

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 2022

Printed in the United States of America

This publication constitutes Supplement 1 to Volume 28, 2022 of *Microscopy and Microanalysis*.

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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 2022 Proceedings
Portland, OR • July 31–August 4, 2022



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- 838 *In-situ TEM and Spectroscopy Studies of Nanoscale Perpendicular Magnetic Tunnel Junction*; H Yun, D Lyu, Y Lv, BR Zink, P Khanal, B Zhou, W Wang, J-P Wang and KA Mkhoyan
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- 850 *Development of Operando X-ray Ptychography at the Advanced Light Source*; D Shapiro, R Celestre and Y-S Yu

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- 854 *High Angle Liquid Cell TEM Tomography for In Situ Observation and 3D Reconstruction in Liquid*; PP Das, J Cookman, AG Perez, S Plana-Ruiz, M López-Haro, JJ Calvino, JG Casablanca, E Grivas, GSE Antipas, NA Ntallis and S Nicolopoulos

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- 862 *Merging Machine Learning and TriBeam Tomography for 3D Defect Detection in an AM CoNi-Based Superalloy*; J Lamb, M Echlin, A Polonsky, R Geurts, K Pusch, E Raeker, A Botman, C Torbet and T Pollock
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- 866 *A Multiscale, Correlative, Air Free Workflow for the Analysis of Li Distribution in Batteries via ToF-SIMS*; ST Kelly, R White, B Tordoff, S Schaedler, T Vorauer, B Fuchsbichler, S Koller and R Brunner
- 868 *Application of a Correlative fs-Laser Workflow for Fast and Easy Feature Access in Failure Analysis of Recycled Automotive Body Parts*; T Schubert, T Bernthaler, T Wulff, B Tordoff and G Schneider
- 872 *Observations of Damage, Defects, and Structuring in Femtosecond Laser Ablated Surfaces*; MP Echlin, AT Polonsky, WC Lenthe, MS Titus, R Geurts, A Botman, M Straw, P Gumbsch and TM Pollock
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- 876 *Single Image Composite Tomography Utilizing Large Scale Femtosecond Laser Cross-sectioning and Scanning Electron Microscopy*; N May, A Phoulady, H Choi, P Tavousi and S Shahbazmohamadi
- 880 *Probing Material Dynamics with an SEM at Nanometer Length and Picosecond Time-scales*; V Iyer and BJ Lawrie
- 882 *The Preparation of Large Area Transmission Kikuchi Diffraction Samples From Bulk Material Without Requiring Lift Out*; P Trimby, K Larsen, M Hjelmstad and A Gholinia

- 884 *Opportunities and Challenges of Ultra Short Pulsed Lasers with Dual Focused Ion Beams for Characterization of Full-Scale Electronic Devices*; JI Deitz, DL Perry, AT Polonsky, TJ Ruggles, H Jungjohann, KL Harrison, JD McBrayer and JR Michael
- 888 *A Multislice Approach to Quantify Laser-Induced Lattice Temperature from Ultrafast Electron Diffraction Measurements of Single-Crystal Films*; DB Durham, KM Siddiqui, C Ophus, AM Minor and D Filippetto
- 892 *Fast Fabrication of Micropillars for Micromechanical Testing Using a Combined fs-Laser – FIB/SEM Approach*; T Schubert, F Zhou, R Pero, N Randall, T Bernthaler and G Schneider

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- 906 *Electron Microscopy and Electrochemical Studies of WO₃ Thin Films Deposited by Pneumatic Spray Pyrolysis*; J Ortiz, D Acosta and C Magaña
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- 912 *Elucidation of 3D Chemical and Physical Architecture of Soil Microstructures by Correlating Spectro-Microscopic Techniques and Developing Novel Computational Methods*; AD Ost, T Wu, T Wirtz, C Höschen, CW Mueller and J-N Audinot
- 914 *Identification and Particle Size Determination of ²³⁸Pu-bearing Particles via Alpha Spectrometry, Autoradiography and Scanning Electron Microscopy*; K Wurth, B Naes, T Tenner, L Hudston, Z Macsik, M Harris, R Steiner and S LaMont
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- 920 *Investigation of Exfoliated Graphene Flakes and Their Self-Assembly Capabilities to Form Thin Coating Films*; K Hood, S Ahmed, R Schmidt, W Qian and J Jiao
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- 932 *nano-FTIR Correlation Nanoscopy for Organic and Inorganic Material Analysis*; T Gokus, A Danilov and A Govyadinov
- 934 *Predicting Prostate Cancer Directly from Tissue Images using Deep Learning on Mass Spectrometry Imaging and Whole Slide Imaging Data*; MIU Haque, D Mukherjee, SA Stopka, NYR Agar, J Hinkle and OS Ovchinnikova
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- 964 *Mapping Surface Corrosion Damages of C1018 Carbon Steel When Exposed to High Temperature Environment*; MH Haque, RK Saini, K Muhammadi and A Bukhamseen
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- 976 *Quantitative Piezoresponse Force Microscopy Informed by Cantilever Vibrations*; JP Killgore
- 978 *XPS Surface analysis augmented using correlative spectroscopy and microscopy*; TS Nunney, P Mack, H Oppong-Mensah, M Baker and J England
- 980 *Structural Analysis of Liquid-Exfoliated Graphene as Building-Blocks for Anti-Corrosion thin films*; W Qian, R Schmidt, JA Turner, K Hood and J Jiao

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- 986 *Influence of Sterilization on the Surface of Nanoparticles Studied with XPS / HAXPES in Comparison to SEM / EDS*; X Knigge, Z Guo, E Valsami-Jones, V-D Hodoroba and J Radnik
- 990 *Latest applications of ToF-SIMS characterization for next-generation electronic materials*; T Terlier, Q Ai, S Sidhik, A Mohite, Y Yao, M Tang and J Lou
- 992 *Mass Spectrometry Imaging of Organic Biomarkers in Geological Samples*; MJ Pasterski, RC Wickramasinghe, AV Ievlev, M Lorenz, JM Gross, F Kenig and L Hanley
- 996 *Multimodal Imaging of the Evolving Interface of Irradiated Aluminide-coated Stainless-steel Cladding*; X-Y Yu, B Matthews, S Riechers, SR Spurgeon, Z Zhu, G Sevigny and W Luscher
- 998 *Probing Structure-Property Relations in Garnet-Type Solid Electrolytes for Next-Generation Electrical Energy Storage with Multimode Analytical Scanning and Transmission Electron Microscopy*; VP Oleshko, AP Kafle, W Wong-Ng, JA Kaduk, B Dutta, I Pegg and GR Stafford
- 1002 *Tribological Study and Surface Characterization of a Boron Coating Applied to an AISI L6 Steel Used in the Agricultural Area*; DS Huerta, EDG Bustos, IH Cruz, MF Martinez, DVM Maximo, MF Baez and SM Saunders

- 1006 *Analysis of Industrial Graphene-Based Flakes – First Results on Morphological Characterization, Sample Preparation and Chemical Composition*; G Chemello, J Radnik and V-D Hodoroaba
- 1010 *Analysis of surface on machinery grade steel Boriding*; YRN Murguia, VJC Suarez, CRTS Miguel, LM Máximo, ME Espinosa, JAJ Loran, MA Doñu-Ruiz and NL Perrusquia
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- 1016 *Effect of entropy on microstructure of $Al_x(CoCrMnMo)_{100-x}$ ($x=15, 30, 45, 60$) high-entropy and medium-entropy alloys produced by mechanical alloying*; GD Avila-Rubio, MA Avila-Rubio, IA Figueroa-Vargas and FJ Baldenebro-López
- 1018 *Effects of Processing Conditions on Powder Particle Size and Morphology in the Mechanical Milled H13 Alloy*; VH Mercado-Lemus, JA Betancourt-Cantera, JE García-Herrera, R Pérez-Bustamante, J Mayen, A Gallegos-Melgar, M Hernandez-Hernandez, L-A Caceres-Díaz and DG Espinoza-Arbeláez
- 1020 *Evaluation of Microstructural Changes in Parenchymal Tissues of Potato During its Convective Drying by Confocal Scanning Laser Microscopy (CLSM)*; SMG Martínez, RA Garay, SD Gallegos-Cerda, JD Hernández-Varela, BA Tamayo and JJ Chanona-Pérez
- 1024 *High-Resolution Atomic Force Microscopy Study of Protein Surface Conformations*; EV Dubrovin, NA Barinov, TE Schäffer and DV Klinov
- 1026 *Improvement in Optical Characterization on Ultra-Low Carbon Steels*; JS Sánchez-Gonzalez, VH Mercado-Lemus, H Arcos-Gutierrez, I Garduño-Olvera, M Hernandez-Hernandez, AE Salas-Reyes, G Altamirano-Guerrero, J Mayen-Chaires, A Gallegos-Melgar, J Edison-Garcia, Rúl Pérez-Bustamante, JA Betancourt-Cantera, L-A Cáceres-Díaz and JC Díaz-Guillen
- 1028 *Microstructure and Mechanical Properties of Borided ASTM A709 Steel by Powder-pack Boriding*; O Gómez-Vargas, J Solís-Romero, CI Carranza-Vargas, SI Martínez-Islas, AM Uribe-Miguel, A Marcelo-Sandra, A Cruz-Avilés, ÁJ Morales-Robles and M Ortiz-Domínguez
- 1034 *Stability Range of Ti-Zr Alloy for Dental Implants*; N Florido-Suarez, I Hulka, J Mirza-Rosca and A Saceleanu
- 1040 *Surface Characterization on Agriculture Steel Boriding*; GJP Mendoza, EDG Bustos, T de la Mora Ramírez, DS Huitron, AJ Loran, NL Perrusquia and MAD Ruiz
- 1044 *TTiN Coating and Fe_2B Layer Obtained by PVD and Powder-pack Boriding Treatments Formed on ASTM A1011 Steel*; LD Fernández-De Dios, A Cruz-Avilés, J Solís-Romero, M de la Luz Moreno-González, G Moreno-González, O Gómez-Vargas, ÁJ Morales-Robles, DM Trápala-Rosalio and M Ortiz-Domínguez

- 1048 *Visualization and Comparison of Cellulose Microfibers Images from Cellulose Derivatives Aerogels in CLSM and PALM Using Conventional Dyes*; SD Gallegos-Cerda, JD Hernández-Varela, JJ Chanona-Pérez, CA Huerta-Aguilar and B Arredondo
- 1052 *Wear Response of A356-doped Ce for Potential Application in Vehicle Components*; I Estrada-Guel, R Martínez-Sánchez, AE Lui-Chavira, A Salas-Moreno, H Martínez-Lara, D Espejel-García, A Villalobos-Aragón and CD Gómez-Esparza

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- 1064 *Structural Characterization of High Entropy Alloy (FeCoCrNiMn) Synthesized by Mechanical Alloying*; CA Arroyo, LB Gómez, CA Ramírez and LD Lvova
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- 1074 *A Complete Micro-Electron Diffraction (MicroED) Solution for Fast Structure Determination for Macromolecules and Small Molecules*; N Young, A Kotecha, L Yu and F Grollios
- 1076 *Electron Counting and Phasing in MicroED*; J Hattne, MW Martynowycz, MTB Clabbers and T Gonen
- 1080 *Crystal Structure Determination of Gramicidin by Microcrystal Electron Diffraction*; N Hoefler and DW McComb
- 1084 *Applying the Semi-Automated MicroED Processing Pipeline, AutoMicroED*; SM Powell, IV Novikova, DN Kim and JE Evans
- 1086 *A Computer Program for Objective Point Symmetry Classifications of Electron Diffraction Spot Patterns with Apparent Hexagonal or Rectangular-Centered Lattice Metric*; L von Koch and P Moeck

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- 1092 *Mechanism of Signal Sequence Handover From NAC To SRP on Ribosomes During ER-protein Targeting*; A Jomaa, M Gamerding, H-H Hsieh, A Wallisch, V Chandrasekaran, Z Ulusoy, A Scaiola, RS Hegde, S-O Shan, N Ban and E Deuerling
- 1094 *Structural Studies of Dicer-2 Complexes*; H Donelick, B Bass and P Shen
- 1096 *Sleeping Beauty Redux – Resting Ribosomes in Neurons*; P Smith, E Petrossian, M Freeman, ZT Campbell and S Loerch
- 1098 *3D Reconstruction of Plant Leaf Cells Using TEM and FIB-SEM*; B Zechmann and G Zellnig
- 1100 *Cryo-EM Structural Studies of the Vibrio cholerae Flagellum*; V Pappas, L Zhang, JC Sanchez and ER Wright
- 1102 *High Resolution Cryo-EM Structure of Drosophila Thick Filaments*; FA Yeganeh, H Rastegarpouyani and KA Taylor
- 1104 *In-Situ TEM Studies on Nanoparticle Interactions with Bacterial Cells*; AH Phakatkar, P Ghildiyal, Y Wang, MR Zachariah, T Shokuhfar and R Shahbazian
- 1108 *Multi-Signal Characterization of Biological Structures at Low-Voltage Using STEM-in-SEM*; K Parker, A Singh and VP Dravid
- 1112 *Ultrastructure of the Gas Vesicle Protein Shell*; P Dutka, D Malounda, MG Shapiro and GJ Jensen
- 1114 *Integrative Structural Analysis of Human Nuclear Pore Complex*; S Mosalaganti, A Obarska-Kosinska, M Siggel, R Taniguchi, B Turoňová, CE Zimmerli, K Buczak, FH Schmidt, E Margiotta, M-T Mackmull, WJH Hagen, G Hummer, J Kosinski and M Beck
- 1116 *Cryo-ET Structural Studies of Ty1 Retrotranspon Capsids*; BS Sibert, A Hannon-Hatfield, DJ Garfinkel and ER Wright
- 1120 *Elucidating the 3D Structure of β -(1,3)-glucan Synthase from Candida glabrata by Subtomogram Averaging*; J Jiang, C Jiménez-Ortigosa, M Chen, KR Healey, J Kong, Y-K Lee, DP Farrell, F DiMaio, DS Perlin and W Dai
- 1124 *Investigating the Ultrastructural Effects of F-BAR Proteins on Neuritogenesis by CLEM and Cryo-ET*; JY Kim, LA English, T Tenpas, JE Yang, EW Dent and ER Wright
- 1128 *Visualizing the Macro- and Micronutrient Distribution of Toxic Cyanobacteria in Two and Three Dimensions*; BG Duersch, Y Luo, S Chen, SA Soini, DMR Somu and VM Merk
- 1132 *WITHDRAWN – Conformational Heterogeneity in ComK-DNA Complexes*; N Elad, G Rosenblum and H Hofmann

- 1134 *Cryo-EM Reveals New Species-specific Proteins and Symmetry Elements in the Legionella pneumophila Dot/Icm T4SS*; J Roberts, MJ Sheedlo, CL Durie, JM Chung, L Chang, M Swanson, DB Lacy and MD Ohi
- 1136 *CryoEM Structure of a Vascular KATP Channel in the Presence of Activating Mg-Nucleotides*; MW Sung and S-L Shyng
- 1138 *Glacios Enhancements for High Throughput, High Resolution Structure Determination Supporting Multiple Acquisition Methods without Performance Compromise*; A Yakushevksa, A Koh, A Kotecha and J Lengyel
- 1140 *Structural Analysis Helicobacter pylori VacA's Channel in Membrane*; SM Connolly, AL Erwin, M Sabb, G Caso, TL Cover and MD Ohi
- 1142 *Uncovering Tumor Suppressor P53 Dynamics Using Microprocessor Materials*; MJ Solares, GM Jonaid and DF Kelly
- 1146 *Free Energy Profiles from Single-molecule CryoEM*; P Cossio
- 1148 *Conformational Dynamics of the CCT Protein Folding Machine*; S Wang, M Sass, G Ludlam, T Smith, BM Willardson and PS Shen
- 1152 *Cryo-EM Studies of Genome Organisation and Transcription Complexes*; SM Vos
- 1154 *Molecular Structure Determination Extrapolated to Zero Dose with an Electron Cryomicroscope*; K Naydenova, J Short and CJ Russo

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- 1160 *Complex of Chaperonin GroEL- α -synuclein Resolved by Cryo-EM*; E Pichkur, N Fedorov, S Kudryavtseva, I Yaroshevich, O Sokolova, V Muronetz and T Stanishneva
- 1162 *Identification of the NTD in hFACT Complex by Electron Microscopy*; O Volokh, AL Sivkina, A Moiseenko, VM Studitsky and OS Sokolova
- 1166 *Structure Of The Head-tail Interface Part Of Myoviridae Bacteriophage TaPaz Revealed by Cryo-EM*; Y Wang, A Moiseenko, M Shneider, A Popova, K Miroshnikov and O Sokolova

Technical Advances in Cryo-EM

- 1168 *The Case for Lower Voltage TEMs: A 100 keV FEG for High Resolution Microscopy*; MM El-Gomati, T Wells, X Zha, R Sykes, CJ Russo, R Henderson and G McMullan
- 1170 *Breaking to the Subnanometer Resolution Range of Cryo-EM SPA Reconstructions Obtained from 120 kV LaB₆ TEM*; S Masiulis, J Staníček, O Sháněl, M Malínský, O Raschdorf and D Nemecek

- 1172 *Large-Format Direct Detection Camera for Cryo-EM at 100 keV*; B Lee, D Joyce, J Kovacs, S Gulati, M Petrillo, M Wu, S Mick, GC Lander, P Mooney, M Lent and C Booth
- 1174 *First Results from a Novel CMOS Detector Optimised for 100keV CryoEM*; D Krukauskas, T Starborg, R Goldsbrough, L O’Ryan, AI Kirkland and N Guerrini
- 1176 *Apollo: A Novel Event-Based Direct Detector for Cryo-EM*; B Bammes, X Fu, M Spilman, R Peng and S Stagg
- 1178 *Improvements in Speed and Hole Finding in Leginon*; WJ Rice and A Cheng
- 1182 *Workflow Optimization for Cryo Electron Microscopy using Side Entry Dual Grid Cryo Transfer Holder and Automated Cryogen Auto-Refilling System*; P Deshmukh, J Schade, HR Tietz, M Vaze and M Stumpf
- 1186 *Laser Phase Plate: Advancing Beyond Proof-of-Concept*; JJ Axelrod, J Dioquino, P Petrov, J Remis, S Sandhaus, J Silber, J Whinnery, RM Glaeser and H Müller
- 1188 *Cryogenic Electron Ptychographic Single Particle Analysis (Cryo-EPT SPA)*; X Pei, L Zhou, C Huang, M Boyce, JS Kim, E Liberti, T Sasaki, P Zhang, DI Stuart, AI Kirkland and P Wang
- 1192 *Dose-efficient tcBF-STEM with Information Retrieval Beyond the Scan Sampling Rate for Imaging Frozen-Hydrated Biological Specimens*; Y Yu, M Colletta, KA Spoth, DA Muller and LF Kourkoutis
- 1196 *Probing Biological Materials by Vibrational Analysis in the Electron Microscope*; OL Krivanek, B Haas, Z Kochovski, J Müller, C Koch, K March, A Dohnalkova, N Dellby, MT Hotz, B Plotkin-Swing, TC Lovejoy and P Rez
- 1198 *Curiously Absent Knock-On Damage of Lithium Metal at Cryogenic Temperatures*; M Mecklenburg, X Yuan and Y Li
- 1200 *Controlled Cryo-EM Sample Preparation Using the VitroJet*; MJG Schotman, G Weissenberger, RJM Henderikx, FJT Nijpels and BWAMM Beulen
- 1202 *Evaluating the chameleon Sample Preparation Device: Case Studies*; M Aragon, H Wei, EYD Chua, JH Mendez, B Carragher and CS Potter
- 1206 *Not All Vacuum Is Created Equal*; LM Alink, R Gheorghita, K Maruthi, H Kuang, A Cheng, E Eng, CS Potter and B Carragher
- 1210 *Reproducible lamella preparation for electron cryo-tomography by in-situ thickness estimation during fluorescence-guided FIB milling*; R Skoupy, DB Boltje, JP Hoogenboom and AJ Jakobi
- 1212 *CryoVR: a Virtual Reality Training System for CryoEM Hands-on Operations*; D Li, J Dong, K Ozcan, D Wan, YV Chen and W Jiang
- 1216 *CryoDRGN2: Ab Initio Neural Reconstruction of Dynamic Protein Complexes*; ED Zhong, A Lerer, JH Davis and B Berger

- 1218 *3D Flexible Refinement: Structure and Motion of Flexible Proteins from Cryo-EM*; A Punjani and D Fleet
- 1220 *Second-order Total Variation for Compressed Sensing Cryo-ET and Subtomogram Averaging*; J Böhning, TAM Bharat and SM Collins
- 1222 *Montage Cryo-Electron Tomography: a High Throughput and Flexible Data Collection Scheme to Explore In-situ Cellular Landscapes while Preserving High-Resolution Data*; J Yang, M Larson, B Sibert and E Wright
- 1226 *Phantoms Improve Robustness of Deep Learning Automated Segmentation in Cryotomography*; J Heebner, C Purnell, M Marsh and M Swulius
- 1230 *Improving Cryo-EM Ice Thicknesses Workflows on the Chameleon Sample Preparation Device*; EYD Chua, H Wei, M Aragon, CS Potter and B Carragher
- 1232 *MeasureIce: Accessible Ice Thickness Measurement for Single Particle Cryogenic Transmission Electron Microscopy*; H Brown and E Hanssen
- 1236 *Optimization of CryoEM Sample Preparation: A New Freezing Strategy to Reduce the Time to Structure Loop*; O Panova, H Vandekerckhove, N Marro, S Rajasooriya, T Booth and MC Darrow
- 1238 *Effects of Chameleon Dispense-to-Plunge Time on Grid Characteristics, Sample Distribution, and Complex Denaturation of the Neisseria gonorrhoeae Ribonucleotide Reductase Inactive Complex*; TS Levitz, EJ Brignole, I Fong, MC Darrow and CL Drennan
- 1244 *Cryo-EXLO for Cryo-TEM of FIB Specimens*; LA Giannuzzi, M Colletta, Y Yu, LF Kourkoutis, AD Iams, K Beggs and AJ Kassab
- 1246 *New cryoEM Methods for Studying Native Biological Complexes, in situ and in Action*; ZH Zhou
- 1248 *National Center for In-situ Tomographic Ultramicroscopy and the Waffle Method: An Approach for Cryo-FIB/SEM Thin Lamellae Preparation*; D Bobe, M Kopylov, AJ Noble, O Klykov, CS Potter and B Carragher
- 1250 *A Next Generation Cryo-FIB Microscope for High-Throughput Cryo-Electron Tomography*; A Rigort, A Kotecha, S Reyntjens and J Mitchels
- 1252 *Expediting Cryo-EM Grid Optimization by Utilizing Statistical Analysis with JMP*; RM Haynes
- 1256 *CryoDiscovery™: Public Data based AI/ML model enhancements for Cryogenic Electron Microscopy Image Analysis*; R Dehart, E Gray, N Kumar and H Yeccaluri
- 1260 *Visualizing Single Molecule Identity and Sample Integrity in situ*; BA Lucas and N Grigorieff
- 1262 *Data Collection Speedups in Leginon*; K Maruthi, H Kuang, A Cheng, W Rice, M Alink, ET Eng, E Chua, S Dallakyan, CS Potter and B Carragher
- 1266 *Smart Leginon: Fully Automated Cryo-EM Grid Screening for CryoEM using Leginon and Ptolemy*; H Kuang, P Kim, A Cheng, K Maruthi, EYD Chua, JH Mendez, H Wei, ET Eng, V Serbynovskiy, CS Potter, B Carragher, AJ Noble and T Bepler

- 1270 *SmartScope: Framework for Autonomous Cryo-EM Imaging*; J Bouvette, Q Huang, AA Riccio, WC Copeland, A Bartesaghi and MJ Borgnia
- 1276 *A Cryogenic Fluorescence Microscope Retrofittable in Coincidence with a FIB/SEM*; DB Boltje, JP Hoogenboom, AJ Jakobi, GJ Jensen, CTH Jonker, AJ Koster, MGF Last, JM Plitzko, S Raunser, S Tacke, R Wepf and S den Hoedt
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- 1292 *On the Road to Correlative Cryo-Lift-Out, Fully Automated Waffles and Beyond – Make the Most out of your Tissue Sample*; JM Plitzko, S Klumpe, OH Schioetz, A Bieber, C Capitanio, J Kuba and A Rigort

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- 1300 *CryoDiscovery™: Federated Learning as a Key Tool for Cryogenic Electron Microscopy Image Analysis*; E Gray and N Kumar
- 1302 *Cryo-Electron Microscopy of Extracellular Vesicles*; K Cai, BS Sibert, A Kumar, J Yang, M Larson, K Thompson and E Wright
- 1304 *Cryo-EM Information Management System and Sample Evaluation at Stanford-SLAC Cryo-EM Center*; H Khant, YT Li, M Shankar, C Hecksel, P Mitchell, Y Liu, L-M Joubert, C Zhang, L Dunn, M Schmid, B Hedman and W Chiu

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- 1308 *3D Fluorescence Localization in Frozen Cells for Targeted Lamella Milling for Electron Cryo-Tomography*; EB van der Wee, DB Boltje, AJ Jakobi and JP Hoogenboom

- 1310 *Correlative Cryo-FIB Milling using METEOR, an Integrated Fluorescent Light Microscope*; M Smeets, C Capitanio, A Bieber, O Schiøtz, P Erdmann and J Plitzko
- 1312 *(Cryo-) Electron Microscopy Workflows of Interactions between Airborne Pollution Particles and Nasal Epithelial Cells*; VG Giner, S Mumby, R Lakhdar, I Mudway, I Adcock, F Chung and A Porter
- 1316 *Correlating Multi-Pass Microscopy and Transmission Electron Microscopy for Biological Materials*; CM Hampton, BB Klopfer, MA Kasevich and LF Drummy
- 1318 *Indirect Correlative Light and Electron Microscopy (iCLEM) Coupled with Computational Modeling Reveals the Nanoscale Basis of Functional Heterogeneities within the Heart*; HL Struckman, N Moise, A Soltisz, A Buxton, I Dunlap, Z Chen, S Weinberg and R Veeraraghavan
- 1320 *Multimodal and Correlative Characterization of Hybrid Structures: Application to Materials for Environmental Remediation*; SM Ribet, B Shindel, C Harms, V Nandwana, R dos Reis and VP Dravid
- 1322 *Sub-Micron Scale Chemical and Mineralogical Analyses on Microbially Induced Calcium Carbonate Precipitates*; N Zambare, T Varga, AK Battu, L Kovarik and A Dohnalkova
- 1324 *Elemental Co-localization of Nutrients, C, Al, and Fe in Soil Minerals with Electron Microscopy and Scatterplot-matrix Analysis*; O Qafoku, M Wirth, W Chrisler, G Orr, R Lybrand, A Dere, D Spinola and D D'Amore
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- 1328 *Synchrotron Radiation and Laser Light Microscopy Partnership for the Study of Biological Systems: The Case of Soft X-ray Tomography and Structured Illumination Microscopy at Cryogenic Temperatures*; M Harkiolaki, N Vyas, C Pizzey, T Fish, A Jadhav, K Nahas and C Okolo
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- 1342 *Correlative Structure-Property Characterisation of the Leafcutter Ant (*Atta cephalotes*) Mandible*; RE Johnston, MW Said, D Labonte, J Russell, E Sackett and R Board

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- 1356 *MMP20-ablated Induced Aberrant Mineralization in Early Secretory Enamel*; Y-H Hsu, A Trout, JD Bartlett, CE Smith and DW McComb
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- 1366 *Antifungal Evaluation of Zn and Zn-Cu Oxochloride Nanoparticles*; LA Hermida-Montero, IC Ruiz-Leyva, F Paraguay-Delgado, D Lardizabal-Gutiérrez, LN Muñoz-Castellanos and C Villalba
- 1370 *Automatic Sample Processing for vEM in a Mouse Model of Breast Cancer*; ES Stempinski, JL Riesterer and CS Lopez
- 1372 *Defects in Cytoplasmic Assembly and Sorting of US9 Pseudorabies Virus Mutants*; S Adamou, G DuRaine, A Vanarsdall and DC Johnson
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- 1380 *A Career Filled with Viruses*; CS Goldsmith
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- 1384 *Utilizing Liquid-Electron Microscopy to Visualize SARS-CoV-2 Assemblies from COVID-19 Patients*; S Berry, L-A DiCecco, W Dearnaley, M Solares, J Gray and D Kelly
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1406 *FACT Unfolds Nucleosome into a Nearly Linear Protein-DNA Structure: Electron Microscopy Analysis*; S Anastasiia, K Maria, V Maria, F Alexey, S Olga and S Vasily

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- 1428 *Zirconia vs Titanium Dental Implants Demonstrate Superior Early Healing in Mice Assessed with PEGASOS Tissue Clearing and Two-Photon Microscopy*; W Stenberg, Y Yi and H Zhao
- 1430 *Molecular Imaging of Biological Samples in Pharmaceutical Development Using Mass Spectrometry Imaging and Machine Learning*; H Hu, H Brown, DM Sanchez and J Laskin
- 1432 *Biofilm Formation of Staphylococcus epidermidis With and Without Collagen Imaged Using Atmospheric Scanning Electron Microscopy and Antibacterial Effect of Ag-decorated Polymeric Particles Imaged by Transmission Electron Microscopy*; C Takahashi, K Moriguchi, M Hori, T Kawai, M Sato and C Sato
- 1434 *Dye Free Determination of NASH in Human Liver Samples Using NAD(P)H Autofluorescence and Machine Learning Analysis*; J Boyd, J Domigue, E Elizabeth and T Cohen
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- 1440 *Advanced In-situ Liquid Phase Transmission Electron Microscopy: A Powerful Tool for Pharmaceutical Studies and Life Science Applications*; H Sun, C Mathisen, E Bladt and HH Pérez-Garza
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- 1458 *Characterization and Optimization of OSTEM; A Novel Detection Method for Single- and Multi-Beam Scanning Electron Microscopy*; A Kievits, J Fermie, P Duinkerken, R Lane, E Carroll, B Giepmans and J Hoogenboom
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- 1484 *Volume Imaging: From HeLa Cells to the Human Nervous System*; AM Steyer
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- 1488 *Effects of Chloramphenicol Treatment on Cellular Storage Granules and Membrane Structures in Rhodobacter sphaeroides*; D Parrell, RAS Lemke, J Olson, TJ Donohue and ER Wright
- 1492 *Visualizing the Intracellular Niche of Human-Infecting Microsporidia Using Serial Block Face Scanning Electron Microscopy*; NV Antao, C Lam, A Davydov, J Sall, F-X Liang, D Ekiert and G Bhabha
- 1494 *Laboratory Cryo Soft X-ray Tomography for Label-Free Imaging of Bulk Samples*; K Fahy, P Sheridan, W Fyans, F O'Reilly and T McEnroe
- 1498 *Soft X-ray Tomography: a Mesoscale Bio-Imaging Technique to Study Single Cells in 3D with Automated Segmentation Tools for Several Sub-Cellular Structures*; B Vanslebrouck, J-H Chen, A Ekman, M LeGros and C Larabel
- 1502 *3D Imaging and Elemental Analysis of Biological Samples*; Y Yamaguchi, Y Moriya, T Haruta and S Asahina
- 1504 *Volume electron microscopy: taking the measure of cells in 3D*; K Narayan

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1518 *Organelle Segmentation Facilitated by Correlative Light Microscopy Data*; R Lane, L Balkenende, S van Staaldune, AHG Wolters, BNG Giepmans, L Voortman and J Hoogenboom

1522 *A Framework to Segment Cellular Ultrastructure from 3D Electron Microscopy Images of Human Biopsies*; A Machireddy, G Thibault, CE Bueno, HR Smith, JL Riesterer, JW Gray and X Song

1526 *Towards Public Archiving of Large, Multi-Modal Imaging Datasets*; M Hartley and G Kleywegt

1528 *Visualizing Early HCoV-229E Viral Infection Events Using Correlative 2D Light and 3D Electron Microscopy Techniques*; A Williams, M Davola, K Mossman, K Grandfield, MW Phaneuf and N Bassim

1532 *Deconstructing the Nucleus to Elucidate Cellular Pliancy in the Retina*; M Lupo, A Shirinifard, D Stabley, S King, J Jeon, S Frase, R Wakefield, A Johnson, C Robinson and M Dyer

1534 *Quantitative Morphological Analysis of Super-resolution Images Provides Validation of Novel Therapies to Prevent Atrial Fibrillation*; L Mezache, A Soltisz, SR Johnstone, B Isakson and R Veeraraghavan

1536 *Real-time 3D Tomographic Imaging of Biological Samples with Zooming to Features of Interest*; V Nikitin, P Shevchenko, F De Carlo

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1544 *Live Cell Imaging: The past, The Present and Future Opportunities*; SC watkins

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- 1550 *Elevating Polarized Light Microscopy to the Third Dimension*; R Oldenbourg
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- 1558 *Hybrid Open-Top Light-Sheet Microscopy for Multi-Scale 3D Imaging of Cleared and Expanded Tissues*; A Glaser
- 1560 *High-Resolution Chemical Imaging of Cells and Tissues*; L Wei
- 1562 *Super-Resolution Microscopy Made Simple*; JC Vaughan
- 1564 *Two-Color Fixed Cell Imaging Using Engineered Point Spread Functions – XPSF Family*; S Fernando, J Martineau, R Hobson, E Jorgensen and J Gerton
- 1568 *Nanoscale Imaging of Biomolecules Using Molecule Anchorable Gel-enabled Nanoscale In-situ Fluorescence Microscopy*; A Klimas, B Gallagher, P Wijesekara, S Fekir, DB Stolz, S watkins, AL Barth, CI Moore, X Ren and Y Zhao
- 1570 *Towards Quantitative Mapping of Organ-Wide Molecular and Anatomical Patterns with Whole Mount Imaging*; Z Wu
- 1572 *Nearest Neighbor-Based Spatial Analysis of Fluorescence Microscopy Data Reveals Increased Association of NaV1.6 with Cardiac Dyads in Mouse Model of Type-2 Diabetes*; AM Soltisz, H Struckman, P Radwanski and R Veeraraghavan
- 1576 *napari: a Python Multi-Dimensional Image Viewer Platform for the Research Community*; C-L Chiu, N Clack and the napari community

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- 1578 *Estimation of elemental pollution in freshwater sediment of Lerma River Using EDS and FRX techniques (Assessment of Lerma River Bed Sediments Using EDS and FRX techniques)*; DK Tiwari, D ríos-Pérez, A Coria-Tellez, D Tripathi and KU Ahamad
- 1584 *Comparison of Age-Related Tyramine Concentration in the Male Mouse Reproductive System*; S Steadman and DP Baluch
- 1586 *Estuarine Copepod Internal Anatomy: An SEM Evaluation of Microsurgery*; SC Kunigelis
- 1588 *Isolation of Striated Muscle Thick Filaments for Cryo-EM*; H Rastegarpouyani, DW Taylor, FA Yeganeh, A Hojjatian and KA Taylor

1592 *Novel Gelatin-based Bioplastic Materials Designed to Replace Polystyrene and Polypropylene in Single-use Hard Plastics*; K Zuravel, L Zuravel, M Adhikari, Z Luo and B Gautam

1594 *Real-time GHz Ultrasonic Imaging of Nematodes at Microscopic Resolution*; A Baskota, J Kuo and A Lal

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1600 *New Tools & New Insights: Unravelling Hydrogen Effects in Structural Alloys*; CC Tasan

1602 *Insight on High Temperature Hydrogen Attack Initiation and Morphology on Case Studies - 3D FIB-SEM and TEM Analyses for Fine Microstructural Characterization of Attacked Low Carbon Steels*; C Flament, O Gillia, T David, R Soulas, L Guetaz, C Le Nevé and R Goti

1606 *Imaging and Quantification of Hydrogen in Materials: SIMS Based Correlative Microscopy*; S Eswara, D Andersen, S Pal and T Wirtz

1608 *Hydrogen Localisation in Metallurgical Samples With High Resolution Secondary Ion Mass Spectrometry (NanoSIMS)*; K Moore, Y Aboura, C Jones, D Martelo, R Morana, R Akid and M Preuss

1610 *WITHDRAWN -Improving the Quantification of Deuterium in Zr Alloy Atom Probe Tomography Data*; M Jones, A London, A Breen, B Jenkins, P Styman, S Sikotra, M Moody and D Haley

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1618 *Direct Observation of Hydrogen Distribution in Pearlite*; Y-S (Eason) Chen, R Niu, P-Y Liu, P Burr and J Cairney

1622 *The Role of an Al-induced Ferritic Microfilm in Martensitic Steels on the Hydrogen Embrittlement Mechanisms Revealed by Advanced Microscopic Characterization*; M Pinson, SM Das, H Springer, K Verbeken and T Depover

1626 *Effects of Mechanical Deformation on Dislocation Density, Phase Separation and Hydrogen Diffusion in 4130 Steel*; ZN Buck, ML Connolly, M Martin, D Lauria, JP Killgore, P Bradley, A Slifka, Y Chen and NC Osti

1628 *Hydrogen Embrittlement of Ni-Based Inconel 718 Superalloy*; H Zhang, Y Wang, X Wang, D Li and W Xiong

1630 *Electron Microscopic Investigation of Hydrogen Effects on Strain Localization and Martensitic Transformations in an Austenitic Stainless Steel*; DL Medlin, JEC Sabisch, JE Nathaniel II, J Sugar, J Ronevich, CS Marchi

- 1632 *Characterization of Hydrogen Effect on Mechanical Properties of Metals at Different Length Scales*; A Barnoush
- 1634 *Hydride Formation and Deformation Mechanisms in Commercially Pure Titanium*; S Antonov, Q Tan and B Gault
- 1638 *Cryogenic Focused Ion Beam Sample Preparation for the Analysis of Hydrogen in Zr Alloy APT Experiments*; M Jones, C Parmenter, B Jenkins, P Styman, S Sikotra, M Moody and D Haley
- 1642 *In-situ Micromechanics of Hydrogen-induced Deformation in Pearlitic Steels*; H Li, R Niu, J Cairney, Y-S Chen
- 1646 *Visualization of Hydrogen-Trapping Sites in Steels by Atom Probe Tomography*; J Takahashi, K Kawakami, S Teramoto, Y Sakiyama and T Omura
- 1648 *Imaging of hydrogen in metals using an atom probe with ultra-low hydrogen background*; P Felfer, B Ott, M Heller, M Weiser and M Monajem
- 1650 *Exploiting Adsorption Dynamics in Atom Probe Tomography for accurate Measurements of Hydrogen Concentrations*; MS Meier, ME Jones, PJ Felfer, PAJ Bagot, MP Moody and D Haley
- 1654 *The Observation of H Isotope in Fe-Cr-Ni Model Stainless Steels at the Nano Scale using Atom Probe Tomography*; DJ Barton, DE Perea, MG Wirth and A Devaraj
- 1658 *Preliminary Atom Probe Tomography Evidence for Hydrogen Trapping at a β -Nb Second Phase Particle in a Neutron-Irradiated Zirconium Alloy*; BM Jenkins, J Haley, M Meier, ME Jones, B Gault, PA Burr, MP Moody and CRM Grovenor

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- 1662 *Hydrogen/Deuterium Detection in Ferrite-Austenite Dual Phase Steels*; A Saksena, X Dong, B Sun, B Gault, D Ponge and D Raabe
- 1664 *Hydrogen/Deuterium Charging Methods for the Investigation of Site-Specific Microstructural Features by Atom Probe Tomography*; H Khanchandani, LT Stephenson, D Raabe, S Zaefferer and B Gault
- 1666 *Quantification of Hydrogen in Metals Applying Neutron Imaging Techniques*; N Kardjilov, A Hilger, H Markötter, A Griesche, R Woracek, F Heubner, L Röntzsch, M Grosse, I Manke and J Banhart
- 1668 *Visualization of Hydrogen Permeation Through Stainless Membrane Using Electron Stimulated Desorption*; AN Itakura, Y Murase, T Yakabe, M Kitajima, N Miyauchi and S Aoyagi
- 1670 *Hydrogen-Assisted Cracking Behavior of a Fine-Grained Equiatomic CoCrFeNi High-Entropy Alloy*; T Kong, H Wang, M Koyama and E Akiyama

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- 1678 *Exploring Vibrational Spectroscopy of Quantum Materials in the Scanning Transmission Electron Microscope*; A Reifsnnyder, M Nawwar, V Doan-Nguyen and DM McComb
- 1682 *STEM Imaging, Monochromated EELS, and Theory of Natural and Artificial Superlattices*; ER Hoglund, JA Hachtel, D-L Bao, A O'Hara, Md. SB Hoque, ST Pantelides, PE Hopkins and JM. Howe
- 1684 *Emergent Phonon Phenomena at Interfaces probed by Vibrational EELS*; CA Gadre, X Yan and X Pan
- 1688 *Electron Microscopy with Spin Polarization Analysis of Topological Magnetic Domains in Amorphous Fe/Gd Thin Films*; R Moraski, I Gilbert, SA Montoya, EE Fullerton and BJ McMorran
- 1690 *Implications on the tuning of gold nanorods interface: Post-synthesis modification using the electron beam in the transmission electron microscope*; EF Vázquez-Vázquez, YM Hernández-Rodríguez, IC Romero-Ibarra and OE Cigarroa
- 1694 *Micromagnetics Simulation as a Supplement to and Diagnostic for Lorentz Transmission Electron Microscopy*; J Reddinger and W Parker
- 1698 *Detection limits for imaging chiral magnetic materials with 4-dimensional Lorentz scanning transmission electron microscopy*; XS Zhang, KX Nguyen, E Turgut, Z Chen, CS Chang, Y-T Shao, GD Fuchs and DA Muller
- 1702 *Methods for Multi-Layer van der Waals Heterostructures Topological Materials Discovery via STEM and LEEM*; DC Bell, C Ozsoy-Keskinbora, A Akey, A Devarakonda, L Fu, E Kaxiras and J Checkelsky
- 1704 *Reveal of Magnetic Domains and Tunable Supercell Structures in Two-dimensional Layered Oxide Thin Film via Differential Phase Contrast Imaging and Atomic-resolution STEM*; D Zhang, J Lu, X Gao, P Lu, J Shen, H Dou, Z He and H Wang
- 1706 *Unravelling Temperature-Dependent Ordered Skyrmion Phases in Magnetic Layered Materials using Lorentz transmission Electron Microscopy*; R Yalisove, S Susarla, H Zhang, R Chen, X Chen, RJ Birgeneau, J Yao, R Ramesh and M Scott
- 1710 *Room Temperature Néel-Type Skyrmions in a van der Waals Ferromagnet Revealed by Lorentz 4D-STEM*; Y-T Shao, H Zhang, R Chen, X Chen, S Susarla, J Reichenadter, L Caretta, X Huang, NS Settineri, Z Chen, J Zhou, E Bourret-Courchesne, P Ercius, J Yao, JB Neaton, RJ Birgeneau, R Ramesh and D Muller
- 1714 *Magnetic signature in a topological Kagome magnet*; G Cheng and N Yao

- 1716 *Identifying Possible Two-Level-System Sources in Superconducting Qubit with Advanced Electron Microscopy*; L Zhou, J-S Oh, X Fang, T-H Kim, M Kramer, A Romanenko, S Posen, A Grassellino, CJ Kopas, M Field, J Marshall, JY Mutus, H Cansizoglu and M Reagor
- 1718 *In-Situ EBIC STEM: Automated Quantification*; G Moldovan, AP Conlan and D Cooper
- 1720 *Characterization and Growth of Quad Unit Cell Linear Defects in Potassium Tantalate*; TB Eldred, K Ahadi and W Gao
- 1722 *Nanoscale engineering of magnetic textures in the layered magnet CrSBr using electrons and helium ions*; J Klein, T Pham, JD Thomsen, JB Curtis, M Lorke, M Florian, A Steinhoff, K Reidy, K Torres, RA Wiscons, J Luxa, Z Sofer, F Jahnke, P Narang and FM Ross
- 1724 *Real space demonstration of electric current-induced isolated skyrmion deformation*; FS Yasin, J Masell, K Karube, A Kikkawa, Y Taguchi, Y Tokura and X Yu
- 1726 *Building Atomic and Plasmonic Devices via Electron Beams: from Desired Structures to Desired Properties*; KM Roccapiore, A Ghosh, R Vasudevan, RR Unocic, MG Boebinger, M Ziatdinov and SV Kalinin
- 1728 *Exploring the Cryogenic Phase Changes within 2D MoTe₂ via TEM, 4DSTEM and Electron Spectroscopy Techniques*; S Abdus, E Moynihan, A Harvey, U Bangert and M Conroy
- 1730 *Atomic-Scale Phase Transformation of CrCl₃ Elucidated by Cryo-STEM*; H-Y Chao and M Chi
- 1732 *In-situ Imaging of Thermally Activated Atomic Reconstruction of Twisted Bilayer Transition Metal Dichalcogenides*; Y Zhang, C-H Lee, G Nolan, J-H Baek, G-H Lee and PY Huang
- 1736 *Channeling-Induced Artifacts in Atom Tracking of Cations in Distorted Perovskites Imaged by HAADF-STEM*; MA Smeaton, N Schnitzer, H Zheng, JF Mitchell and LF Kourkoutis
- 1740 *Imaging Charged Domain Walls in a 2D Ferroelectric*; E Han, S Nahid, G Nolan, Y Zhang, A Schleife, AM van der Zande and PY Huang
- 1742 *Universal Torsional Periodic Lattice Distortion in Twisted 2D Materials*; SH Sung, YM Goh, H Yoo, R Engelke, H Xie, Z Li, A Ye, PB Deotare, AJ Mannix, J Park, L Zhao, P Kim and R Hovden
- 1746 *Layer Stacking Determination in Topological Semimetal MoTe₂ via STEM Imaging, Liquid He TEM, and Quantitative Electron Diffraction*; JL Hart, L Bhatt, M-G Han, D Hynek, JA Schneeloch, Y Tao, D Louca, Y Zhu, LF Kourkoutis and JJ Cha
- 1750 *Probing Changes in the Electronic Structure and Chemical Bonding of Ti₃C₂ MXene Sheets with Electron Energy-Loss Spectroscopy*; A Hassan, WJ Kennedy, H Koerner, J Hwang and DW McComb
- 1752 *Mapping pm-scale Lattice Distortions and Measuring Interlayer Separations in Stacked 2D Materials by Interferometric 4D-STEM*; MJ Zachman, J Madsen, X Zhang, P Ajayan, T Susi and M Chi
- 1756 *Probing Sources of Decoherence at Defects and Interfaces in Superconducting Quantum Materials and Devices*; AA Murthy, R dos Reis, SM Ribet, M Checchin, A Grassellino, VP Dravid and A Romanenko

- 1758 *Uncovering the role of ordering in MoSi superconducting nanowire single photon detectors with 4D STEM*; GL Burton, AE Lita, AA Herzing, SW Nam and A Roshko
- 1762 *Autonomous Detection and Identification of Defects in Nanoscale Devices using Electron Diffraction Imaging*; J-M Zuo, R Yuan and J Zhang
- 1764 *Direct Measurement of Atomic Reconstruction, Strain, and Disorder in Moiré Materials using 4D-STEM*; M Van Winkle, NP Kazmierczak, C Ophus, KC Bustillo, S Carr, HG Brown, J Ciston and DK Bediako
- 1768 *Extending Bragg Interferometry for the Study of Magic Angle Trilayer Graphene*; C Groschner, IM Craig, M Van Winkle, C Ophus, KC Bustillo, J Ciston and D Kwabena Bediako
- 1770 *Probing three-dimensional chiral domain walls in polar vortices*; S Susarla, S Hsu, P Behera, B Savitzky, S Das, P Ercius, C Ophus and R Ramesh
- 1772 *Multi-scale Visualization of Ferroelectric Domains in a Magnetically Frustrated TbInO₃ Thin Film*; H El-Sherif, M Anderson, J Nordlander, E Koskelo, C Brooks, ME Holtz, JA Mundy, I El Baggari
- 1776 *In-situ Magnetic Domain Behavior in van der Waals Fe₃GeTe₂*; Y Li, R Basnet, K Pandey, J Hu, W Wang, X Ma, ARC McCray, AK Petford-Long and C Phatak
- 1778 *Disentangling Exciton Linewidth Broadening Factors in Transition Metal Dichalcogenide Monolayer with Electron Energy Loss Spectroscopy*; F Shao, SY Woo, N Wu, R Schneider, AJ Mayne, S Michaelis, A Arora, BJ Carey, JA Preuß, N Bonnet, C Mattevi, K Watanabe, T Taniguchi, R Bratschitsch and LHG Tizei
- 1780 *In-situ Lorentz imaging of room-temperature ferromagnetic domains in monolayer vanadium-doped WS₂*; A Ray, M Liu, B Zheng, D Zhou, VH Crespi, M Terrones and DA Muller
- 1784 *Atomic resolution STEM imaging of novel Van der Waals materials synthesized by soft chemical methods*; G Cheng and N Yao

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- 1786 *Mapping valence electron distribution and magnetic field by 4D-STEM*; L Wu, Q Meng and Y Zhu

Imaging Chemical Reactions using High Speed Electron Microscopy (EM)

- 1790 *Time-Resolved Analytical Electron Microscopy with Single Nanosecond Electron Pulses*; M Picher, SK Sinha, Y Hu, T LaGrange and F Banhart
- 1792 *Harnessing High Temporal Resolutions to Explore Fluxional Behavior on CeO₂ Nanoparticles under Reducing Conditions*; R Manzorro, Y Xu, DS Matteson and PA Crozier
- 1794 *Probing graphene defect kinetics at millisecond time resolution using direct detection and machine learning*; C Huang, C Allen, S Skowron, I Lobato, T Sasaki, S Van Aert, E Besley and A Kirkland

- 1798 *Towards Microsecond Time-Resolved Cryo-Electron Microscopy*; JM Voss, OF Harder, G Bongiovanni, PK Olshin, M Drabbels and UJ Lorenz
- 1800 *Room Temperature Decoking of Catalyst Nanoparticles Using Localized Surface Plasmon Resonance Energy*; W-C David Yang, A Agrawal and R Sharma
- 1802 *Advancements in UltraFast Electron Microscopy*; D Leonhardt, E Montgomery, C Jing, B Wyderski, Y Zhao, S Reisbick, Y Zhu, J Lau and J Roehling

On Demand – Imaging Chemical Reactions Using High Speed Electron Microscopy (EM)

- 1804 *Liquid chemistry dynamics with electron microscopy (EM): Nano-catalysis mechanisms by processing EM images and videos with machine intelligence*; VP Ananikov

Mechanisms of High Strain Rate Plastic Deformation: Plasticity and Microstructural Evolutions of Adiabatic Shear Bands

- 1806 *Experimental Development of Fracture Analysis in AISI D2 Steel Subjected to Accelerated Aging Conditions*; M Flores-Baez, I Flores-Baez, G Urriolagoitia-Sosa, B Romero-Ángeles, IF Barajas-Ambriz, DI Islas-Jiménez and GM Urriolagoitia-Calderón
- 1810 *Mechanical Properties of Bond Coatings and Ni-based Superalloys at Extreme Temperatures*; S Bhowmick and E Hintsala
- 1814 *Mechanisms of cracking in pure magnesium during high strain rate plastic deformation*; P Nowakowski, M Ray and P Fischione

In Situ TEM Characterization of Dynamic Processes During Materials Synthesis and Processing

- 1818 *Exploring Calcium Phosphate Biomineralization Systems Using In Situ Liquid Phase Electron Microscopy*; L-A DiCecco, R Gao, D Athanasiadou, RL Chan, KMM Carneiro, DF Kelly, E Sone and K Grandfield
- 1822 *Probing Reaction Intermediates, Kinetics, and Surface Chemistry during Nanoparticle Synthesis and Assembly with Liquid Phase TEM*; T Woehl, M Wang, U Dissanayake, J Sun and A Leff
- 1824 *Ultra-Transparent Atomic Layer Deposition Membranes for Liquid Cell TEM*; R Dhall, M Elowson, A Schwartzberg, SB Alam, SY Chang, V Tommasini, A Gashi, EM Chan, S Cabrini and S Aloni
- 1828 *Liquid Phase Transmission Electron Microscopy Visualization of Surface Pattern Formation during Chemical Reaction Driven Assembly of Nanoparticles*; TU Dissanayake and TJ Woehl
- 1832 *In Situ Transmission Electron Microscopy Observation of 3C-SiC Heteroepitaxial Growth on Si Nanomembrane*; K Kim, S Son, S Lee, J-H Ahn and Z Lee

- 1834 *2D to 3D Structural Transformation of Calcium Oxalate Revealed by In Situ Graphene Liquid Cell TEM*; LV Sorokina, AH Phakatkar, R Shahbazian-Yassar and T Shokuhfar
- 1838 *Atomistic Reaction Kinetics and Chemistry Revealed using In Situ STEM*; J Smith, X Chen and W Gao
- 1840 *Identifying Experimental Parameters for In Situ TEM Heating Experiments on Metastable Microstructures: Application to a Quasicrystal-Reinforced Al Alloy*; B Yavas, MX Li, HR Leonard, SP Alpay and M Aindow
- 1844 *In situ TEM observations of thermally activated phenomena in materials under far-from-equilibrium conditions*; S Vijayan, K Bawane, F Giulia Dilemma, L He, C Fink and JR Jinschek
- 1848 *Structure and Phase Stability in Extreme Environments Explored via In-situ TEM Experiments*; E Lang, N Madden, R Schoell, T Clark, DP Adams and K Hattar
- 1852 *In-situ (S)TEM Investigation of Phase Transformation Mechanism in the Ni-rich Cathodes During Cycling*; I Siachos, W Li, CS Coates, AR Genreith-Schriever, CP Grey and BL Mehdi
- 1854 *Surface modification of Au nanoparticles induced by time exposition under the electron beam in TEM: Understanding the formation of self-assembled Au nanoporous structures*; D Saldivar-Ayala, YM Hernández-Rodríguez and OE Cigarroa
- 1858 *In Situ Observation of Disconnection-Mediated Grain Rotation*; Y Tian, M Xu, L Estrada, H Hahn, D Srolovitz and X Pan
- 1860 *Structural Characterization of Gold Nanoparticles Using Liquid-phase 4D-STEM*; O Lin, C Liu, W Chen, J-M Zuo and Q Chen
- 1862 *In-situ Transmission Electron Microscopy Study of 2D Transition Metal Oxide Nanosheets Formation inside the Liquid Sandwiched Between Graphene Layers*; A Amiri and R Shahbazian
- 1864 *Pt carbide formation during graphitic carbon growth studied using in situ TEM*; HC Nerl and M Plodinec
- 1866 *In Situ Solid Phase Crystallization of Functional Ceramics in the Transmission Electron Microscope*; JL Wardini, J Gonzalez, G Harrington and WJ Bowman
- 1868 *Real-time Analysis of Oxygen Vacancy of Indium Oxide via Environmental Transmission Electron Microscopy*; C Qiu, M Li, S Dogel, H Hosseinkhannazer, L Wang, D Perovic and J Howe
- 1872 *Data Synchronization in Operando Gas and Heating TEM*; F Zhang, M Pen, RG Spruit, H Perez Garza, W Liu and D Zhou
- 1874 *Dynamic atomic-scale imaging of cluster-ion anti-perovskites using low-dose cryogenic HRTEM*; BE Janicek, S Mair, Y-M Chiang, C Ophus and X Jiang
- 1878 *Efficient Sampling and Reconstruction Strategies for in-situ SEM/STEM*; ND Browning, M Bahri, J Castegna, K Chen, BL Mehdi, D Nicholls, W Pearson, AW Robinson, J Taylor, J Wells and Y Zheng
- 1880 *Rhodium Doping of Strontium Titanate for Enhanced Visible Light Absorption*; P Haluai and PA Crozier

- 1884 *Revealing the Reaction Behavior of $\text{Co}_{0.86}\text{Mn}_{0.14}\text{O}$ under H_2 using in situ Closed-Cell Gas Reaction S/TEM*; KA Unocic, N LiBretto, AT To, JA Kropf, DA Ruddy, TR Krause, LF Allard and SE Habas
- 1888 *Tacking Directional Movement of Nanomotors with Liquid Cell Electron Microscopy*; J Wan, Q Zhang, M Asta and H Zheng
- 1892 *Direct Observation of Atomic Scale Diffusion Processes Using in situ HRSTEM*; P Schweizer, L Pethö, E Huszár, LM Vogl, J Michler and X Maeder
- 1896 *Laser-Induced Dynamics of Nano-Energetic Systems via In-situ TEM*; S Kumari, T Isik and V Ortalan
- 1898 *Atomic scale insights into Dynamic Phase Changes in 2D Materials during In-situ Thermal Processing*; JH Warner
- 1900 *Operando Quantitative Electrochemical STEM Studies of Cu Underpotential Deposition on Nanocrystal Surfaces*; Y Yang, Y-T Shao, HD Abruña and DA Muller
- 1904 *In-situ Liquid Phase TEM of Soft and Active Matter*; JP Patterson
- 1906 *Detection of Adsorbates Induced Changes on Pt/CeO₂ Catalyst using In Situ Electron Holography*; P Haluai, MR McCartney and PA Crozier
- 1908 *In-situ Electrokinetics Using Liquid Phase Transmission Electron Microscopy*; MS Larsen, MN Yesibolati and KS Mølhav
- 1912 *Capturing High-Entropy Alloy Particle Growth by Liquid-Phase Transmission Electron Microscopy*; J Sun, A Leff and TJ Woehl
- 1916 *First Steps Towards In-Situ Heating Experiments of Monolithic LiNiO₂ Particles in O₂ Atmosphere*; T Demuth, M Malaki, S Ahmed, P Kurzhals, A Beyer, J Janek and K Volz
- 1918 *Strain Distribution Analysis during Tensile Deformation of Silicon Nanowire with 4D-STEM*; S Wang, H Wang, X Fang, Y Zhu and W Gao
- 1922 *In-situ TEM laser heating for manipulation of cooling rates and observation of precipitate dissolution kinetics*; K Small, J Rodelas, E Barrick, R DeMott and K Hattar
- 1924 *Submillisecond Electron Microscopic Video Imaging for Cinematic Molecular Science*; K Harano
- 1926 *Accessing Chemically Ordered Phases in TaS₂ via High Temperature In-situ TEM*; N Agarwal, SH Sung, J Schwartz and R Hovden

On Demand – In Situ TEM Characterization of Dynamic Processes During Materials Synthesis And Processing

- 1928 *Dynamic Observation of Nanovoid Formation in Lithium- Manganese-Rich Cathode Materials with Solid Electrolyte*; S Li, Y Sun, N Li, W Tong, X Sun and S Hwang

- 1930 *In-situ Atomic-Scale Visualization of Ordering Transformations in Pt-Fe Nanoalloys*; X Chen, S Zhang, C Li, DN Zakharov, S Hwang, Y Zhu, J Fang, G Wang and G Zhou
- 1934 *Is dielectrophoresis effective for increasing local concentration of particles in liquid-cell transmission electron microscopy?*; T Yamazaki, H Niinomi, H Katsuno, H Hosseinkhannazer, E Daigle and Y Kimura
- 1938 *Local Temperature Measurement of Joule Heating During In-situ TEM Electroplasticity Test of Ti-6Al*; X Li and AM Minor
- 1940 *Atomic Imaging of Superelasticity of 2-dimensional Freestanding Perovskite Ferroelectric Films*; H Huyan, M Xu, D Ji, C Du, X Wang, J Schoenung, R Wu and X Pan
- 1944 *Electrochemical Dissolution and Redeposition of Metallic Nanostructures Revealed by Liquid Phase Transmission Electron Microscopy*; AF Beker, Y Pivak, H Sun and HHP Garza
- 1946 *Electrochemical Mass Spectroscopy for In-Situ Liquid Phase Electron Microscopy*; H Sun, JN Hartmann, R Spruit, Y Pivak, D Trimarco and HHP Garza
- 1948 *Local Structure and Crystallization Process in Mechanochemically Prepared Na₃PS₄*; H Nakajima, H Tsukasaki, T Kimura, A Sakuda, A Hayashi and S Mori

Nanoscale Optics with Electrons and Photons

- 1950 *Multimodal Correlative Microscopy to Study the Chemical and Energetic Landscape of Alloyed Halide Perovskites*; K Frohna, M Anaya, S Macpherson, J Sung, TAS Doherty, Y-H Chiang, AJ Winchester, KWP Orr, JE Parker, PD Quinn, KM Dani, A Rao and SD Stranks
- 1954 *Correlation of Atomic Structure and Luminescence Of Two-dimensional MoSe₂/WSe₂ In-plane Nanodot Heterostructures*; S Bachu, SY Woo, B Huet, N Trainor, DR Hickey, JM Redwing, M Kociak, LHG Tizei and N Alem
- 1958 *(S)TEM Characterization of Functionalized Adamantanes by Low-Dose EELS and PDF Analysis in their Pristine and Laser-Irradiated States*; J Belz, J Haust, F Hüppe, A Beyer and K Volz
- 1962 *Unveiling Single Particle Coupling of Metallic Nanoparticles and Whispering Gallery Mode Resonators*; Y Auad, C Hamon, M Tencé, H Lourenço-Martins, V Mkhitarian, O Stéphan, FJG de Abajo, LHG Tizei and M Kociak
- 1966 *Thermal Effects on the Phonon Polariton Response of Nanoscale Cavities*; MJ Lagos, C Wong, Y-W Yeh, IC Bicket, BS Agboola and ND Bassim
- 1970 *Impact of the Nanoscale Gap Morphology on Plasmons in Doped Indium Oxide Nanostructure Dimers*; Y Wu, A Konecná, SH Cho, DJ Milliron, JA Hachtel and FJG de Abajo
- 1972 *In Situ Engineering and Characterization of Photonic Modes in Dielectric Nanocubes*; Y Wang, P Haluai and PA Crozier

- 1976 *Non-Classical Crystal Morphology and Secondary Phase Directed Growth of Tetragonal SnO Microcrystals*; J Koushik, RK Rai and N Ravishankar
- 1978 *Optical Properties of Zinc Ferrite Nanoparticles Embedded in Zinc Oxide Thin Films Investigated by STEM, EELS and CL*; C Elgvin, SB Kjeldby, KG Both, PD Nguyen and Ø Prytz
- 1982 *Pico-scale Distortions in Encapsulated Monolayer α -RuCl₃ Characterized with 3D Electron Diffraction*; YM Goh, SH Sung, B Yang, G Ye, S Biswas, DAS Kaib, R Dhakal, S Yan, C Li, S Jiang, F Chen, H Lei, R He, R Valenti, SM Winter, AW Tsen and R Hovden
- 1986 *Revealing Photonic Properties with High Spatial Resolution: An EELS Study on Ceria Nanocubes*; Y Wang, S Yang and PA Crozier
- 1990 *The Prospect of Quantum-Optical Information Transfer using an Electron Microscope Beam*; O Kfir
- 1994 *Atomic Floquet Physics Explored with Free Electrons*; EA López, V di Giulio, FJG de Abajo
- 1986 *Defocus Phase Contrast in Photon-Induced Near-field Electron Microscopy*; JH Gaida, H, Lourenco-Martins, SV Yalunin, A Feist, M Siviš, T Hohage, FJG de Abajo and C Ropers
- 2000 *Inelastic Holography and Interaction-Free Measurements with Interferometric STEM*; BJ McMorran, CW Johnson, AE Turner and FJG Abajo
- 2002 *Nanoscale Imaging of Plasmonic Hot Spots in Au Nanocapsule Dimers by Ultrafast Electron Microscopy*; H Liu, P Singh, A Jaiswal, TE Gage and I Arslan
- 2004 *Low Dimensional III-V and II-VI Semiconductors*; D Dede, N Morgan, N Gäcshter, T Nurmamyrov, M de Luca, S Rubini and A Fontcuberta i Morral
- 2006 *Using Cathodoluminescence from Continuous and Pulsed-Mode SEM to Elucidate the Nanostructure of Hybrid Halide Perovskite Materials*; JF Orri, F Kosasih, Y Sun, G Kusch, G Divitini, R Oliver, C Ducati and S Stranks
- 2010 *Correlative Electron Energy-Loss Spectroscopy Bandgap Mapping and DFT Modeling in AlGaN Diodes*; JI Deitz, JD Sugar, B Kiefer, NS Baldonado, AA Allerman and MH Crawford
- 2012 *Photon-Correlation Cathodoluminescence Spectroscopy in a SEM: A Tool to Analyze the Performance of Optoelectronics Devices*; S Finot, C Le Maoult, E Gheeraert, D Vaufrey and G Jacopin
- 2014 *Tuning the Optical Properties of 2D materials with Defects and Strain*; C-H Lee, Y Zhang, MA Hossain, Y Zhang, A van der Zande and PY Huang
- 2016 *Probing Optical Phenomena of Si@MoS₂ Core-Shell Architectures at Nanoscale by Valence EELS*; Y-S Lee, T Hinamoto, SA Dereshgi, S Hao, M Cheng, H Sugimoto, M Fujii, C Wolverton, K Aydin, R dos Reis and VP Dravid
- 2020 *Exploring Mie Resonances, Anapole States, and Anapole-Exciton Polaritons in Nanopatterned TMD Materials Using STEM EELS*; AB Yankovich, CM Escudero, B Munkhbat, DG Baranov, R Hillenbrand, J Aizpurua, T Shegai and E Olsson

2024 *STEM-EELS Mapping of Eigenmodes and Coupling Effects of Photonic Silicon Nanocavities*; DTL Alexander, V Flauraud and F Demming

2026 *Infrared Plasmons in Single La-doped BaSnO₃ Nanocrystals Revealed by Monochromated STEM-EELS*; H Yang, A Konečná, FJG de Abajo and PE Batson

On Demand – Nanoscale Optics with Electrons and Photons

2030 *Evolution of Superstructure Demarcated with Heterointerface and Polymorphic Transformation in BiMnO₃ Compounds*; S Choudhury, V Mohan, AS Pal, RJ Mandal and J Basu

2032 *In-situ Calibration for Angle-resolved Valence EELS*; M Malac, M Hayashida, H Müller, Y Taniguchi and RF Egerton

Correlative Microscopy and High-Throughput Characterization for Accelerated Development of Materials in Extreme Environments

2036 *Automated Analysis of Grain Growth Under in-situ Irradiation Using Convolutional Neural Network*; X Xu, Z Yu, A Motta and X Wang

2038 *Laboratory-Based 3D X-ray Imaging of Neutron-Irradiated Ceramic Particle Nuclear Fuel*; NL Cordes, BJ Gross, WC Chuirazzi, JJ Kane and JD Stempien

2040 *Neural Networks for Dose Reduced Reconstruction Image Denoising in Neutron Tomography*; MC Daugherty, JM LaManna, Y Kim, E Baltic, DS Hussey and DL Jacobson

2046 *Real-time, On-Microscope Automated Quantification of Features in Microcopy Experiments Using Machine Learning and Edge Computing*; KG Field, P Patki, N Sharaf, K Sun, L Hawkins, M Lynch, R Jacobs, DD Morgan, L He and CR Field

2050 *Computer Vision Approaches for Segmentation of Nanoscale Precipitates in Nickel-Based Superalloy IN718*; NM Senanayake and JLW Carter

2052 *Investigation of Stress Corrosion Cracking in CMSX-4 Turbine Blade Alloys Using Deep Learning Assisted X-ray Microscopy*; H Bale, M Kothari, A Holwell, M Phaneuf, S Gray and J Legget

2054 *STEM-EELS Analysis of Niobium Oxide Multilayer Films for High Temperature Memristor Devices*; BT De Gregorio, E Lock, K Knipling and H Cho

2058 *Real-time Multi-Object Tracking of Ion-irradiation Induced Defects in in situ TEM Videos*; R Sainju, W-Y Chen, S Schaefer, Q Yang, C Ding, M Li and Y Zhu

2060 *Identifying Chemical Disordering in Irradiated SiC Fiber-Reinforced SiC Matrix Composites with High-Throughput Correlative Microscopy*; KS Mao, T Koyanagi, T Nozawa and Y Katoh

2062 *From Event Detection to Physical Hypothesis Learning via Automated and Autonomous Microscopy*; SV Kalinin, Y Liu, R Vasudevan, K Kelley and M Ziatdinov

- 2064 *Correlating Automated High-Throughput ADF-STEM and 4D-STEM Imaging for the Characterization of Irradiation-Induced Defects*; A Lin, SH Mills, A Pattison, W Theis, A Minor and P Ercius
- 2068 *Characterization of Irradiated 309L Stainless Steel Cladding Produced by Laser Directed Energy Deposition*; SC Bozeman, OB Isgor and JD Tucker
- 2070 *Towards Optimized Characterization of Dislocation Loops in Irradiated FCC Alloys Using On-Zone STEM Techniques*; P Xiu, H Bei, Y Zhang, L Wang and KG Field
- 2072 *Transmission EBSD of Aluminide Coatings on Stainless Steel in a Scanning Electron Microscope*; JA Silverstein
- 2074 *New Correlative Microscopy Approaches to Understand the Microstructural Origins of Creep Cavitation in Austenitic Steels*; T Martin, S He, E Horton, H Shang, A Fernandez-Caballero, N Grilli, M Mostafavi, D Knowles, A Cocks and P Flewitt
- 2076 *Microanalysis of the Effects of Tokamak Thermal Transients on Eurofer 97 Steel*; J Hargreaves, D Kumar, H Dawson, L Harding, HD Andrade and TL Martin
- 2080 *Aqueous Corrosion of WCLL Breeder Blanket Structural Material Eurofer-97 for Nuclear Fusion Reactors*; D Kumar, R Burrows, L Platts, A Siberry, A Gunn, M Zimina, C Harrington, R Springell, T Martin and A Del Nevo
- 2084 *Evaluation of Microstructural Evolution in Isothermally Aged Ferritic Candidate Cladding Materials for Sodium-cooled Fast Reactor Applications*; B Adam, D Sprouster, A Koziol, L Rolly and JD Tucker
- 2086 *Coupling Extreme Environments in the SEM: Present and Future Developments*; E Lang, SA Briggs, T Clark, N Heckman, A Monterrosa, CM Barr, BL Boyce, D Buller and K Hattar
- 2088 *High Throughput Characterization to Quantify Microstructural Heterogeneities in Additively Manufactured Haynes 282*; A Gupta, S Vijayan, O Schmid, J Jinschek and C Fink
- 2092 *Multi-scale Characterisation of Heat Treatment in Single Crystal Nickel-based Superalloys*; VCI Strutt, MP Bagot, D Rugg, A Radecka, M Appleton, J Woolrich and PAJ Bagot
- 2094 *Analyzing the Static Corrosion of T91 in Liquid Lead and Bismuth Eutectic at the Atomic Scale*; M Zhang, M Lapington, W Zhou, MP Short, PAJ Bagot, MP Moody and F Hofmann
- 2098 *Correlative Micro-CT and FIB-SEM Tomography for Refined Macro-scale Pore Volume Measurements in TPBAR LiAlO₂ Pellets*; B Matthews, A Albrecht, A Denny, C Barrett and D Senior
- 2100 *High Throughput Studies on Irradiated High Entropy Alloys*; M Bachhav, B Queylat, M Moorehead, D Murray, C Parkin, N Curtis, P Nelaturu, D Thoma, D Morgan and A Couet
- 2102 *3D Nanoscale Analysis of Implanted Deuterium in Tungsten using Atom Probe Tomography*; MS Meier, PAJ Bagot, A Hollingsworth, A Wohlers, MP Moody and D Haley
- 2106 *Advanced Characterization of Fuel Cladding Chemical Interaction between U-10Zr Fuel and HT9 Cladding Tested in Fast Flux Test Facility*; Y Wang, BD Miller, JM Harp, MN Bachhav, L Capriotti and T Yao

- 2108 *Quantifying Defect Pathways for Disorder in $La_{1-x}Sr_xFeO_3$ / $SrTiO_3$ Thin Films*; BE Matthews, K Yano, S Akers, M Sassi, S Taylor, L Wang, R Paudel, R Comes, Y Du, E Lang, K Hattar and SR Spurgeon
- 2110 *Bridging the Atomic Scale and the Mesoscale in the Characterization of Defect Production and Evolution in High Entropy Alloys*; F Selim, G Beausoleil, D Kaoumi and K Hattar
- 2112 *Revisit the Effect of He^+ Irradiation on the Structure and Mechanics of Metallic Glass*; Y Xie, J Schorers and P Hosemann
- 2114 *In situ 4D-STEM Imaging to Develop a Fundamental Understanding of Coupled Transport of Vacancies*; SH Mills, SE Zeltmann, P Ercius, A Kohnert, B Uberuaga and AM Minor
- 2116 *Real-Time and Correlative Imaging of Localised Corrosion Events by High-Speed Atomic Force Microscopy*; S Moore, R Burrows, L Picco, OD Payton and TL Martin
- 2118 *Integration of Gas-Cell TEM, Nano-calorimetry and RGA on Oscillating Phenomena at High Temperatures in Catalysis*; D Zhou, RG Spruit, M Pen, T Qian, X Zhang, F Zhang, X Liu, W Liu and HP Garza
- 2120 *Correlative Multimodal Microscopy Using AFM-in-SEM in Material Science*; V Hegrova, R Dao and J Neuman
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- 2554 *Fine Structure Mapping in Graphene: From Electronic Transitions To Atomic Orbitals*; M Bugnet, M Ederer, VK Lazarov, L Li, QM Ramasse, S Löffler and DM Kepaptsoglou
- 2556 *The Interface of the Most Polar Layered Oxide Superconductor Solved by Coordinated Experiments and Theory*; BH Goodge, B Geisler, K Lee, M Osada, BY Wang, D Li, H Hwang, R Pentcheva and LF Kourkoutis
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- 2572 *Imaging Nanomagnetism in 3D: Potential Improvements for Vector Electron Tomography Reconstruction*; GR Lewis, E Ringe and P Midgley
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- 2580 *Cryogenic Electron Microscopy on Strongly Correlated Quantum Materials*; M-G Han, L Wu and Y Zhu
- 2582 *Combining STEM Imaging and X-Ray Diffraction for Structure Determination of a New Highly Distorted Infinite-Layer Phase*; MA Smeaton, WJ Kim, BH Goodge, K Lee, M Osada, HY Hwang and LF Kourkoutis

- 2586 *The Advanced Characterization and Structure-Property Correlation of BaMnO₃ for the Oxygen Reduction Reaction Using Electron Microscopy*; L Hughes, A Roy, C Downing, MP Browne, A Zhussupbekova and V Nicolosi
- 2590 *Atomic Scale Crystal Field Mapping of Polar Vortices in Oxide Superlattices*; S Susarla, P García-Fernández, C Ophus, S Das, P Aguado-Puente, M McCarter, P Ercius, LW Martin, R Ramesh and J Junquera
- 2594 *Tunable Microstructures in Entropy-Stabilized Oxide Thin Films Studied with Unsupervised Machine Learning Assisted Transmission Electron Microscopy*; L Miao, G Kotsonis, J-P Maria and N Alem
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- 2600 *Effect of Ca Doping on the Microstructure and Mechanical Properties of Magnesium Aluminate Spinel*; A Campos-Quiros, A Kundu and M Watanabe
- 2604 *Crystal Surfaces and Their Role on Electrochemical Activity in MgV₂O₄ Crystals*; FJ Lagunas Vargas, GCB Alexander, A Lee Punaro, C Moscosa, J Cabana and RF Klie
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- 2608 *4D-STEM Mapping of Nanoscale Structural Ordering in Cathode Materials*; W Chen, X Zhan, R Yuan, S Pidaparthi, Z Tang, J-M Zuo and Q Chen
- 2610 *Correlating Surface Strain with Activity in Commercial Platinum Catalysts*; DJ Kelly, BA Brandes, P Liu and TW Hansen
- 2612 *Mapping Local Structure, Electronic and Excitonic Properties at the 2D/3D Interface*; K Reidy, A Konečná, E Park, B Haas, J Dahl Thomsen, JP Klein, CT Koch, FM Ross and JC Idrobo
- 2614 *Tracking Degradation in Individual Catalyst Nanoparticles Under Fuel Cell-Relevant Cycling Conditions by Identical-location STEM*; H Yu, MJ Zachman, DA Cullen, C Li, J Xie, L Hu, KC Neyerlin, N Kariuki, DJ Myers and R Mukundan
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- 2800 *Effect of Etching Method on the Morphology and Stability of Ti_2CT_x MXene*; O Udoh, A Briles, B Gautam and DE Autrey
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- 2830 *Growth and characterization of Boron Nitride/Diamond Heterostructures*; S Vishwakarma, JM Brown, A Patel, MR McCartney, RJ Nemanich and DJ Smith
- 2832 *Hardness Behavior of CNT/Al7075 RRA Heat Treated Composites*; BL Vargas-Rodríguez, E Cardoso-Lozano, J Mayen-Chaires, H Arcos-Gutierrez, F Pérez-Bustamante and R Pérez-Bustamante
- 2834 *High Entropy Alloy AlCoFeNiMoTi Particles as Reinforcement in an Al 2024 Matrix Synthesized by Powder Metallurgy*; MS Avila-Rubio, GD Avila-Rubio, JA Baldenebro-López and FJ Baldenebro
- 2836 *High Purity Graphene Prepared Via a Cheap Method of Synthesis from a CO_2 Atmosphere*; E Cuadros-Lugo, HA Martinez-Rodríguez, D Lardizabal-Gutiérrez, C López-Melendez, I Estrada-Guel, JM Herrera-Ramirez, C Carreño-Gallardo

- 2838 *High-Temperature Growth of $Mn_5Ge_3C_x$ Thin Films on Ge (001) Substrates: Reactive Deposition Epitaxy vs. Solid Deposition Epitaxy*; A Alvidrez-Lechuga, JT Holguín-Momaca, CR Santillán-Rodríguez and SF Olive-Méndez
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- 2850 *Mechanical Reinforcement of AISI1018 Steel by a Ni-based Self-fluxing Alloy Coating Applied by Plasma Transferred Arc (PTA)*; L-A Cáceres Díaz, O González Ornelas, R Pérez-Bustamante, JE Edison-Garcia, M Nango Blanco, JM González Carmona, JM Alvarado Orozco, J Muñoz Saldaña
- 2854 *Microstructural Evolution and Strengthening Mechanisms in a 2xxx Series Modified Al Alloy*; KA García-Aguirre, J Holguín-Momaca, MA Ruiz-Esparza-Rodriguez, JC Guía-Tello, CG Garay-Reyes, I Estrada-Guel, R Martínez-Sánchez
- 2858 *Quantum light and free electrons*; V Di Giulio, M Kociak, FJ Garcia de Abajo
- 2862 *SEM Study of a Ti-Ta-Sn Ternary Alloy by Powder Metallurgy*; A Mejía, L Bejar Gómez, C Aguilar, C Parra González and I Alfonso
- 2864 *STEM Analysis of Vacancies in Magnetite Nanoparticles*; P Sharp, A Kerrigan, P Hasnip, Z Nedelkoski, S Majetich, Q Ramasse, D Kepaptsoglou and V Lazarov
- 2866 *Stroboscopic Imaging Using RF Strip-Line Technology*; S Reisbick, M-G Han, C Liu, Y Zhao, E Montgomery, C Jing and Y Zhu
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- 2876 *Synthesis by AACVD, microstructural characterization and mechanical properties of a Cr_2O_3/Fe_3O_4 nanocomposite*; KI Contreras-Vargas, C Carreño-Gallardo, K Campos-Venegas, A Hurtado-Macias, P Pizá-Ruiz, P Amázaga-Madrid
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- 2886 *TEM Characterization of Complex Nanoprecipitates in Single-Phase V-Nb bearing Automotive Steels*; A Kaldellis, N-I Makris, A Alexandratou, S Deligiannis, P Tsakiridis and G Fourlaris

- 2890 *TEM Characterization of Retained Austenite Stabilization on TRIP Steel*; N-I Makris, A Kaldellis, A Alexandratou, S Deligiannis, P Tsakiridis and G Fournalis
- 2894 *The galling mechanism and behaviour of Tristelle 5183*; S Rogers, J Daure, P Shipway, D Stewart and D Dye
- 2898 *The Occurrence of Dolomite in Carbonate Organofacies and Its Relationship to Diagenesis and Catagenesis as Revealed by Mineral Maps Developed Using Energy Dispersive Spectroscopy and Back Scatter Electron*; D Jacobi, J Longo and J Rodriguez

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- 2904 *Improving the Noise Floor and Speed of Your Detector: A Modular Hardware Approach for Under \$1000*; JJP Peters, T Mullarkey and L Jones
- 2908 *Seamless communication between high-performance computing system and electron microscopes for on-demand automated data transfer and remote control*; D Mukherjee, A Al-Najjar, K Roccapriore, J Hinkle, A Lupini, C Meyer, S Kalinin, O Ovchinnikova and N Rao
- 2912 *Lessons Learned in Building a Modern Microscopy Data Ecosystem at NIST*; J Taillon
- 2914 *Benchmarking the Performance of a New Photoelectron Source*; F Quigley, C Downing, C McGuinness and L Jones
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- 2920 *Pivot Point: The Key to TEM Automation*; M Olszta, K Fiedler, D Hopkins, K Yano, C Doty, M Oostrom, S Akers and S Spurgeon
- 2922 *Automated Spectrum Imaging Using Hybridized DMScript and Python Code in DigitalMicrograph*; L Spillane and B Schaffer
- 2924 *Machine Learning-Driven Automated Scanning Probe Microscopy for Ferroelectrics*; Y Liu, K Kelley, R Vasudevan, H Funakubo, S Fields, T Mimura, S Trolier-McKinstry, J Ihlefeld, M Ziatdinov and S Kalinin
- 2928 *Fast Automatic Focusing of the Scanning Electron Microscope using a GPU-accelerated PC*; D Holburn, B Breton, T Rowsell and R Xu

- 2930 *Development of a FAIR Data Management Infrastructure*; S Shabih, M Kühbach, M Scheidgen, L Himanen, S Brockhauser, B Haas and C Koch
- 2934 *Retrofitting a Photoelectron Source: Improving Resolution & Functionality*; F Quigley, C Downing, C McGuinness and L Jones
- 2936 *Approaching Real-Time Low-Dose STEM: Image Recovery from Subsampled Measurements via Online Bayesian Dictionary Learning*; J Wells, D Nicholls, A Robinson, A Moshtaghpour, Y Zheng, J Castegna and N Browning
- 2940 *A Materials Scientist's CANVAS: A System for Controlled Alteration of Nanomaterials in Vacuum Down to the Atomic Scale*; C Mangler, J Meyer, J Kotakoski, A Mittelberger, K Mustonen and T Susi

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- 2950 *Identification of Increased Blood Brain Barrier Permeability in the Visual Cortex of the HIV-1 Transgenic Rat*; M Worthington, S Williams, F Benedetti, D Zella, D Davis, J Bryant and F Denaro
- 2952 *Microscopy Education In The Fourth Industrial Revolution*; M Bolorizadeh
- 2954 *On the Role of Microscopy in Mechanical Engineering Education*; C Solomon
- 2958 *Ray-Tracing Electrons through a Magnetic Lens*; D Landers, I Clancy, D Weber, R Dunin-Borkowski and A Stewart
- 2962 *The Application of Micro-Scale Analysis Tools in Industrial Problem Solving*; J vajki Vass

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- 2964 *Object detection in SEM images using CNN: Geological application on size distribution of pyrites in Mudrocks*; P Periwal

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2988 *Doing More with Less: Artificial Intelligence Guided Analytics for Electron Microscopy Applications*; S Akers, M Oostrom, C Doty, M Olszta, D Hopkins, K Fiedler and S Spurgeon

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2994 *Approaches Taken to Streamline and Consolidate Large Dataset Processing Techniques, with a Focus on Ptychography*; T Pekin, M Schloz, PF Robledo, A Gladyshev, S Shabih, B Haas and C Koch

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- 3054 *4D-STEM Analysis with the Open Source py4DSTEM and crystal4D Toolkits*; C Ophus, AM Rakowski, J Munshi, B Savitzky, S Zeltmann, A Bruefach, M Scott, J Ciston, AM Minor and MKY Chan
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- 3216 *National Network for Cryo-Electron Tomography Application Portal*; M Larson, K Thompson and E Wright
- 3218 *Physical and Chemical Morphology of Organic Compounds at PM10 by TEM-EDS and GC-SM*; R Ramirez-Leal, H Estuardo -Moreno, A Gomez-Alvarez, H Esparza-Ponce, A Lucero-Acuña and F Almendariz
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- 3224 *Core shell structures in comparative study of the composition $x = 0.01$ ($BaTi_{1-5x}Nb_{4x}O_3$) prepared by the barium titanate route and the solid-state route*; A Arenas-Flores, M Ortiz-Domínguez, O Gómez-Vargas, J Solís-Romero, Á Morales-Robles, A Cruz-Avilés, Á Duran-Sarabia, E Cardoso-Legorreta and J Zuno