

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE  
The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS  
University Printing House, Shaftesbury Road, Cambridge CB2 8BS, UK  
One Liberty Plaza, New York, NY 10006, USA  
477 Williamstown Road, Port Melbourne, VIC 3207, Australia  
Ruiz de Alarcón 13, 28014 Madrid, Spain  
Dock House, The Waterfront, Cape Town 8001, South Africa

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First published 2020

Printed in the United States of America

This publication constitutes Supplement 2 to Volume 26, 2020 of *Microscopy and Microanalysis*.

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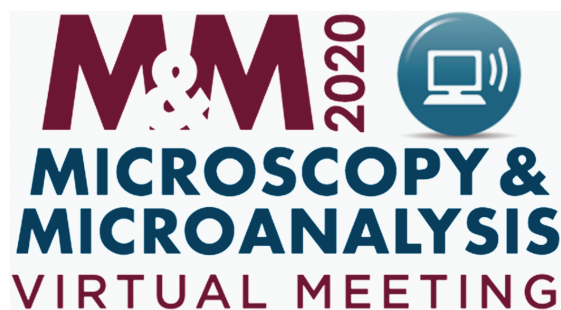
John Mansfield, Editor in Chief, 4304 Spring Lake Blvd., Ann Arbor, MI, 48108-9657, USA; Tel: (734) 994-3096; Fax: (734) 763-2282; E-mail: [thejfmjfm@me.com](mailto:thejfmjfm@me.com)

### **Office of Publication**

Cambridge University Press, One Liberty Plaza, New York, NY 10006, USA. Tel: (212) 337-5000; Fax: (212) 337-5959.

# Microscopy & Microanalysis

The Official M&M 2020 Proceedings  
Virtual Meeting • August 4–7, 2020



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- 1648 *Advances in Cryo-Electron Microscopy for Understanding Energy Materials*; D Markovich, M Zachman, S-H Yu, R Selhorst, T Moon, H Abruña, K Noonan and L Kourkoutis



- 1652 *Cryo-EM of Li Metal Battery Aging and Failure Mechanisms*; K Jungjohann, D Long, R Gannon, S Randolph, S Goriparti, L Merrill and K Harrison
- 1654 *Cryo-STEM-EDX for Reliable Characterization of Sulfur Distribution and the Rational Design of Sulfur Hosts for Li-S Batteries*; Y Yang, B Levin, N Zhang, H Abruña and D Muller
- 1660 *Stabilizing Fuel Cell Materials Through Cryogenic Cooling for Simultaneous EELS-EDS Analysis*; D Cullen, M Zachman, A Lupini and M Chi

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- 1664 *Advanced FIB/SEM Characterization of Nuclear Materials in the Irradiated Materials Characterization Lab*; D Murray, F Teng, N Poudel and K Gofryk
- 1666 *Probing the Unique Radiation Damage Response of Oxide Interfaces Using Multi-modal STEM Imaging, Diffraction, and Spectroscopy*; S Spurgeon, B Matthews, T Kaspar, W Jiang, J Gigax, L Shao, V Shutthanandan and M Sassi
- 1668 *Characterizing Zircaloy-4 Corrosion Films Formed Under Neutron Irradiation Using Focused Ion Beam Tomography*; G Lucadamo, J Seidensticker and B Ensor

### ***In Situ TEM at the Extremes - Corrosion***

- 1670 *In-situ Atomic-scale Imaging of Unidirectional Oxide Growth During the Oxidation of Metals*; G Zhou
- 1672 *In Situ Atomic Scale ETEM Observation of Oxide Nucleation and Growth During Initial Oxidation of Cu and Cu-Ni Alloy*; M Li, M Curnan, R Garza, M Gresh-Sill, S House, W Saidi and J Yang
- 1674 *In Situ Study of Cu Oxidation in gas environment*; K He, X Hu and V Dravid
- 1676 *In-situ Oxidation State Mapping by Electron Energy-loss Spectroscopy*; L Spillane, P Longo, B Schaffer, B Miller, P Thomas and R Twesten
- 1678 *In-situ Atomic-Resolution Observations of Surface Passivation Induced Metal/Oxide Interfacial Transformation*; X Chen, D Wu, X Sun, D Zakharov, S Hwang, D Su and G Zhou

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- 1680 *Three-dimensional Analysis of Materials at Multiple Length Scales*; J Sugar, N Bartelt, D Robinson, B Antoun, CS Marchi, T Smith, C Alleman, H Ding, D Ding and S Vitale
- 1684 *Controlled Self-organization on Germanium Using Focused Ion Beam (FIB): From Quasi-periodic Nanoripples to Well-ordered Periodic Nanostructures*; B Kamaliya, V Garg, R Mote, M Aslam and J Fu
- 1688 *3D Characterization of a Novel CoNi-superalloy for Additive Manufacturing*; A Polonsky, T Francis, K Pusch, M Echlin, A Botman, S Randolph, R Geurts, J Filevich and T Pollock



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1694 *Atomic-resolution Operando and Time-resolved In Situ TEM Imaging of Oxygen Transfer Reactions Catalyzed by CeO<sub>2</sub>-supported Pt Nanoparticles*; J Vincent and P Crozier

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1700 *Imaging of Magnetic Textures in Polycrystalline FeGe Thin Films via in-situ Lorentz Transmission Electron Microscopy*; N Bagues, B Wang, T Liu, C Selcu, S Boona, R Kawakami, M Randeria and D McComb

### ***Management and Operation of Microscopy and Microanalysis Facilities***

1704 *Imaging Conductivity in a Single Atomic Layer*; O Dyck, J Swett, A Lupini and S Jesse

1706 *Pitfalls and Successes of Building a Dedicated Electron Microscopy Facility from Scratch*; E Hanssen

1708 *Does Your Core Rate Structure Really Matter?*; J Hunter

1710 *Using IoT to Improve Uptime and Customer Satisfaction*; M Schweitzer

1714 *Microscopy and Image Processing Recordkeeping: Never Again Lose Track of Your Metadata*; F Robert, N Piché and M Marsh

### ***Biological Sciences Tutorial: Optimization of Cryo-EM Data Collection Using Advanced Direct Detectors***

1716 *Optimization of Cryo-EM Data Collection Using Advanced Direct Detectors*; M Spilman

### ***Advances in Modeling, Simulation, and Artificial Intelligence in Microscopy and Microanalysis for Physical and Biological Systems***

1718 *Emergent Structure in Magnetic Microrollers*; M Driscoll, E van der Wee, A Donev, B Sprinkle, A Sokolov and A Snezhko

1720 *Denoising Large In Situ TEM Image Datasets: A Convolutional Neural Network-based Approach*; J Vincent, S Mohan, C Fernandez-Granda and P Crozier

1722 *Denoising Atomic Resolution Hyperspectral Data with Tensor Singular Value Decomposition*; C Zhang, R Han, A Zhang and P Voyles

- 1724 *Denoising of Sparse Three- and Four-dimensional Hyperspectral Electron Microscopy Data Using a Total Variational Method*; S Zeltmann, A Minor and C Ophus
- 1728 *A New Fast Helium Ion Imaging Technique Through Rapid Acquiring and Restoring Using the Point Spread Function Deconvolution Method*; P Tavousi, B Ahmadi, N May, S Snider-Drysdale, Z Shahbazi, D Di Mase and S Shahbazmohamadi

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- 1732 *Scanning Electron Diffraction of 'Soft' Materials – Application to Organic and Hybrid Systems*; D Johnstone and P Midgley
- 1734 *4DSTEM of Beam-sensitive Materials: Optimizing SNR and Improving Spatial Resolution*; K Bustillo, S Zeltmann, M Chen, J Donohue, A Mueller, C Ophus, J Ciston and A Minor
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- 1740 *4D-STEM Quantification of Nanoscale Ordered Domains in Organic Semiconducting Polymers*; GC Ortiz, M Zhu, L Dou and J Hwang
- 1744 *Interaction-free Interferometry with Electrons*; A Turner, C Johnson and B McMorrان

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- 1748 *What Are the Applications of meV EELS ?*; P Rez, K March and K Venkatraman
- 1750 *Low-energy Electronic Excitations in Transition-metal Oxide as Probed by STEM-EELS Spectromicroscopy*; A Gloter, C Su, X Li, K Ruotsalainen, A Nicolaou and O Stephan
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- 1756 *Resolving Nanostructured Materials Down to the Single-atom Limit*; X Cai, A Tricoli, H Liu, Y Cai, C Dwyer, N Wang and Y Zhu

- 1760 *Tracking Atomic Scale Oxygen Exchange in Dynamic Structure of CeO<sub>2</sub> Nanoparticle Surfaces*; M Tan, B Bolas, E Lawrence and P Crozier
- 1762 *EELS Analysis of Two-dimensional Co<sub>3</sub>O<sub>4</sub> and Supported La Single Atoms*; J Xu, Y Wang, D Wang and J Liu

### ***Direct Phase Imaging with Coherent Electron Beam in TEM***

- 1764 *In-situ Observation of Magnetic Skyrmion Crystal Growth from the Conical Phase*; T-H Kim, H Zhao, B Xu, B Jensen, A King, M Kramer, L Ke and L Zhou
- 1766 *Hollow-cone Foucault Imaging of Magnetic Textures in Hexagonal Ferrite; BaFe<sub>10.35</sub>Sc<sub>1.6</sub>Mg<sub>0.05</sub>O<sub>19</sub>*; S Mori, A Kotani and K Harada
- 1770 *Exploring the Local Energy Landscape of Aperiodic Artificial Spin Ices via Lorentz TEM*; A Petford-Long, F Barrows, V Brajuskovic and C Phatak
- 1772 *A New Type of Domain and Interacting Bloch-lines in a Dzyaloshinskii-Moriya Multilayer Thin Film*; J Garlow, S Pollard, M Beleggia, H Yang and Y Zhu

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- 1774 *Proposal: Let's Develop a Community Consensus K-ratio Database*; N Ritchie, D Newbury, E Bullock, P Carpenter, J Donovan, J Fournelle, A von der Handt, H Lowers, A Moy, O Neill and E Vicenzi
- 1778 *Can the ISO 14595 Method be Used to Validate the Heterogeneity and Composition of Natural Mineral Standards Using WDS And/or EDS?*; S Burgess, P Pinard, S Kearns, B Buse, H Dyson and R Jones
- 1782 *Using Multi-Element Reference Materials for Approximating Concentrations in Soils and Sediments from Micro XRF Spectra*; S McIntyre, L Van Loon, N Sherry, M Bauer and N Banerjee
- 1786 *Adventures with Oxides: Utilizing Commercial and Internal Reference Materials for Geological and Materials Science Samples*; K Crispin
- 1788 *Matrix-Bracketing Blanks & Peak Overlap Correction for Ti-V-Cr in Diverse Tourmalines*; JW Singer and M Lupulescu

### ***Surface and Subsurface Microscopy and Microanalysis of Physical and Biological Specimens - Correlation of Spectroscopic Methods with Microanalysis***

- 1790 *Studying the UO<sub>2</sub> Electrochemistry In Situ Using SEM*; X-Y Yu, J Yao, S Chatterjee, J Son and E Buck

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- 1794 *Capturing the Atomic Coordinates of Surface and Subsurface Structure in 4D with Atomic Electron Tomography*; J Zhou, Y Yang, Y Yang, C Ophus, F Sun, A Schmid, H Zeng, P Ercius and J Miao
- 1798 *Multidimensional Sample Surface Analysis by AFM-in-SEM*; V Novotna, V Hegrova, J Horak, Z Novacek, M Pavera and J Neuman
- 1800 *In-situ Correlative Analysis of Electrical and Mechanical Properties of 3D Nanostructures by Combination of AFM, SEM and FIB*; C Schwalb, P Frank, S Hummel, J Sattelkov, R Winkler, J Huetner, O Domanov, G Fantner and H Plank
- 1802 *Latest Advances in Nanoscale Chemical Imaging and Spectroscopy*; A Roy

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- 1804 *Ultra-high Energy Resolution EELS*; N Dellby, T Lovejoy, G Corbin, N Johnson, R Hayner, M Hoffman, P Hrncrik, B Plotkin-Swing, D Taylor and O Krivanek
- 1806 *An Optimized In-column Detection System for the Ultra-high Resolution BrightBeam™ SEM Column*; J Jiruše, P Sytař, J Páral and T Hrnčíř
- 1808 *High-resolution Multimodal Confocal Raman-imaging in SEM by Means of RISE Microscopy*; J Englert, U Schmidt, O Hollricher and H Fischer
- 1810 *NanoMi: An Open Source (Scanning) Transmission Electron Microscope*; M Malac, M Cloutier, M Salomons, S Chen, S Yakubu, M Leeson, J Pitters, D Vick, D Price, D Homeniuk, M Hayashida and R Egerton

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- 1812 *Cryo-EM of Helical Polymers at Near-atomic Resolution Yields Many Surprises*; E Egelman
- 1814 *Structural Study of the Legionella pneumophila Dot/Icm T4SS Using Cryo-electron Microscopy*; C Durie, M Sheedlo, JM Chung, B Byrne, T Knight, M Swanson, D Lacy and M Ohi
- 1816 *Imaging Fungal Contamination of Protective Organic Coatings*; T Brown and J Lee

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- 1818 *Unsupervised Determination of the Number of Conformations in Single-particle Cryo-EM*; Y Zhou, A Moscovich, P Acharya and A Bartesaghi
- 1820 *Embedding Heterogeneous Cryo-EM Data with 3D Principal Component Analysis and Variational Autoencoders*; D Tegunov

1822 *CryoDRGN: Deep Generative Models for Reconstructing Heterogeneous 3D Structures from Cryo-electron Micrographs*; E Zhong, T Bepler, B Berger and J Davis

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1824 *Cryogenic-electron Microscopy for Battery Materials*; Y Li, R Sinclair and Y Cui

1826 *Development of Cryogenic Techniques for Characterizing Energy Storage Materials in Electrochemical Process*; M Zhang and S Meng

1828 *Air-protective Cryo-FIB Tomography of Sensitive Materials for Energy Applications*; J Cui, H Zheng and K He

1830 *Interphases of Magnesium Metal Anodes Enabled by Cryogenic Electron Microscopy*; D Long, S McClary, N Hahn, K Zavadil and K Jungjohann

## ***In Situ TEM at the Extremes - Mechanical***

1834 *Investigating Alloying Effect on Dislocation Mechanisms with In Situ and Multi-dimensional Characterizations*; Q Yu

1838 *Atomic-scale Analysis of Mechanical Response of SrTiO<sub>3</sub> by MEMS-based in Situ STEM Mechanical Testing*; E Tochigi, T Sato, N Shibata, H Fujita and Y Ikuhara

1842 *In Situ TEM Investigation of the Electroplasticity Phenomenon in Ti-6Al*; X Li, S Zhao, J Turner, K Bustillo, R Dhall and A Minor

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- 1854 *Extract High Resolution 3D Quantitative Elemental Map Using a Combined HAADF-STEM and EDS Tomography*; Y Yuan, N Brodusch, F Voisard, B Nijikovsky, A Moores and R Gauvin
- 1856 *3D Visualization of Nanoscale Tomography Using Holographic Displays*; J Pietryga and R Hovden
- 1860 *Achieving High-resolution of Large Specimens Using Aberration-corrected Tomography*; R Yalisove, SH Sung, J Schwartz, C Groschner, P Pelz, H Zheng, Y Jiang, C Ophus, M Scott, P Ercius and R Hovden

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- 1872 *In-situ and In-operando Cobalt Oxidation Studied by Atom Probe Tomography*; S Lambeets, M Wirth, G Orren, N Kruse and D Perea

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- 1874 *Quantagenetics® and Machine Learning: A New Paradigm in Material Identification*; N McMillan and C McManus
- 1876 *Including the Oxidation State of Iron to Improve Matrix Corrections in EPMA Analyses*; E Bullock, A Locock, A von der Handt, J Fournelle, M Dungan and J Donovan
- 1878 *Machine Learning on STEM-EDS Data for Quantifying Overlapping Deep-Mantle Rock Assemblages*; H Chen, F Nabiei, J Badro, DTL Alexander and C Hébert
- 1882 *New EPMA-XRF Integration Allows Rapid Trace Element Analysis of Geological Materials*; R Wakimoto, T Yokoyama, K Tsukamoto, K Kato and V Robertson
- 1884 *Quantification of Bastnaesite and Hydroxylbastnaesite Using Electron Probe Microanalysis and Cathodoluminescence*; H Lowers and G Swayze

### ***Technologists' Forum Roundtable: Commercial Technical Careers in Microscopy – No PhD? No Worries***

- 1888 *Microscopy Career and How It Defined My Choices*; C Henry
- 1890 *Career Path Under the Lens: From Technician to Technical Specialist*; KD Derr
- 1892 *Me, Microscopy and No PhD*; R Kerstin



## ***Biological Sciences Tutorial: CryoEM Sample Preparation: Problems and Potential Solutions***

1894 *What's Going On with My CryoEM/CryoFIB-SEM Sample, and How Might I Improve It?*; A Noble, C Potter and B Carragher

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- 1976 *npSCOPE: A New Instrument Combining SIMS Imaging, SE Imaging and Transmission Ion Microscopy for High Resolution In-situ Correlative Investigations*; O De Castro, A Bieseimer, E Serralta, N Klingner, G Hlawacek, P Gnauck, SD Pinto, F Lucas, C Bebeacua and T Wirtz

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- 1978 *LaserFIB – the New All-in-one Tool to Speed up Sample Preparation for APT*; T Volkenandt, FP Willard, S Mueller, M Kaestner and B Tordoff
- 1980 *Automation of In-trench TEM Lamella Workflow Increasing Throughput for Lift-out*; M Šikula, L Hladík, J Oboňa and R Váňa
- 1982 *Advances in Large-area Sample Preparation Using Broad Argon Ion Beam Milling for Multiphase Materials*; P Nowakowski, M Ray and P Fischione
- 1986 *Towards the Nanoscale-ultrathin Metal Coatings as a Solution for Imaging of Fine-scale Structures*; A Walkiewicz
- 1988 *PhysicalBrickDatum: A Deep Physical Model for N-Dimensional Microscopy Data*; M Kundmann
- 1990 *A Path to EUV Photoresist Reference Metrology Using Restricted Tilt Electron Tomography*; A Barnum, M Biedrzycki and A Moussa

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- 1992 *In Situ Structural Analysis of Bacterial Nanomachines by Combining Cryo-FIB Milling, Cryo-ET and Sub-tomogram Analysis*; Y Chang and J Liu
- 1994 *Whole-cell Cryo-ET Structural Studies of Respiratory Syncytial Virus*; B Sibert, J Yang, J Kim, J Dickson and E Wright
- 1998 *Correlative Cryo-electron Tomography to Study Native Protein Organization and Membrane Architecture in Cells*; P Hoffmann

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- 2000 *The Host Cell Recognition and Penetration Apparatus of Staphylococcal Bacteriophages*; J Kizziah, K Manning, A Dearborn and T Dokland
- 2002 *Focus on Nematodes: Microscopic Roundworms*; G Bauchan, J Mowery, R Ochoa, E Palevsky and L Carta

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- 2010 *The Application of Cryogenic TEM for Studying Protein–Metal–Organic Frameworks*; J Patterson
- 2014 *Soft Microscopy: Multimodal, Correlative and Dynamic Characterization of Soft and Hybrid Structures*; V Dravid
- 2016 *Microscopy-Based Approaches to Characterizing Analogs of Classical Electrons in Colloidal Crystals Engineered with DNA*; J Du, S Wang, V Dravid and C Mirkin

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- 2020 *Correlative Measurement of Color Centres in Nanodiamond Using Optical and Advanced Electron Microscopy and Spectroscopy*; S Chang, H Wen and C Dwyer
- 2022 *Time-resolved Cathodoluminescence in a Transmission Electron Microscope Applied to NV Centers in Diamond*; S Meuret, Y Auad, L Tizei, HC Chang, F Houdellier, M Kociak and A Arbouet
- 2024 *New Diamond Structures Observed by Aberration-corrected TEM*; J Wen, D Luo, L Yang and H Xie

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- 2028 *Low Temperature Electron Microscopy and Manipulation of Electronic Order*; I El Baggari, D Baek, M Zachman and L Kourkoutis
- 2032 *Investigation of Solid-state Transformations Under Extreme Thermal Transients Using In-situ TEM Heating Experiments*; S Vijayan, M Shao, R Wang, Z Kong and J Jinschek
- 2034 *Atomic Scale Tracking of a Charge Order Transition with Continuously Variable Temperature Cryo-STEM*; N Schnitzer, E Bianco, A Admasu, J Kim, S-W Cheong, I El Baggari and L Kourkoutis

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- 2036 *In Situ Atomic-scale Observation of Thermal-induced Detwinning in Face-centered Cubic Metals*; F Cao, M Xu, F Ye, TM Kaufman and X Pan

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- 2038 *Visualizing Chemical Processes in Semiconductors with In Situ TEM*; U Mirsaidov
- 2040 *Probing Composition Distribution in Nanoalloy Catalysts with Correlative Electron Microscopy*; S Liu, I Gow, T Davies, A Barnes, M Sankar, X Gong, A Howe, M Dixon, G Hutchings, K Chris and Q He
- 2044 *Self-assembly of Periodical < C >-screw Dislocation Array in Hot-compressed Pure Magnesium*; Y Liu, M Lin and G-z Zhu
- 2046 *Operando Imaging of Ion Migration in Metal Halide Perovskites*; Y Liu, A Ievlev, L Collins, N Borodinov, S Kalinin and O Ovchinnikova

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- 2050 *Putting Planetary Materials into the Gap: Insights into Planetary and Stellar Processes from in Situ Measurements in the TEM*; T Zega
- 2052 *TEM Structural and Compositional Studies of Presolar SiC Grains and Their Relation to Raman Spectra*; S Singerling, N Liu, L Nittler, C Alexander and R Stroud
- 2056 *A Sintered and Sulfidized Equilibrated Aggregate from an Interplanetary Dust Particle*; Z Gainsforth, A Westphal and C Jilly-Rehak
- 2060 *3D Microstructural and Microanalytical Analyses of Wark-Lovering Rims in the Allende Meteorite*; J Weber, T Ramprasad, K Domanik, Y-J Chang and T Zega
- 2062 *Fast, Computer-Assisted Detection of  $\mu\text{m}$ -Scale Dust Impact Craters on Spacecraft Materials*; B De Gregorio, R Stroud, J Opsahl-Ong, T Brintlinger and A Westphal

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- 2066 *Pulsed-Laser-Driven TEM for Studying Temporal Aspects of Beam Damage*; D Flannigan and E VandenBussche
- 2068 *Sputtering During Microanalysis in the Analytical Electron Microscope*; N Zaluzec
- 2072 *Soft X-ray Scanning Transmission Microscopy Studies of Radiation Damage by Electron, Ion and X-ray Beams*; A Hitchcock, H Yuan, L Melo and N Basim

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2076 *An Atom-probe Tomographic Study of Kinetic Pathways of Retention Excesses and Depletions at Gamma (F.C.C.)/gamma-prime (L1<sub>2</sub>) Interfaces in a Ni-Al-Cr-Re Superalloy*; S-I Baik and D Seidman

2078 *Exploration of Novel Ordering Mechanism in Titanium Alloys Using Atom Probe Tomography and Aberration-corrected Scanning Transmission Electron Microscopy*; Y Zheng, S Antonov and H Fraser

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2518 *Cryo-electron Tomography Workflows for Quantitative Analysis of Actin Networks Involved in Cell Migration*; F Fäßler, G Dimchev, V-V Hodirna, B Zens, C Möhl, F Bradke and F Schur

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2520 *Snapshots of Endotoxin Extraction from the Gram-negative Inner Membrane*; B Orlando, Y Li and M Liao

2522 *Deletion of the ntrYX Two Component System in Rhodobacter sphaeroides Causes the Generation of Diverse Extracellular Membrane Structures*; D Parrell, K Lemmer, T Donohue and E Wright

2524 *Three-dimensional Architecture of the Microsporidian Spore and Rapid Firing Kinetics of the Harpoon-like Invasion Machinery*; P Jaroenlak, M Cammer, A Davydov, J Sall, M Usmani, JJ Becnel, F(A) Liang, D Ekiert and G Bhabha

2528 *Structure and Immune Recognition of the Porcine Epidemic Diarrhea Virus Spike Protein*; R Kirchdoerfer

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2532 *Nucleoid Remodeling During Environmental Adaptation as Seen Through Soft X-ray Tomography*; M Hammel

2534 *Bridging the Microalga Mesoscale: High-throughput Systems Biology and Bioimaging for Guided Biodesign of Microalgae*; C Smallwood, J-H Chen, J Evans and G McDermott

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2538 *In Situ, Operando Lithium K-edge Energy-loss Spectroscopy of Battery Materials*; W Zhang, S Yao and F Wang

2542 *Hidden Subsurface Reconstruction and Its Atomic Origins in Layered Oxide Cathodes*; L Li, E Self, D Darbar, L Zou, I Bhattacharya, D Wang, J Nanda and C Wang

2546 *Charge Ordering in Manganite and Ferrite Systems*; S Cheng, S Deng, C Xu, J Tao and Y Zhu

2550 *Probing the Cation Distribution in Gamma-alumina Enabled by O-K Edge Artifact Suppression Using Cryo-EELS*; H Ayoola, C-H Li, S House, J Kas, J Rehr, J Jinschek, W Saidi, J Yang and C Bonifacio

2554 *In-situ Electron Microscopy to Inform Superior Magnetic Nanocomposites*; J Watt, T Dreier and D Huber

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2556 *Accurately Imaging, Tracking and Moving Single Atoms*; A Lupini, B Hudak, S Jesse, J Song, O Dyck, P Snijders and S Kalinin

2558 *Controlled Functionalisation of 2-D Materials for Quantum Device Development: Assessment of Single Atom Behaviour via Atomic Resolution Electron Microscopy and Spectroscopy*; U Bangert, M Hennessy, E O'Connell, E Courtney, E Moynihan, A Harvey, Q Ramasse, D Kepaptsoglou, H Hofsaess, M Auge, S Rost and B Kardynal

2560 *Uncovering the Mechanism for Electron-beam Manipulation of Dopants in Silicon*; A Markevich, B Hudak, A Lupini and T Susi

2562 *Mapping Dopant Defect Complexes at the Nano and Atomic Scale for Quantum Computing*; M Hauwiller, A Kumar and J LeBeau

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2568 *Establishing Flask-Relevant Reaction Conditions for Imaging Bimetallic Nanocrystal Formation with Liquid Phase Transmission Electron Microscopy*; M Wang and T Woehl

2572 *Quantifying the Effects of Beam Overlap on Radiation Damage via Radiolysis Products in the In-situ Liquid (S)TEM Cell*; J Lee, D Nicholls, N Browning and B. Layla Mehdi



2576 *Nucleation and Growth Visualization of Self-Assembled Polymeric Micelles/Vesicles Using in Situ Liquid Cell-TEM*; V Jabbari, DJ Banner, AH Phakatkar and R Shahbazian-Yassar

2580 *In Situ Growth of Metal Nanoparticles on Two-dimensional Materials Under Electrochemical Conditions*; SF Tan, K Reidy, H Lee and F Ross

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2584 *Nanometer-scale Analysis of Space-weathered Lunar Regolith by Atom Probe Tomography*; J Lewis, D Isheim, B Jolliff, D Seidman, R Ogliore and J Gillis-Davis

2588 *Investigating the Role of Sulfides in the Space Weathering of Carbonaceous Chondrites*; L Chaves, M Thompson and M Loeffler

2592 *Characterization of Glass Alterations in Ancient Glass from Various Environments from Broborg, a Vitrified Swedish Hillfort*; B Matthews, B Arey, C Pearce and A Kruger

2594 *Coordinated Analysis of Mercury Analog Samples Subjected to Simulated Space Weathering*; M Thompson, M McGlaun, KV Kaaden, M Loeffler and F McCubbin

2598 *Investigating Space Weathering Effects Using Coordinated Analysis of a  $H^+$ - and  $He^+$ -Irradiated Carbonaceous Chondrite*; D Laczniak, M Thompson, C Dukes, R Morris, S Clemett, L Keller and R Christoffersen

2602 *STEM of Three Itokawa Grains: Space Weathering and Presence of Cubanite*; K Burgess and R Stroud

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2606 *3D Atomic Scale Quantification of Nanostructures and their Dynamics Using Model-based STEM*; S Van Aert, A De Backer, A De wael, J Fatermans, T Friedrich, I Lobato, C O'Leary, A Varambhia, T Altantzis, L Jones, A den Dekker, P Nellist and S Bals

2610 *Elements of a Purpose Built Electron Cryomicroscope for Single-particle CryoEM*; C Russo and R Henderson

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2616 *Increased LEAP Utilization Through Automation of Multi-specimen Alignment and Acquisition*; D Reinhard, T Payne, E Strennen, B Geiser, G Groth and D Lenz

2618 *Project Tomo: Toward Atomic-scale Analytical Tomography*; T Kelly, R Dunin-Borkowski and J Meyer



2622 *A System for Electrostatic Reconstructions*; B Geiser, J Bunton, I Martin, D Reinhard, D Lenz, T Prosa and D Larson

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2628 *Magnetic Near Field Imaging with Electron Energy Loss Spectroscopy Based on Babinet's Principle*; M Horák, V Křápek, M Hrtoň, A Konečná, F Ligmajer, M Stöger-Pollach and T Šikola

2632 *A Slot Aperture Enabled High Efficient and Accurate EMCD from a Single Acquisition of Momentum Resolved EELS*; Y Li, M Wu, R Shi and P Gao

2634 *Test and Characterization of a New Post-column Imaging Energy Filter*; H Müller, M Linck, R Schillinger, A Leibscher, I Massmann, V Gerheim and S Uhlemann

2636 *Very Low Energy Electron Transmission Spectroscopy of 2D Materials*; I Konvalina, B Daniel, M Zouhar, A Paták, J Piňos, T Radlička, L Frank, I Müllerová and E Materna-Mikmeková

2640 *Atomic Resolution Vibrational EELS Acquired from an Annular Aperture*; R Shi, Y Li, Q Luo and P Gao

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2648 *Graphite Oxide Preparation Following a Mechanochemical Green Route and Spontaneous Air Oxidation*; G Tarango-Rivero, JM Mendoza-Duarte, CG Garay-Reyes, I Estrada and R Martínez-Sánchez

2650 *Plasmonic Properties of Silver Amalgam Nanoparticles Studied by Analytical Transmission Electron Microscopy*; M Horák, F Ligmajer, T Šikola, M Fojta and A Daňhel

2654 *Surface Characterization of Nano-sized Star Block Copolymers for Antifouling Coatings on Water Purification Membranes*; J-Y Cho, MA Islama, K Azyat, Y-H La, M Sadrzadeh and A Myles

- 2658 *Advances in Optical Microscopy Austenitic Characterization by Combination of Different Chemical Etchings*; V Mercado, R Perez, B Ramiro-Rodriguez, JC Díaz-Guillén, H Arcos-Gutierrez, J Mayen, JA Betancourt-Cantera, A Gallegos-Melgar, M Hernandez-Hernandez and I Garduño-Olvera
- 2662 *Effect of Preheating Temperature and Cooling Rate on the Microstructure Development of Welded Pearlitic Rail Steel*; H Aglan and T Rahman
- 2664 *Morphological and Compositional Characterization of Electrochemically Active Perovskite Oxides for Sensing Biological Molecules*; T Hatchell, K Hutchenson, G George, Z Luo and S Han
- 2666 *Effect of Salt Fog Spray and Ultraviolet Exposure on the Fracture Surface Morphology of Fiber Reinforced Polymer Composites*; M Al Ahsan, T Rahman, A Ludwick and H Aglan
- 2670 *Wear Properties of TiN Coating on AISI M2*; M Ortiz-Domínguez, O Gómez-Vargas, J Solis-Romero, I Morgado-González, A Arenas-Flores and J Zuno-Silva
- 2674 *Reduced Magneli Layers on Anatase TiO<sub>2</sub> Nanocrystals Surface Revealed by HAADF STEM Imaging*; S Bakardjieva, R Klie, VY Zenou, M Klementová and S Adamec
- 2678 *SEM Study of Oxidative Stage of the Electro-Fenton Process in the Treatment of Effluents from Pulp and Paper Plants*; CM Junior, N dos Santos, J Spadotto, G Solórzano and LA Teixeira
- 2682 *Treatment and Observation of Advanced Carbon-based Nanomaterials by Slow Electrons*; EM Mikmekova, I Konvalina, I Mullerova, M Lejeune and T Asefa
- 2686 *Analysis of Li Ion Battery Anodes Using In-situ FIB-ToF-SIMS*; V Smentkowski, R Hart, H Cao, F Kollmer, J Zakel and H Arlinghaus
- 2690 *Epoxy Resin Removal Technique in Cross-section Cuts for SEM*; G Gonzalez-Mancera
- 2692 *Sectioning of Cultured Cells by Ar Ion Beam Milling for SEM Observations*; S Tanaka and Y Ohmi
- 2694 *Correlated Post-mortem Raman and TEM Investigation of Nanoindentation Induced Structural Changes in Silicon as a Function of Temperature*; P Manimunda, E Hintsala, D Stauffer and SAS Asif
- 2698 *Improved Microanalysis Using Cathodoluminescence Spectrum Imaging with Higher Spatial Sampling*; D Stowe, J Lee, M Bertilson, S Fahey and J Hunt

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- 2704 *Plasma Cleaning with Alternate Gases*; R Vane, E Kosmowska and M Cable
- 2708 *Tungsten Probe Tip Cleaning*; J Saujauddin, T Niemi, T Lundquist, B Niu and M Cable

- 2710 *Fixturing Options for Atom Probe Tomography*; K Rice, Y Chen, R Ulfig and T Onishi
- 2712 *Novel Workflow for Improved Throughput, Turnaround Time, and Cross Section Preparation of Microelectronic Devices*; W Podrazky, J Clarke, T Sunaoshi, A Morikawa, C Nomaguchi and A Muto
- 2714 *Development of Dark-Field Photonic Scanning Transmission Electron Microscopy (DFP-STEM)*; A Muto, Y Dan and K Hosoya
- 2718 *High Speed SEM Elemental Mapping with Micro-XRF-EDS*; A Menzies, S Boehm and J Mastovich
- 2722 *High-resolution Nano-imaging with Transmission Nanofocus X-ray Source*; A Adibhatla, T Tuohimaa and F Yang
- 2724 *"Integrated EPMA" with New Multifunction Technology*; K Kato, K Tsukamoto, N Mori, R Wakimoto and S Kamijo
- 2726 *Automation of TEM Optical Alignments*; J Jiša and O Svoboda
- 2728 *Extreme In Situ Mechanics of Bond Coatings and Ni-based Superalloys Using an Advanced SEM Nanomechanical Instrument*; S Bhowmick and E Hintsala

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- 2730 *3D Visualization of Neurites in Mouse Primary Hippocampal Neuron Cultures Using Cryo-Electron Tomography*; Y Yu, B Yadav-Samudrala, R Meeker, S Fitting and L Kourkoutis
- 2732 *Automated Cryo-plunging Robot to Prepare Samples for Single Particle Analysis (SPA), Cryo-EM, Cryo-ET, Cryo-fluorescence and Cryo-CLEM*; A Kamp, M van Nugteren, H Vader, M Schwertner, D Stacey, R Koning and B Koster
- 2734 *In Situ Investigations of the Bacterial Type II Secretion System*; Z Yu, T Huo, M Chen, X Shi, S Ludtke and Z Wang
- 2736 *Comparing EM Approaches for Studying Filoviral Glycoproteins*; AP Herrera, N Nguyen, T White and D Burke

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- 2744 *Structure of the Shigella flexneri Podophage HRP29*; S Subramanian and K Parent
- 2746 *Analysis of Mineralized Matrices in Calcium Bodies with and without Bacteria in Two Species of Terrestrial Crustaceans*; M Vittori, V Srot, B Bussmann, F Predel, P van Aken and J Štrus

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- 2752 *Simultaneous Optical Photothermal Infrared (O-PTIR) and Raman Spectroscopy of Submicrometer Atmospheric Particles*; N Olson, Y Xiao, Z Lei and A Ault
- 2754 *Multimodal Characterization of the Oleophilic Hydrophobic Magnetic (OHM) Sponge: A Nanocomposite Material for Oil Spill Remediation*; S Ribet, V Nandwana, R dos Reis, T Abbott, E Roth and V Dravid
- 2758 *Synthesis and Characterization of Iron Oxide Nanoparticles with Enhanced Magnetization Using Pluronic F-127*; F Gutierrez, J Araujo, G Perez, J Gardener and G Solórzano
- 2762 *Synthesis and Characterization of Monodisperse Magnetic Nanoparticles by a Scanning Susceptometer*; J Araujo, F Gutierrez, E Yokoyama, G Perez and G Solórzano
- 2766 *Patchy Polymer Micelles and Hybrids: Self-Assembly, Characterization and Utilization in Catalysis*; J Schöbel, C Hils, M Drechsler, J Breu, A Greiner and H Schmalz
- 2768 *Developments in the Correlative Cryo Confocal Light Microscope (C3LM) at the Advanced Photon Source*; E Vacek, O Schmidt, S Bean, S Chen, Q Jin and C Jacobsen
- 2770 *Super-resolution Cryo-fluorescence Microscopy of High-pressure Frozen Thick Samples : A Screening Study of C. elegans*; K Narayan, I Chang, M Rahman, A Harned and O Cohen-Fix
- 2772 *Cell Stretcher Based on Single-crystal Bimorph Piezoelectric Actuators*; I Kubasov, A Kislyuk, A Turutin, A Shportenko, A Temirov, M Malinkovich and Y Parkhomenko
- 2774 *Mitochondria Can Trigger the Axodendritic Polarization of OSRN in Fish?*; S De and M Aich
- 2778 *Insights into the Mechanisms of Screw Feeder Plugging by Heated Pine Forestry Residues Using In-situ and Correlative Microscopy*; J Gruber, Y Zeng, S Rowland, D Carpenter and B Donohoe

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- 2782 *Imaging Sub-cellular 3D Structures Using Soft X-ray Microscopy*; J-H Chen, A Ekman, V Weinhardt, V Loconte, G Mc Dermott, MA Le Gros and C Larabell

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- 2784 *A New Cryo-FIB-TEM Approach for Damage-free Characterization of Garnet Electrolytes in Solid-state Batteries*; H Zheng, J Cui and K He

- 2786 *Resolving Nanoscale Heterogeneity in Battery Interphases with Cryo-EM*; W Huang, H Wang, D Boyle, Y Li and Y Cui
- 2790 *Characterization Technique for Advanced Materials for Lithium Batteries in an SEM*; H Demers, A Paoella and K Zaghib
- 2794 *Modulation of Single-Atom Metal Sites for Enhanced Ambient Ammonia Electrosynthesis*; L Han and H Xin
- 2798 *In Situ TEM Studies of Lithiation/de-lithiation in Chemically-complex Alloys*; M Tamadoni-Saray and R Shahbazian-Yassar
- 2802 *Structural and Electrochemical Characterizations of NiCo-S@GO composite as Supercapacitor Electrode*; J Yu, X Pang, X Gao, Z Cui, Q Zhang, L Sui and L Dong
- 2804 *Comparative Study of ZnO and CdS/ZnO Thin Films Deposited by Chemical Bath Deposition Technique as a Buffer Layer for Solar Cell Applications*; A Garcia and S Zarate
- 2806 *Scanning Electron Microscopy and Spectroscopy Characterization of Cobalt Ferrite Nanoparticles by a Facile Hydrothermal Synthesis Method*; J Vinh, X Liu, R Contreras, J Barnes, A Goforth and J Jiao
- 2810 *Cobalt Doping in Tantalum Nitride Thin Films Prepared by Sputtering*; S Macartney, L Sheppard and R Wuhler
- 2814 *Influence of Calcination Parameters over the Morphology and Formation of Co<sub>3</sub>O<sub>4</sub> Nanoparticles*; J Morales-Rodriguez, A Faudoa-Arzate, WM Chávez-Montes, M Sánchez-Carrillo, PR Realyvazquez-Guevara and C Arzate-Quintana
- 2818 *Shape Control of Fe<sub>3</sub>O<sub>4</sub> Nanoparticles*; G Perez, J Araujo, P Romero and G Solorzano

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- 2824 *Development of a Holographic Analytical Microscope for Quantum Materials Research*; D Bell, A Graham, J Rooney, L Cessna and Y Taniguchi
- 2828 *Mapping and Controlling Strain in Epitaxially Connected Quantum Dot Superlattices – a Path to Designer Quantum Materials*; M Smeaton, I El Baggari, D Balazs, T Hanrath and L Kourkoutis
- 2832 *New Single Photon Sources by Optoelectronic Tailoring of 2D Materials Using Low Energy Ion Implantation*; M Hennessy, E O'Connell, S Rost, M Auge, E Moynihan, M Bui, H Hofsaess, B Kardynal and U Bangert

2834 *Axial-Radial Heterostructures of Telluride Nanowire*; D Samantaray, A Kumar, P Ghosh, D Chatterjee, P Bellare and N Ravishankar

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2838 *Fraction Crystalline from Electron Powder Patterns of Unlayered Graphene in Solidified Carbon Rain*; P Fraundorf, M Lipp, T Hundley, C Silva and P Chrostoski

2842 *Scanning Electron Microscopy Analysis of High Purity Libyan Desert Sandstone Silica Sand*; NA Zreiba and RM Dweiby

2846 *Composition and Size Effects on the Phase of Mixed Organic/Inorganic Particles*; D Veghte, J Dawson and M Freedman

2850 *Seasonal Variation of Nanoparticles in the Ortles Glacier, Eastern Alps*; H Colijn, A Ellis, J Olesik and P Gabrielli

2852 *Effect of Salt Surfactant Interaction on Crystal Growth Observed Using Surface Enhanced Ellipsometric Contrast (SEEC) Imaging*; R Saini, M Haque and A Gizzatov

2854 *Efficiency and Cost Effectiveness Analysis of Water Repelling Penetrants on Aged Masonry Structures*; J Al-Sharab, R Abukhalaf, M Striegl, J Church, L Strauss, D Rye and D Forero-Salcedo

2858 *Automated Mineralogy and Quantitative Compositional Analysis of Geological Samples on a Multi-Functional Scanning Electron Microscope*; R Jones, M Hiscock, H Jiang and A Stavropoulou

2860 *Fracture Surface Morphology of Cracked Organic Matters in Kerogen-rich Source Rock Observed in Electron Microscope*; M Haque

2862 *Quantitative Image Analysis of Source Rocks Using Machine Learning Segmentation*; S Eichmann, P Srinivasan, S Zhang and J Howard

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2870 *Low Dose HRTEM of Interfacial Melting of Cubic Ice at Low Temperature*; J Wen, Y Lin, X-M Lin and A Lei

2874 *The Ultimate Detection Limit: Building Electron Diffraction Patterns One Electron at a Time*; C Kisielowski, P Specht, D Yancey, S Rozeveld, J Kang, A McKenna and D Barton



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- 2880 *Correcting Systematic Energy Deficits in the Laser-pulsed Atom Probe Mass Spectrum of SiO<sub>2</sub>*; B Caplins, P Blanchard, A Chiamonti, D Diercks, L Miaja-Avila and N Sanford
- 2882 *Study of Correlative Evaporation and Ion Dissociation in Atom Probe Data*; Y Chen, B Geiser, E Oltman, K Rice, R Ulfing and T Prosa
- 2884 *Analysis of 316L Stainless Steel Interaction with Galvanizing Alloy Bath*; A Khaliq, T Subhani and H Ali
- 2888 *Effect of Plastic Deformation on the Activation Energy for Precipitation of S' Phase in Al<sub>2024</sub> Alloy*; JC Guía-Tello, CG Garay-Reyes, HM Medrano-Prieto, MA Ruiz-Esparza-Rodriguez, MC Maldonado-Orozco, G Rodriguez-Cabriaes and R Martínez-Sánchez
- 2890 *Fabrication of Al<sub>2024</sub> Alloy by Core-shell Structured Ti/B<sub>4</sub>C Composite Particles*; E Cuadros-Lugo, C Carreño-Gallardo, E Ledezma-Sillas, C López-Meléndez and JM Herrera-Ramirez
- 2894 *Homogeneous Distribution of Alumina Nanoparticles in the 6061 Aluminum Alloy via Mechanical Alloying*; V Mercado, R Perez, JC Díaz-Guillén, M Alvarez-Vera, H Arcos-Gutierrez, J Mayen, AE Salas-Reyes, A Gallegos-Melgar, M Hernandez-Hernandez and J Acevedo
- 2898 *Effect of 4 Wt% Magnesium on The Micro-hardness Of Aluminum Alloy Synthesized by Mechanical Milling*; I Santos-Ramos, LB López-Sosa, J Zárate-Medina and G Rosas
- 2902 *Al-10Mg Nanostructured Alloy by High-energy Mechanical Alloying*; JJ Sánchez-Cuevas, J Zárate-Medina, O Navarro and G Rosas
- 2904 *Characterization of Ti-Ta-Sn Metallic Foams*; A Mejia, L Bejar, L Bejar-Vega, A Bejar, C Aguilar, C Parra and I Alfonso
- 2906 *Manufacturing, Mechanical and Electrochemical Characterization of Zr-Based Amorphous Ribbons*; A Escamilla, J Verduzco and I Figueroa
- 2910 *Comparative Analysis of Hardness Performance of a 7075 Aluminum Alloy Having Carbon Fiber and Carbon Nanotubes*; R Pérez-Bustamante, F Pérez-Bustamante, F Avalos-Belmontes, J Ramos-Cano, H Arcos-Gutierrez, LA Caceres-Diaz, JE Garcia-Herrera and R Martínez-Sánchez
- 2914 *Influence of HIP Sintering and Ce/La Additions on the Microstructure and Hardness on Inconel 718 Nickel-based Superalloy*; HM Medrano-Prieto, CG Garay-Reyes, MA Ruiz-Esparza-Rodriguez, I Estrada, JC Guía-Tello, Q Estrada, JM Silva-Aceves, JS Castro-Carmona, H Camacho-Montes and R Martínez-Sánchez
- 2916 *Conventional and Electromagnetic-induction Sintering of High Entropy Alloys for Low-temperature Applications*; LL Zubia, CG Garay-Reyes, MA Ruiz-Esparza-Rodriguez, JM Mendoza-Duarte, I Estrada, PA Guerrero-Seañez, MA Rascón-Sánchez, JP Flores-De-los-Ríos, R Martínez-Sánchez and MA Castro-Reyes

- 2918 *Metastable fcc Structure of Ti-Mg Alloy Synthesized by Mechanical Alloying*; A Tejada-Ochoa, C Carreño-Gallardo, N Kametani, S Yotsumoto, N Adachi, Y Todaka and JM Herrera-Ramirez
- 2922 *Strengthening of an Al 7075 Alloy with Graphene Synthesized by an Environmental Friendly Method*; E Cuadros-Lugo, C Carreño-Gallardo, JM Herrera-Ramirez, C López-Meléndez and D Lardizabal-Gutierrez
- 2926 *Study of the DO<sub>3</sub> Superlattice Structure of The Fe<sub>74.3</sub>Si<sub>14.2</sub>Cu<sub>1</sub>Nb<sub>3</sub>B<sub>7.5</sub> Alloy*; G Perez, L Benyosef and G Solorzano
- 2928 *Microstructural Behavior of the Intermetallic Compound CaMgSi Synthesized by Mechanical Milling and Spark Plasma Sintering*; JLA Ponce-Ruiz, S Ishizuka, N Adachi, Y Yamada, Y Todaka, JE Ledezma-Sillas and JM Herrera-Ramirez
- 2932 *Aluminium Matrix Composites (AA6061/CaSiO<sub>3</sub>) Obtained by Powder Metallurgy*; DC Valenzuela, OH Negrete, MAE Romero, GT Munive, AV Soto, JHC López, FB Bojórquez, HE Ponce, JH Paredes
- 2934 *Wear Behavior of Graphene-Platelet/Al7075 Composites Produced by Mechanical Alloying*; R Pérez-Bustamante, F Pérez-Bustamante, J Ramos-Cano, G Rosales-Sosa, H Arcos-Gutierrez, I Garduño-Olvera and R Martínez-Sánchez
- 2938 *High-entropy Alloys Fabricated Through Powder Metallurgy for Low-temperature Applications*; LL Zubia, CG Garay-Reyes, MA Rascón-Sánchez, I Estrada, JP Flores-De-los-Ríos, R Martínez-Sánchez, A Caro-Duran, MC Maldonado-Orozco, PA Guerrero-Seáñez and MA Ruiz-Esparza-Rodriguez
- 2940 *The Effect of Beam Scan Strategies on the Microstructure of EBM Additively Manufactured Inconel 738*; C Blackwell, M Shao, S Vijayan, S Kumar, S Babu and J Jinschek
- 2942 *Multi-Material Binder Jet Printing of Functional Ni-Mn-Ga Alloys*; E Stevens, K Kimes, J Martin and M Chmielus

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- 2946 *Streamlining Processing and Utilization of EM Data - An Efficient Open-source Solution*; C Koch, D Weber, A Clausen, A Mittelberger, S Shabih, J Müller, B Haas, A Eljarrat, J Weinrich and C Meyer
- 2950 *NexusLIMS: Leveraging Shared Microscopy Resources for Data Analysis with a Configurable Laboratory Information Management System*; J Taillon, R Plante, M Newrock, J Lau and G Greene
- 2954 *A Python Based Open-source Multislice Simulation Package for Transmission Electron Microscopy*; H Brown, P Pelz, C Ophus and J Ciston
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