondary melt processing including vacuum induction melting (VIM), vacuum arc remelting (VAR), electroslag refining (ESR), and electron beam cold hearth remelting (EBCHR). No other dedicated conference specializes in this type of melting.
- Abstracts are due by January 7, 2022. If your abstract is scheduled for presentation during LMPC 2022, a proceedings manuscript is required. The manuscript deadline is April 1, 2022.

Other Meetings of Note

Offshore Technology Conference (OTC Asia 2022) March 22-25, 2022 Kuala Lumpur, Malaysia

World Congress on Artificial Intelligence in Materials and Manufacturing (AIM 2022) April 3-6, 2022 Pittsburgh, Pennsylvania, USA

8th International Conference on Solid - Solid Phase Transformations in Inorganic Materials (PTM2022) June 27–July 1, 2022

Xi'an, China

Congress on Safety in Engineering and Industry (Safety Congress 2022) August 15-17, 2022 Fort Worth, Texas, USA

Materials Science & Technology 2022 (MS&T 2022) October 9-13, 2022 Pittsburgh, Pennsylvania, USA

COPPER-COBRE 2022 (Copper 2022) November 13-17, 2022 Santiago, Chile

TMS 2023 Annual Meeting & Exhibition March 19-23, 2023 San Diego, California, USA

Superallov 718 & **Derivatives 2023** (Superalloy 718) May 14-17, 2023 Pittsburgh, Pennsylvania, USA



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call for papers

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



June 2022 Manuscript Deadline: January 1, 2022

Topic: 30 Years of Oliver-Pharr: Then, Now and the Future of Nanoindentation

Scope: The 1992 seminal publication by W.C. Oliver and G.M. Pharr laid a cornerstone for the development of nanoindentation as reference technique for nanomechanical characterization. The "Oliver-Pharr" method has enabled transformative research efforts in a wide range of fields spanning materials science, geology, biology, and medicine. This special topic is devoted to its applications, as well as current developments and future trends.

Editors: Verena Maier-Kiener, Benoit Merle, and Samantha Lawrence

Sponsor: Nanomechanical Materials Behavior Committee

Topic: Magnetic Materials for Multifunctional Applications

Scope: Papers are invited on magnetic materials which can be used for multifunctional applications in the power and energy sector (energy conversion, energy storage, power generation, etc.). Fundamental and applied research in this area with an emphasis in novel processing, and the interplay between composition-processing-structure-microstructureproperty-performance is welcome. Peer-reviewed manuscripts based on original research, literature review, and scientific viewpoint will be considered for publication.

Editors: Surojit Gupta, Radhika Barua, Manoj Mahapatra, and Lan Li

Sponsor: Energy Conversion and Storage Committee

Topic: Magnetic Structure Characterization over Multiple Length Scales

Scope: Magnetic structures form over multiple length scales. Characterization of magnetic structures over multiple length scales plays an essential role in advancing the understanding of structure-property-processing relationships of magnetic materials. This topic covers various complementary characterization techniques that help illuminate the magnetic phenomena from atomic-scale spin configurations to nanoscale structures to meso-scale domains in magnetic materials. **Editor:** Yongmei Jin

Sponsor: Magnetic Materials Committee

Topic: New Frontiers in Physical Metallurgy of Steels

Scope: This topic seeks articles focusing on physical metallurgy of steels with novel alloying concepts including increased levels of elements such as Mn, Al, and Si. Novel microstructure concepts and processing strategies to manufacture high-performance steels are encouraged. Research articles highlighting recent advances in experimental and modeling studies for multi-phase steel microstructure such as TRIP/TWIP effect and interface precipitation, as well as their industrial applications, are recommended. **Editors:** Amit Behera and Ana Araujo

Sponsor: Steels Committee

July 2022

Manuscript Deadline: February 1, 2022

Topic: Cold Dwell Fatigue of Titanium Alloys

Scope: The topic of dwell fatigue of titanium alloys is experiencing a resurgence of international activity following the realization that the industry workhorse Ti-6A1-4V is susceptible to cold dwell fatigue. This special topic will focus on the state of the art in understanding and modeling dwell fatigue failure of titanium alloys.

Editors: Adam Pilchak and Michael Gram **Sponsor:** Titanium Committee

Topic: In-situ Methods for Understanding Deformation & MS Evolution in Mg Alloys

Scope: Magnesium and its alloys have many unique transformations that occur during loading and thermomechanical processing due to its HCP crystal structure. Advanced in-situ characterization techniques are powerful tools for providing valuable information in real time. When used in combination with mechanical loading, processing techniques, and thermal treatments, comprehensive studies have been carried out to understand complex relationships between processing, structure, and properties. **Editors:** Aeriel Leonard and Domonkos Tolnai **Sponsor:** Magnesium Committee

Topic: Interactions between Biomaterials and Biological Tissues and Cells

Scope: Manuscripts are solicited in all areas of research that investigate the physical, mechanical, biological, and biochemical interactions between engineered biomaterials and

call for papers

biological tissues and cells. Topics of interest include but are not limited to biointerfaces, mechanobiology, biocompatibility, tissue compatibility, inflammatory responses, biodegradation, toxicity, tissue regeneration, protein-materials interactions, cell-material interactions, and biomimetic and bioinspired surfaces.

Editors: Jing Du, Dinesh Katti, and Vinoy Thomas **Sponsor:** Biomaterials Committee

Topic: Machine Learning and New Paradigms in Computational Materials Research

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

Editors: Sara Kadkhodaei, Eva Zarkadoula, and James Morris

Sponsor: Chemistry and Physics of Materials Committee

August 2022 Manuscript Deadline: February 1, 2022 Topic: Applications of Autonomous Data Collection and Active Learning

Scope: Recent advances in data processing and robotics have expanded the possibilities for real-time data feedback to improve in situ monitoring of characterization and manufacturing processes. This special topic will focus on experimental methodologies that employ automatic data collection routines for materials characterization, with

an emphasis on utilizing these data to enable closed loop controls.

Editors: Andrew Polonsky and Amit Pandey **Sponsor:**Advanced Characterization, Testing, and Simulation Committee

Topic: Isostructural Precipitate-Matrix Combinations

Scope: The microstructural template of ordered precipitates (for example L12, DO22, or B2) within a disordered matrix is prevalent in the design of many alloy systems. This special topic brings together communities working on isostructural ordered/disordered precipitate/matrix alloy systems. Areas of interest include the mechanism of precipitation, phase transformations, and mechanical properties. **Editors:** Bharat Gwalani, Matt Steiner, Ashley Paz Y Puente, Jonah Klemm-Toole, and Rajarshi Banerjee **Sponsor:** Phase Transformations Committee

Topic: Two-Dimensional (2D) Materials, Devices, and Sensors

Scope: The ever-expanding class of 2D materials exhibit emergent properties originating from their reduced physical dimensions and highly-anisotropic nature. Atomically thin 2D materials offer exciting new opportunities across many disciplines/applications, spanning nano-optoelectronics, sustainable energy, high-performance sensors, advanced environmental and healthcare technologies, etc. This special topic, in synchrony with the 2022 Symposium on Functional Nanomaterials, welcomes manuscripts concerning 2D nanofilms/nanosheets/monolayers, their hierarchical assemblies, heterostructures, frameworks, and organicinorganic hybrids, as well as derivative 2D devices and sensors.

Editors: Michael Cai Wang and Wenzhuo Wu Sponsor: Nanomaterials Committee

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ble of Contents

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