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- 348 *Emergent chirality in a polar meron to skyrmion transition revealed by 4D-STEM*; Y-T Shao, S Das, Z Hong, R Xu, S Chandrika, F Gómez-Ortiz, P García-Fernández, L-Q Chen, H Hwang, J Junquera, L Martin, R Ramesh and D Muller
- 352 *Impact of the Synthesis Kinetics of Entropy-stabilized Oxide Thin Films Probed with 4D-STEM and STEM-EELS*; L Miao, G Kotsonis, J Ciston, C Ophus, J-P Maria and N Alem
- 356 *Atomic scale understanding of the electronic structure of 5d-3d perovskite oxide heterostructures using STEM-EELS*; S Susarla, X Huang, S Sayed, L Caretta, H Zhang, S Salahuddin, P Ercius and R Ramesh
- 360 *Interplay between Polar Distortions and Superconductivity in SrTiO₃*; S Salmani-Rezaie, H Jeong, K Ahadi and S Stemmer

Nanoscale x-ray and Electron Microscopy Techniques and Applications in Material Science

- 364 *Study of Functional Materials by Correlative Electron and Synchrotron X-ray Microscopy*; Y Liu, T Zhou, X Zhou, Z Cai and M Holt
- 368 *Correlation between Surface Morphology and Corrosion Behaviour of Ni-P-Graphene and Ni-P-Carbon Nanotube Composite Coatings*; A Meshram, MK Punith Kumar and C Srivastava
- 370 *Use of LOM and EBSD to Identify Bainite in Complex Phase Steel*; R de Melo Correia Lima, J Spadotto and F Cosme Rizzo
- 374 *Microstructural Alteration in Conventional Metallic Coatings by Carbonaceous Additives (Graphene Oxide and Carbon Nanotubes)*; MY Rekha, A Gupta, K Jyotheender and C Srivastava
- 378 *Multi-scale and multimodal x-ray microscopy and applications*; X Xiao

Investigating Phase Transitions in Functional Materials and Devices by In Situ/ Operando TEM

- 380 *In-situ observation of the in-plane field induced nucleation of skyrmion using Lorentz-TEM*; B Wang, P Wu, N Bagués, Q Zheng, J Yan, M Randeria and D McComb
- 382 *Current-driven Dynamics of Magnetic Skyrmion Bunches*; F Yasin, K Karube, A Kikkawa, Y Taguchi, Y Tokura and X Yu
- 384 *Cryogenic Atomic Resolution and 4D STEM Imaging for Energy and Quantum Materials*; M Chi and AR Lupini
- 386 *Operando and in situ in a TEM imaging in a cryogenic temperature range*; M Duchamp, J Vas, R Ignatans, AD Mueller, R Medwal, R Rawat and V Tileli

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- 388 *In Situ and Operando Imaging of the Evolution of Battery Materials and Interfaces*; M McDowell
- 390 *Correlative relationship between nanomorphology, crystallinity, texture and device efficiency of organic BHJ solar cells studied by energy-filtered TEM*; C Harreiss, M Wu, S Langner, S Rechberger, J Will, CJ Brabec and E Spiecker
- 394 *Processing of Electroactive Ceramics in the Transmission Electron Microscope*; J Wardini, J Gonzalez, G Harrington and W Bowman
- 396 *4D-STEM Determination of Atomic Structure of Amorphous Materials for Renewable Energy Applications*; M Abbasi Gharacheh, J Meng, Y Dong, D Morgan, X Wang and J Hwang

- 400 *Examining Partial Crystallization in the $\text{Co}_{(78-x)}\text{Fe}_2\text{Mn}_x\text{B}_{14}\text{Si}_2\text{Nb}_4$ Magnetic Amorphous Nanocomposite Alloy Series*; A Koenig, D Tweddle, A Leary, R Noebe, C Mewes, T Mewes and G Thompson

Advanced Application of Atom Probe Tomography: Specimen preparation, Instrumentation, and Data analysis

- 404 *Enhanced Atom Probe Imaging using Generalised Field Evaporation Models*; C Fletcher, M Moody, J Scheerder, C Fleischmann, B Geiser and D Haley
- 408 *A Machine Learning Approach to Cluster Characterization for Atom Probe Tomography*; R Bennett, A Proudian and J Zimmerman
- 412 *On the Voltage and Bowl Correction of Trigger-Uncorrelated Multihit Events*; B Caplins, A Chiaramonti, L Miaja-Avila and N Sanford
- 416 *Isotopic Analysis of Irradiated Ceramic Fuel for Burnup and Microchemical Assessment Using Atom Probe Tomography*; M Bachhav, J Kane, F Teng, F Cappia and L He
- 418 *Evaporation Dynamics of Boron Dopants in Silicon*; J Op de Beeck, C Freysoldt, R Cuduvally, J Scheerder, RJH Morris, P van der Heide, W Vandervorst and C Fleischmann

Analytical Sciences Symposia

Advances in Focused Ion Beam Instrumentation, Applications and Techniques in and Materials and Life Sciences

- 422 *Prevention Beats Removal: Avoiding Stripe Artifacts from Current Variation in Particle Beam Microscopy Through Time-Resolved Sensing*; L Watkins, S Seidel, M Peng, A Agarwal, C Yu and V Goyal
- 426 *Alternative Post-FIB Polishing Using Low-Energy Argon Ion Milling to Prevent Grid Redeposition*; C Bonifacio, P Nowakowski, M Ray and P Fischione
- 430 *The combined use of SEM, EPMA and FIB for the characterization of novel biomaterials for bone regeneration*; M Essani, P Abellan, P Weiss, J Le Bideau, B Charbonnier and H Moussi
- 434 *Electron Irradiation Cleaning of the SEM and its Samples*; A Vladar, D Hoyle and H Kotaro
- 436 *Improved Focused Ion Beam Sample Preparation Techniques for Transmission Electron Microscopy and Failure Analysis of Memristor Devices*; B Athey, K Mahalingam, S Ganguli, A Hilton and R Dhall
- 438 *Evaluation of Gallium Ion\Xe Plasma Beam for Patterning of Suspended Silicon Nitride Membranes*; S Jiang, T Isik, C Yilmaz Akkaya, S Kumari and V Ortalan
- 440 *Operando Investigation of Energy Storage Material by FIB-SEM System*; X Zhou, L Zhu and Y Liu
- 444 *Investigation of the effect of gallium ion (Ga^+) irradiation on the fluorescence properties of synthetic microdiamonds*; MS Maqbool, D Hoxley, A Stacey, E Balaur, B Johnson and B Abbey

Full System and Workflow Automation for Enabling Big Data and Machine Learning in Electron Microscopy

- 448 *Hierarchically Structured Classification of Carbon Nanostructures from TEM Images by Machine Learning and Computer Vision*; C Wang, Q Luo and E Holm
- 450 *Characterization of III/V Semiconductors on Silicon by Analyzing 4D-STEM Data with Convolutional Neural Networks*; D Heimes, J Scheunert, A Beyer, J Belz, S Firoozabadi and K Volz
- 454 *Smart EPU: SPA Getting Intelligent*; Y Deng, F Grollios, H Kohr, B van Knippenberg, M Janus and F Caglar
- 456 *Dual source X-ray and electron SEM system: Elemental mapping of an Epithermal gold-bearing sample from Karangahake, New Zealand*; A Menzies and S Boehm
- 462 *Tool Readiness for TEM*; S Aerts
- 464 *A Deep Learning Approach to Retrieving 3D Structure Information from High Resolution Time-Resolved TEM Images*; R Manzorro, M Leibovich, J Vincent, S Mohan, D Matteson, C Fernandez-Granda and P Crozier
- 466 *Superior Neural Network for Distinguishing Between Atomic Species*; MH Leth Larsen, WB Lomholdt, AS Dreisig, S Helveg, O Winther, T Hansen and J Schiøtz
- 470 *Automated Experiment in SPM: Bayesian Optimization for efficient searching of parameter space to maximize functional response*; R Vasudevan, K Kelley, J Hinkle, H Funakubo, S Kalinin, S Jesse and M Ziatdinov
- 472 *Lossless Deep Image Compression at the Edge for 3D Electron Microscopy*; J Hinkle, T Young, I Haque, C Reid and O Ovchinnikova
- 474 *A hybrid image retrieval system for microscopy images*; W Jiang, E Schwenker, T Spreadbury, O Cossairt and MKY Chan
- 478 *Making the Stitching Process of Montaged SEM Images Automatic Using Fourier Transform Properties*; N Khoonkari, C Anand and N Bassim

Microscopy and Microanalysis of Biomineralized and Biomimetic Materials and Structures

- 482 *Determining the structure of the seminal biomineral/protein interface by cryo-EM*; G Abelya, G Davidov, R Zalk, R Zarivach and GA Frank
- 484 *Molecular structure characterization of extracted cellulose from different apple cultivars by transmission electron microscopy*; LE Rojas Candelas, J Chanona-Pérez, J Hernández-Varela, C Kisielowski and H Calderon
- 488 *Development of a porous titanium-base biomaterial with modulus of elasticity close to that of bone structure*; K Rivera, C López, R Pérez, D Lardizabal-Gutiérrez, J Herrera-Ramirez and C Carreño-Gallardo

490 *In Situ Graphene Liquid Cell Investigation of Metal Ion Modifiers of Calcium Oxalate*; L Sorokina, A Phakatkar, R Shahbazian-Yassar and T Shokuhfar

Biological Sciences Symposia

3D Structures: From Macromolecular Assemblies to Whole Cells (3DEM FIG)

- 494 *Application of the scanning ion-conductance microscopy (SICM) in study of voriconazole impact on Candida parapsilosis surface structure*; N Savin, V Kolmogorov, R Timoshenko, A Vaneev, A Iakovlev, O Suchalko, N Grammatikova, I Levshin, N Klyachko, Y Parkhomenko, S Salikhov, A Majouga, A Erofeev, P Gorelkin and Y Korchev
- 496 *Scanning ion-conductance microscopy methods for studying local mechanical properties of living cells*; A Iakovlev, N Savin, O Suchalko, V Kolmogorov, P Gorelkin, A Erofeev and P Novak
- 500 *Cell stiffness and ROS level alterations in living neurons mediated by β -amyloid oligomers measured by scanning ion-conductance microscopy*; O Suchalko, R Timoshenko, A Vaneev, V Kolmogorov, N Savin, N Klyachko, E Barykin, L Gorbacheva, G Maksimov, S Kozin, A Erofeev, Y Korchev, P Novak, C Edwards, A Majouga, A Makarov and P Gorelkin
- 504 *Scanning probe microscopy investigation of the bacteriophage effect on bacterial biofilms*; E Dubrovin, N Kuzmina, E Varlamova, V Kolmogorov, P Gorelkin, A Erofeev, A Popova and O Batishchev
- 508 *Atomic force microscopy of the nucleolus of Ginkgo biloba*; ML Segura-Valdez, AP Mendoza von der Borch, S de J Cruz-Gómez and LF Jiménez-García
- 510 *Investigating Role of Ferritin in Ex Vivo Erythropoiesis by Block-face SEM and STEM-EELS*; M Aronova, S-J Noh, G Zhang, C Byrnes, E Riehm Meier, Y Kim and R Leapman
- 514 *Fast Method for Estimating Stain Density in Electron Microscopy of Conventionally Prepared Biological Specimens*; R Leapman, A Fera, G Zhang and Q He
- 520 *Oxygen PFIB/SEM tomography of Biological Samples*; D Slamková
- 524 *Enabling a Paradigm Shift in CryoEM Sample Preparation with chameleon*; MC Darrow, T Booth, JP Moore, K Doering, P Thaw and RS King
- 526 *Through-grid wicking enables high-speed cryoEM specimen preparation*; YZ Tan and J Rubinstein
- 530 *Optimizing Preparation of Graphene Oxide Grids for Cryo-EM*; G Grandinetti and Y Narui
- 532 *Crystalline Ice: Not all bad!*; L Koepping, A Bondy and M Su
- 538 *Equiatomic Ti-Cu alloys synthesized by powder metallurgy and melting techniques*; N Perez-Morales, I Estrada-Guel, A Torres-García, M Rocha-Rubio, JF Hernández-Paz, CA Rodríguez-González and CD Gómez-Esparza
- 540 *A series of Ti-Hf-Sn-Ta alloys produced in solid-state as prospective biomedical materials*; KO Núñez-Acosta, I Estrada-Guel, A Torres-García, M Rocha-Rubio, JF Hernández-Paz, CA Rodríguez-González and CD Gómez-Esparza

- 542 *Capsules with Concentric Biopolymer-Nylon Shells Imaged by Cryo-FIB/SEM*; SN Subraveti, W-A Chiou, J Rao and S Raghavan
- 546 *Evaluation of the penetrating ability of a perspective copper-containing drugs into cells using an electro-chemical nanocapillary-based sensor*; R Timoshenko, A Vaneev, N Savin, N Chmelyuk, O Krasnovskaya, A Savchenko, A Majouga, P Gorelkin, Y Korchev and A Erofeev
- 550 *Study of Biocompatibility, Mechanical Properties and Microstructural Analysis of Ag-Pd Alloy*; J Vaswani-Reboso, N Florido-Suarez, P Socorro-Perdomo and J Mirza-Rosca
- 554 *Photodynamic antibacterial action of guanidine and biguanidine derivatives of chlorin e6*; M Sokolova, A Ignatova, P Ostroverkhov, A Mironov, M Grin and A Feofanov

Multi-Modal Multi-Dimensional Microscopy

- 558 *High-throughput imaging of biological samples with Delmic's FAST-EM*; J Fermie, W Zuidema, R Šejnoha, A Wolters, B Giepmans, J Hoogenboom and P Kruit
- 562 *Exploring in-situ viral infection with multi-modal cryogenic correlative FLM-FIB/SEM/Cryo-ET for vitrified mammalian cells*; J Yang, M Larson, J Kim and E Wright
- 566 *Correlative Light and Electron Microscopy for the Study of the Structural Arrangement of Bacterial Microcrystalline Cellulose Microfibrils*; A Williams, M Babi, M Reid, K Grandfield, J Moran-Mirabal and N Bassim
- 570 *Correlative quantitative nanomechanical mapping and confocal imaging of living cells by scanning ion-conductance microscopy*; V Kolmogorov, N Savin, A Iakovlev, A Vaneev, Y Efremov, S Lavrushkina, H Lopatukhina, A Erofeev, N Klyachko, I Kireev, A Majouga, C Edwards, P Novak, Y Korchev and P Gorelkin
- 572 *A Multipronged Microscopy Approach Identifies Common Anti-Arrhythmic Strategy for Atrial Fibrillation and Myocardial Infarction*; L Mezache, G Nuovo and R Veeraghavan
- 574 *Microstructural characterization of the Ti-30Nb-6Sn alloy synthesized by mechanical alloying*; E Jiménez, L Béjar, C Aguilar, I Alfonso and O Hernandez

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

- 578 *Investigations the Electronic Structure in Monoclinic phase Gadolinium Sesquioxides by Electron Energy Loss Spectroscopy*; S-C Liou, C-H Kuo and G-J Shu
- 582 *High Resolution Images of High Entropy & Multi-Metallic Nano Particles*; A Lehr, M Yacaman, J Velazquez Salazar and J Sanchez

- 586 *Complex Dielectric Function via the Kramers-Kronig Analysis in the Valence Electron Energy-Loss spectrum for ZnTiO₃*; J Pantoja-Espinoza, G Herrera-Perez, C Ornelas-Gutiérrez, J Uribe-Chavira, M Meléndez-Zaragoza, J Salinas-Gutiérrez, A López-Ortiz and V Collins-Martínez
- 588 *Complex Dielectric Function and Optical Properties for the Perovskite BCZT via VEELS-STEM*; G Herrera-Perez, C Ornelas-Gutiérrez, S Marungo-Ramirez, A Reyes-Rojas and L Fuentes-Cobas
- 590 *Bandgap and Complex Dielectric Function from the Low-Loss Energy Spectrum for SnO₂ Prismatic Nano-Rods*; J Morales-Mendoza, G Herrera-Perez, C Ornelas-Gutiérrez and F Paraguay-Delgado
- 592 *Vibrational Spectroscopy of Beam-Sensitive Materials in the Transmission Electron Microscope*; A Reifsnnyder, S Zhang, Y Wu and D McComb
- 596 *Correcting STEM distortions in atomically resolved elemental maps*; P Potapov, A Lubk, M Kamp, M Stuebinger, R Claessen and M Sing
- 600 *Combining ADF-EDX scattering cross-sections for elemental quantification of nanostructures*; Z Zhang, A De Backer, I Lobato, S Van Aert and P Nellist
- 604 *Towards quantitative elemental mapping across interfaces by combining momentum-resolved STEM and EDX*; M Cattaneo, K MacArthur, J Barthel and K Müller-Caspary
- 608 *Intrinsic Helical Twist and Chirality in Ultrathin Tellurium Nanowires*; A Londono-Calderon, D Williams, B Savitzky, C Ophus, S Ma, H Zhu, M Schneider and M Pettes
- 610 *Optimizing STEM Optics for EELS of Amorphous and Crystalline Materials in Semiconductors*; A Shah and Y Rangel
- 612 *The time-of-flight (ToF) analysis of transmitted electrons at energies of hundred of eV for pure elements*; I Konvalina, M Zouhar, B Daniel, A Paták, J Piños, L Frank, I Müllerová and E Materna Mikmeková
- 616 *Emerging Opportunities in STEM to Characterize Soft-Hard Interfaces*; S Ribet, A Murthy, E Roth, X Hu, R dos Reis and V Dravid
- 620 *How many detector pixels do we need for super-resolution ptychography?*; X Zhang, Z Chen and D Muller
- 624 *Study of sodium metal plasmon using electron energy loss spectroscopy*; S Yang and P Crozier
- 626 *High-Throughput Intelligent Analysis of High and Low-Loss EELS*; C Gadre, X Yan, C Addiego and X Pan
- 630 *In-Situ Spectrum Imaging with Synchronized and Automated Stimulus Control*; L Spillane, B Miller, B Schaffer, P Thomas and R Twisten

Emerging Low-Dimensional Nanomaterials and Their Heterostructures

- 634 *Commissioning and Calibration of a Photoemission Electron Microscope*; F Niefind and S Pookpanratana

- 636 *Correlative Electron Microscopy Enables Scalable Characterization of 2D half-van der Waals Heterostructures*; H El-Sherif, N Briggs, J Robinson and N Bassim
- 640 *Atomic Scale Investigation of Interfaces in MoS₂-ReS₂ In-plane Heterostructures Using High Resolution S/TEM*; S Bachu, L Stanton, C Qian, D Reifsnnyder Hickey and N Alem
- 642 *Characterisation and Defect Analysis of 2D Layered Ternary Chalcogenides*; T Simonian, A Roy, V Nicolosi and Z Sofer
- 644 *Atomic Study on Defects in 2D PtSe₂ Monolayers Using Electron Microscopy*; J Chen and J Warner
- 646 *Investigation of Oxide Phases of MoS₂: van der Waals Epitaxially Formed α -MoO₃ on MoS₂*; A Yoon and Z Lee
- 648 *Engineering vertical heterostructure of Bi₂Se₃-VSe₂: A novel wet chemical synthetic approach*; N Goyal, R Rai, R Ram and N Ravishankar
- 650 *Si@MoS₂ Core-Shell Architecture: Characterizations and Implications for Nanophotonic Applications*; Y-S Lee, J DiStefano, R dos Reis and V Dravid
- 654 *In-situ TEM Studies of Structural Modification in WS₂ during Intercalation of Li and Na*; M Singh, C Ghosh, S Parida, MT Janish, P Kotula, A Doble, A Dongare and CB Carter
- 658 *Atomic-resolution in-situ cooling study of functionally terminated 2D transition metal carbides.*; F Lagunas, C Zhou, D Talapin and R Klie
- 662 *Identification of nanoscale localized strain in 2D transition metal dichalcogenide hybrid architectures through scanning transmission electron microscopy*; T Brintlinger, T Chowdhury and T Kempa
- 666 *Anion exchange method to synthesize layered materials and heterostructures*; RK Rai, R Ram and N Ravishankar
- 670 *Colloidal synthesis of MoSe₂, WSe₂ and their hierarchical structures as bifunctional electrocatalysts*; RK Rai, B Sarkar, R Ram and N Ravishankar
- 674 *Controlling morphology and crystal structure of tungsten nitride nanomaterials*; O Wenzel, V Rein, M Hugenschmidt, C Feldmann and D Gerthsen
- 678 *Tungsten oxide nanowires locally grown on suspended carbon fibers*; A Salazar, A Faudoa-Arzate, A Montesinos-Castellanos, P-R Realyvazquez-Guevara and SO Martinez-Chapa
- 684 *Cryogenic Transmission Electron Microscopy Investigation of Carbon Nanothreads*; D Reifsnnyder Hickey, S Juhl, A Biswas, E Elacqua, V Crespi, T Strobel and N Alem

Quantum Materials Probed by High Spatial and Energy Resolution in Scanning/Transmission Electron Microscopy

- 686 *Influence of primary beam energy on localized surface plasmon resonances mapping by STEM-EELS;* M Horák and T Šikola
- 690 *Probing the dynamics of ferroelectric topological oscillators with the electron beam;* Y-T Shao, Y Nahas, P Sergei, S Das, R Xu, S Chandrika, KP Harikrishnan, H Hwang, R Ramesh, L Bellaiche and D Muller
- 694 *Measuring the Mean Inner Potential Of Bernal Graphite Using Off-axis Electron Holography;* A Auslender, G Levi, V Ezersky, S Gorfman, O Diéguez and A Kohn
- 698 *Three dimensional vectorial imaging of surface phonon polaritons;* X Li, G Haberer, U Hohenester, O Stéphan, G Kothleitner and M Kociak
- 700 *How sharp are atomically sharp high- T_c La_2CuO_4 interfaces?;* Y Eren Suyolcu, Y-M Wu, G Kim, G Christiani, B Keimer, G Logvenov and PA van Aken
- 702 *Probing Phonon Polaritons Across Nanoscale Gaps;* I Bicket, C Wong, J Tefal, N Bassim and MJ Lagos
- 706 *Near-Infrared Cathodoluminescence Polarimetry of a Plasmonic Vertical Split Ring Resonator;* I Bicket, E Bellido, S Meuret, T Coenen, A Polman and G Botton
- 710 *Decoding defect ordering from ADF-STEM images of van der Waals $CrGa_2Te_7$ ferromagnetic crystals using the unsupervised machine learning algorithm;* L Miao, Y Guan, J Ning, W Xie, J Sun, Z Mao and N Alem
- 712 *Direct observation of polarization-induced two-dimensional electron/hole gases at ferroelectric-insulator interface;* H Huyan, C Addiego, C Heikes, D Schlom and X Pan

Nanoscale x-ray and Electron Microscopy Techniques and Applications in Material Science

- 714 *Synthesis and Characterization of $Sr_2Co_{2-x}Fe_xO_{5+d}$ Perovskite Oxides;* SR Ede, C Poasada, J Guffie, W Ratcliff, H Wu, S Han and Z Luo
- 716 *Maximum thicknesses of EELS log ratio thickness measurement for several elements;* M Hayashida and M Malac
- 720 *Microscopic Characterization of Eco-friendly Lokta Paper;* GM Aryal, W Ware, S Han, G George, Z Luo, KP Kandel, B Gautam and B Neupane
- 722 *Tuning the electrodeposition texture of β -Sn coatings for enhanced corrosion resistance;* A Gupta and C Srivastava
- 726 *Graphene oxide prepared by a room temperature oxidation using a green mechanochemical method;* G Tarango-Rivero, G Herrera-Perez, C Carreño-Gallardo, CG Garay-Reyes, I Estrada-Guel and R Martínez-Sánchez

- 730 *TEM Study for the Identification of Phases in Al₂₀₂₄ Alloys Cold Rolled-30%*; JC Guía-Tello, CG Garay-Reyes, HM Medrano-Prieto, G Rodríguez-Cabriales, MA Ruiz-Esparza-Rodríguez, JM Mendoza-Duarte and R Martínez-Sánchez
- 734 *Dark-field TEM study of the microstructural behavior in AZ31B/MWCNTs composites produced by the sandwich technique*; C Isaza, Y Cardona-Maya, J Rudas, C Carreño-Gallardo, J Herrera-Ramirez and J Meza
- 738 *Estimating illumination coherence width from focused-probe intensity profiles*; A Zjajo, I Matzkevich, A Rezikyan, H Du and R Dunin-Borkowski
- 742 *Characterizing the Back-Contact Interface of Poly-Crystalline Cd(Se)Te Devices with XEDS, EELS, and HRSTEM*; J Farrell, A Bothwell, M Jamarkattel, M Heben, J Sites and R Klie
- 746 *Optimized Amplitude-Dividing Beam Splitter Gratings for 4D STEM Holography*; A Ducharme, C Johnson, P Ercius and B McMorran

Analytical Sciences Symposia

Diffraction Imaging Across Disciplines

- 748 *Symmetry Analysis in Metallic Glasses by Electron Nanodiffraction*; S Huang, C Francis and P Voyles
- 754 *Multislice electron ptychography enables lattice vibration-limited resolution and linear phase-contrast imaging in thick samples*; Z Chen, Y Jiang, Y-T Shao, M Holtz, M Odstrcil, M Guizar-Sicairos, I Hanke, S Ganschow, D Schlom and D Muller
- 758 *Dose-efficient tcBF-STEM imaging with real-space information beyond the scan sampling limit*; Y Yu, K Spoth, D Muller and L Kourkoutis
- 762 *Strategies for fast and reliable 4D-STEM orientation and phase mapping of nanomaterials and devices*; J-M Zuo and X Zhu
- 764 *Unifying 3D electron diffraction and serial electron diffraction into a high-resolution, high-accuracy and high-throughput structural analysis technique*; X Zou

Advances in Focused Ion Beam Instrumentation, Applications and Techniques in and Materials and Life Sciences

- 768 *Imaging and Ion-Beam Milling of Biological Specimens with the Helium-Ion Microscope*; M Schmidt, C Bandara, M Tamisier, I Maasilta and J Byrne
- 770 *New Imaging modality for surface and sub-surface imaging using Scanning Transmission Helium Ion Microscopy*; S Tabean, S Eswara, M Mousley, O De Castro, J-N Audinot and T Wirtz
- 774 *Characterization of selective layer and biomolecules fouling in polymeric membranes for microalgae filtration applications using 3D FIB/SEM*; H Roberge, P Moreau, E Couallier and P Abellan
- 776 *Forward modeling of volume electron microscopy (vEM) of stained resin-embedded biological samples*; Y Yuan, S Clusiau, R Gauvin, C Bleck, A Phoulady, P Tavousi, S Shahbazmohamadi, N Piché and M Marsh

- 778 *Comparison of segmentation algorithms for FIB/SEM tomography of porous polymers: Importance of image contrast for machine learning segmentation*; M Čalkovský, E Müller, M Meffert, N Firman, F Mayer, M Wegener and D Gerthsen

Microscopy and Microanalysis for Real World Problem Solving

- 782 *How Many Microscopies Does It Take to Get to the Root Cause of the Fail? Sample Prep, Imaging, and In-Situ Analysis for Integrated Circuit Failure Analysis at the 14nm Node*; LC Sheridan
- 784 *Highly Accurate and Portable 3D Surface Analysis Tool (APSA) for Printed Circuit Boards (PCB) Reconstruction and Assurance*; MA Mallaiyan Sathiaseelan and N Asadizanjani
- 788 *Strain measurements in industrial applications: A case study of solder bumps in semiconductor devices*; P Nowakowski, M Ray and P Fischione
- 792 *The novel feature based inspection technique that can detect defects that can affect the deterioration of the electrical properties of semiconductor devices*; S Ryu, Y Sohn and Y Yang
- 794 *Advanced quality control scanning system for electronic materials*; N Castaneda, DJ Solanki, JK Meen, G Majkic and FC Robles Hernandez

New Frontiers in In-Situ Electron Microscopy in Liquids and Gases (L&G EM FIG Sponsored)

- 796 *Practical Aspects of Performing Quantitative EELS Measurements of Gas Compositions in Closed-Cell Gas Reaction S/TEM*; K Unocic, M Griffin, J Schaidle, S Habas, F Walden, R Unocic and L Allard
- 800 *Electron energy-loss spectroscopy for direct visualization of gas adsorption sites*; W-C Yang, C Wang and R Sharma
- 802 *Resolution Models for Energy-Filtered TEM Imaging over Thick Liquid or Amorphous Layers*; E Ortega and N de Jonge
- 804 *Development of liquid cells for high resolution imaging and chemical analysis in situ with Transmission Electron Microscopy*; J Shangguang, X Peng, S Betzler and H Zheng

Full System and Workflow Automation for Enabling Big Data and Machine Learning in Electron Microscopy

- 808 *Advances in Machine Learning Based Modeling and Control of Particle Accelerators*; A Edelen
- 810 *Aberration Corrector Tuning with Machine-Learning-Based Emittance Measurements and Bayesian Optimization*; C Zhang, Z Baraissov, C Duncan, A Hanuka, A Edelen, J Maxson and D Muller
- 814 *Aberration Measurement and Correction in Scanning Transmission Electron Microscopy using Machine Learning*; R Sagawa, F Uematsu, K Aibara, T Nakamichi and S Morishita

- 818 *Adaptive Scanning in Ptychography through Deep Reinforcement Learning*; M Schloz, J Müller, T Pekin, W Van den Broek and C Koch
- 822 *Convolutional neural network as a tool for automatic alignment of electron optical beam shaping devices*; E Rotunno, A Tavabi, P Rosi, S Frabboni, P Tiemeijer, R Dunin-Borkovski and V Grillo

Biological Sciences Symposia

3D Structures: From Macromolecular Assemblies to Whole Cells (3DEM FIG)

- 826 *Hybrid structural methods to probe atomic features of the Type III Secretion Injectisome of Pathogenic Bacteria*; N Strynadka
- 828 *Inhibition of bacterial binding through dysfunction of bacterial adhesion pili*; M Doran and E Bullitt
- 832 *Cryo-Electron Tomography of Microtubules and Granules in Mouse Platelets*; J Dickson, W Chen, J Strauss, R Li and E Wright
- 836 *Cryo-EM structure of F-actin decorated by HMM in rigor state*; A Hojjatian, D Taylor, N Daneshparvar, P Fagnant, K Trybus and K Taylor
- 840 *The Myosin II Coiled-Coil Domain Atomic Structure in its Native Environment*; H Rahmani, W Ma, Z Hu, N Daneshparvar, D Taylor, JA McCammon, T Irving, R Edwards and K Taylor

Cryo-EM at Local, Regional, and National Cryo-EM Centers

- 844 *The Scottish Centre for Macromolecular Imaging - Evaluation of the JEOL CryoARM 300 and Direct Electron DE64 combination for automated cryoEM in a national cryo-EM centre*; D Bhella and J Streetley
- 846 *A modular 100 keV vacuum sealed FEG for high resolution electron microscopy*; M El-Gomati, T Wells, X Zha, R Sykes, R Henderson, C Russo and G McMullan
- 848 *Challenges of offering cryo-EM services to National and International users during an extended lockdown period.*; L Renault
- 850 *CU-Boulder Center for Cryo-Electron Microscopy (CCET)*; A Hoenger

Frontiers in Fluorescence Lifetime and Super-resolution Imaging of Biological Structures and Dynamics

- 852 *High-Throughput Super-Resolution Microscopy for Reconstructing Molecular Architecture*; S Manley

- 854 *Visualization of nanostructural dislocations in microcrystalline cellulose fibrils through super-resolution fluorescence microscopy*; M Babi, A Palermo, T Abitbol, A Fatona, V Jarvis, A Nayak, E Cranston and J Moran-Mirabal
- 858 *pixOL: pixel-wise point spread function engineering for measuring the 3D orientation and 3D location of dipole-like emitters*; T Wu, J Lu and M Lew
- 864 *Optimizing Point Spread Functions to Discern Highly Overlapping Emission Spectra*; S Fernando, J Martineau, E Jorgensen and J Gerton
- 868 *Computational Recovery of Engineered Point Spread Functions in Single Molecule Localization Microscopy using the Double Helix 3DTRAX Software*; S Gaumer, W Colomb, A Loiacono, L Kimerling and A Agrawal

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

- 872 *Probing Properties of Nanomaterials with Advanced Electron Energy-Loss Spectroscopy*; P Crozier, J Vincent, K Venkatraman, Y Wang and S Yang
- 876 *Thermometry of Nanoparticles: Technique, Pitfalls and Challenges*; B Sapkota, P Parajuli, S Ogut and R Klie
- 880 *Nanoparticle Chains for Plasmonic Band Engineering*; J Schultz, D Schletz, P Potapov, AM Steiner, J Krehl, T König, M Mayer, A Lubk and A Fery
- 884 *STEM-EELS Analysis of High Entropy Oxide Nanoparticles*; A Phakatkar, R Shahbazian-Yassar and T Shokuhfar
- 888 *Coupling of Photonic and Plasmonic Modes in Oxide and Supported Metal Nanoparticles: Finite Element Simulation and EELS Study*; Y Wang and P Crozier

Emerging Low-Dimensional Nanomaterials and Their Heterostructures

- 892 *Unidirectional Assembly on Distorted Two-Dimensional Crystal Substrates*; K Kim, Y Lee, S Lee and M Jang
- 894 *S/TEM Characterization of Vertical Heterostructures Formed by Mono- to Multi-layer Graphene and WSe₂*; S Bachu, B Huet, D Reifsnnyder Hickey, C Qian, J Redwing and N Alem
- 896 *Two-dimensional charge order stabilized in clean polytype heterostructures*; SH Sung, N Schnitzer, S Novakov, I El Baggari, X Luo, J Gim, N Vu, Z Li, T Brintlinger, Y Liu, W Lu, Y Sun, P Deotare, K Sun, L Zhao, L Kourkoutis, J Heron and R Hovden
- 900 *Synthesis and self-assembly of one-dimensional nanostructures of a transition metal trichalcogenide*; T Pham, N Deshmukh, M Filler and F Ross
- 904 *Deep Learning Enabled Atom-by-Atom Analysis of 2D materials on the Million-Atom Scale*; C-H Lee, A Khan, D Luo, C Shi, Y Zhang, M Abir Hossain, A van der Zande, B Clark and P Huang

Defects in Materials: How We See and Understand Them

- 908 *Advances in heteroepitaxial integration of III-V and IV-VI semiconductors with electron channeling contrast imaging*; E Hughes, B Haidet, B Bonaf, J Selvidge, C Shang, J Norman, J Bowers and K Mukherjee
- 912 *Quantitative misfit dislocation characterization with electron channeling contrast imaging*; A Blumer, M Baan, Z Blumer, J Boyer and TJ Grassman
- 916 *Defect analysis of star defects in GaN thin films grown on HVPE GaN substrates*; T Ruggles, J Deitz, A Allerman, CB Carter and J Michael
- 918 *Failure Analysis in FeCo Magnetic Alloys through Electron Channeling Contrast Imaging Defect Characterization*; J Deitz, T Ruggles, P Noell, D Susan and J Michael

Quantum Materials Probed by High Spatial and Energy Resolution in Scanning/Transmission Electron Microscopy

- 920 *Structure-Transport Properties of Topological Nanowires*; J Cha
- 922 *Cryogenic Lorentz TEM study of a Berezinskii-Kosterlitz-Thouless phase transition in the quasi-two-dimensional ferromagnet K_2CuF_4 ?*; Y Togawa, T Akashi, H Kasai, G Paterson, S McVitie, Y Kousaka, H Shinada, J-i Kishine and J Akimitsu
- 924 *Tracking motion of topological defects in a stripe charge-ordered phase with continuously variable temperature cryo-STEM*; N Schnitzer, B Goodge, E Bianco, A Admasu, J Kim, S-W Cheong, I El Baggari and L Kourkoutis
- 928 *Identification of Topological Spin Textures in Frustrated Fe_3Sn_2 Magnetic System*; J Cui, H Zheng, J Watt and K He
- 930 *Innovative Electron Microscopy for Multi-Layer van der Waals Heterostructures Quantum Materials Discovery*; D Bell, C Ozsoy-Keskinbora, A Akey, A Devarakonda and J Checkelskey

Nanoscale x-ray and Electron Microscopy Techniques and Applications in Material Science

- 932 *Correlative Tomography - Bridging the length-scales through correlative X-ray and Electron Imaging*; P Withers, J Donoghue and T Burnett
- 934 *Comprehensive, multidimensional and correlative particle characterization of a saxolite and talcum compound to support the understanding of complex separation processes*; S Englisch, R Ditscherlein, O Furat, L Hansen, D Drobek, J Wirth, S Carl, T Leißner, B Apeleo Zubiri, A Weber, V Schmidt, U Peucker and E Spiecker

- 938 *A scale-bridging study of the influence of TCP phases on the mechanical properties of an additive manufactured Ni-base superalloy combining microcompression testing, X-ray nanotomography and TEM*; M Sommerschuh, J Wirth, S Englisch, T Przybilla, B Apeleo Zubiri, J Pistor, B Merle, C Körner, M Göken and E Spiecker
- 944 *Correlative Zernike phase contrast X-ray nanotomography to determine the distribution and orientation of graphite particles in a carbon fiber reinforced epoxy resin for improved thermal conductivity*; S Carl, S Englisch, J Wirth, B Apeleo Zubiri, S Bard, V Altstädt and E Spiecker
- 948 *In-situ Gold-Silicon Eutectic Mixture Formation*; D Veghte, C Goodwin and J Ranney

Investigating Phase Transitions in Functional Materials and Devices by In Situ/Operando TEM

- 952 *Recovery of long-range order in two-dimensional charge density waves at high temperatures*; SH Sung, YM Goh, N Schnitzer, I El Baggari, K Sun and R Hovden
- 956 *Direct observation of reversible oxygen migration and phase transitions in ferroelectric $\text{Hf}_{0.5}\text{Zr}_{0.5}\text{O}_2$ thin-film devices*; P Nukala, M Ahmadi, S de Graaf, BJ Kooi, B Noheda, H Zandbergen and Y Wei
- 960 *Tracking quantum phase transitions with continuously variable temperature cryo-STEM*; E Bianco, N Schnitzer, B Goodge, I El Baggari, M Smeaton and L Kourkoutis
- 962 *Intelligent Microscopy: A Path Toward Tailored Materials at the Atomic Scale*; M Taheri, J Hart and C Pate

Microscopy & Spectroscopy of Energy Conversion and Storage Materials

- 964 *Designing Atomic Edge Structures in 2D Transition Metal Dichalcogenides for Improved Catalytic Activity*; R Unocic, X Sang, G Hu, V Fung, M Boebinger, K Xiao and P Ganesh
- 966 *The atomic-scale microstructure of metal halide perovskite elucidated via low-dose electron microscopy*; M Rothmann, J Kim, J Borchert, K Lohmann, C O'Leary, A Sheader, L Clark, H Snaith, M Johnston, P Nellist and L Herz
- 970 *Quantifying the local structure of incommensurately modulated tetragonal tungsten bronze from STEM images*; S Funni, M Cabral and E Dickey
- 974 *Elucidating fuel cell catalyst degradation mechanisms by identical-location transmission electron microscopy*; H Yu, M Zachman, D Myers, R Mukundan, H Zhang, P Zelenay, K Neyerlin and D Cullen
- 978 *Multiple ADF-STEM Towards the Optimization of Electron Tomography Reconstructions of Pt/C fuel cell catalyst nanostructures*; A da Silva, T David, Z Saghi and L Guetaz

Advanced Application of Atom Probe Tomography: Specimen preparation, Instrumentation, and Data analysis

- 982 *Developing cryogenic and vacuum transfer capabilities at the Australian Centre for Microscopy and Microanalysis*; I McCarroll, L Tegg, L Daly, T Sato and J Cairney
- 984 *Nanoscale Chemical Imaging in Zeolite Catalysts by Atom Probe Tomography*; J Poplawsky, S Van Vreeswijk, J Schmidt, M Monai, F Zand and B Weckhuysen
- 986 *In Situ Atom Probe Tomography Study of The Influence of Deformation on Early Stages of Oxidation of Fe18Cr10Ni Alloy*; A Devaraj, S Lambeets, M Olszta, T Liu, J Silverstein and D Perea
- 990 *The effect of laser energy on the measurement of oxide stoichiometry of Co₂FeO₄ nanoparticles by atom probe tomography*; T Li, W Xiang and A Bala Krishnan

Analytical Sciences Symposia

Diffraction Imaging Across Disciplines

- 992 *Wide Dynamic Range, 10 kHz Framing Detector for 4D-STEM*; H Philipp, M Tate, K Shanks, L Mele, M Peemen, P Dona, R Hartong, G van Veen, YT Shao, S Gruner, J Thom-Levy and D Muller
- 994 *High-Fidelity 4D-STEM Enabled by Live Processing at 15'000 Detector Frames Per Second*; B Haas, A Mittelberger, C Meyer, B Plotkin-Swing, N Dellby, O Krivanek, T Lovejoy and C Koch
- 998 *Low-Cost Direct Electron Detection in the SEM for EBSD and ECCI*; J Tessmer and M De Graef
- 1000 *Leveraging Hybrid Pixel Electron Detection Technology to Expand Electron Microscopy Observation of Material Structures at low Voltages*; A Pakzad and R dos Reis
- 1004 *An Ultrafast Direct Electron Camera for 4D STEM*; D Chatterjee, J Wei, A Kvit, B Bammes, B Levin, R Bilhorn and P Voyles

Advances in Focused Ion Beam Instrumentation, Applications and Techniques in and Materials and Life Sciences

- 1008 *Multimodal characterisation on FIB instruments combining nano-scale SIMS and SE imaging*; T Wirtz, O De Castro, HQ Hoang, L Cressa, S Eswara, A Biesemeier and J-N Audinot
- 1012 *Combined focused ion beam and secondary ion mass spectrometry for high resolution light element detection applied on Li-ion batteries*; G Wilhelm, U Golla-Schindler, K Wöhrle, C Geisbauer, G Cooke, T Bernthaler and G Schneider
- 1016 *Is the Helium Ion Microscope (Ne) suitable for EBSD sample preparation?*; A Wolff
- 1018 *Nanocrystalline Diamond Grids for FIB Specimen Preparation and S/TEM Analytics*; L Giannuzzi, N Moldovan, J Trindell and J Sugar

1020 *In-situ Correlative Analysis of electrical and magnetic properties of Ion-beam treated surfaces by combination of AFM and FIB*; C Schwalb, J Hütner, H Frerichs, M Wolff, R Winkler, S Andany, P Hosemann, G Hlawacek, G Fantner and H Plank

1022 *The virtual FIB: Simulating 3D in situ lift-out for visualization and technique development*; A Mosberg

Microscopy and Microanalysis for Real World Problem Solving

1026 *Use of Full-Field X-ray Imaging and Ptychographic X-ray Computed Tomography for the Investigation of 3D Morphology of Micro-Nano Silver Materials for Advanced Electronics Packaging Applications*; Y-C Lin, X Liu, K Chou, EHR Tsai, C Zhao, M Holler, A Diaz, S Petrash, YK Chen-Wiegart and W-K Lee

1028 *Micro Computed Tomography Analysis of Four-Way Conversion Catalysts using Artificial Intelligence-Enabled Image Processing*; R Palomino, K-B Low, C Ji, I Petrovic, F Waltz and T Schmitz

1030 *Multi-Energy X-Ray Computed Tomography for Source Rock Characterization*; A Korolkovas, S Yoon, A Katsevich, S Eichmann, Q Sun, M Frenkel, G Eppler and J Chen

1032 *Metal Foams: Linking Dynamic CT Results to Simulation and Modeling*; A Grießer, M Hümbert, S Rief, W De Boever and L Hunter

1034 *Dynamic X-ray micro-CT insights of the recovery of ore bodies in presence of clay*; J Dewanckele, W De Boever, A Grießer, Y Wang and F Meng

New Frontiers in In-Situ Electron Microscopy in Liquids and Gases (L&G EM FIG Sponsored)

1036 *Developing near-atomic-scale chemical analysis in liquid-phase S/TEM to study high capacity battery anodes*; R Serra Maia, E Detsi, J Corsi, M Wang, J Pikul and E Stach

1040 *Beam-induced heating at low electron fluxes during liquid phase transmission electron microscopy*; B Fritsch, A Hutzler, M Wu, L Vogl, MPM Jank, M März and E Spiecker

1044 *In-situ Liquid Electrochemical TEM Investigation of Semi Solid-State LMNO Micro-Battery*; A Bhatia, M Hallot, S Cretu, N Folastre, M Berthe, D Troadec, P Roussel, J-P Pereira-Ramos, R Baddour-Hadjean, C Lethien and A Demortière

1048 *The effect of interfaces in liquid phase electron microscopy from an empirical viewpoint*; P Abellan and J LaVerne

Advances in Analytical STEM-in-SEM

1050 *STEM-in-SEM: A Re-Emerging Material Measurement Approach*; R Keller

1052 *Combining in situ heating with transmission diffraction and imaging in SEM for investigation of early stages of solid-state dewetting*; P Denninger, P Schweizer, T Schwoppe, C Dolle and E Spiecker

- 1056 *Analysis of superconducting thin films in a modern FIB/SEM dual-beam instrument*; L Grünewald, D Nerz, M Langer, S Meyer, N Beisig, P Cayado, R Popov, J Hänisch, B Holzapfel and D Gerthsen
- 1060 *STEM-tomography in SEM*; L Han, M Boese, B Tordoff, M Andrew and E Drake
- 1062 *NanoMi Open Source (S)TEM Platform: Initial SEM Implementation*; M Malac, K Kumar, D Wen, JA Marin-Calzada, M Cloutier, M Salomons, D Homeniuk, S Chen, J Pitters, D Vick, D Price, M Hayashida and R Egerton

Vendor Symposium

- 1064 *5D-STEM: Live processing and display at 15,000 diffraction patterns per second*; A Mittelberger, B Haas, B Plotkin-Swing, C Meyer, N Dellby, L Piazza, O Krivanek, C Koch and T Lovejoy
- 1066 *Spectra optimizes the use of electron dose*; E Van Cappellen, C Maunders, I Kieft, M Bischoff, F Van Uden, M Ovsyanko, B Markus, R Krijnen, C Ozsoy-Keskinbora, B Freitag, C Smit, V Altin and R Geurink
- 1068 *A New Spectroscopic Imager for X-rays from 0.5 keV to 150 keV Combining a Fully Depleted pnCCD Coupled to a Columnar CsI(Tl) Scintillator with Fano Limited Energy Resolution and Deep Subpixel Spatial Resolution*; L Strueder
- 1070 *Strategies for Multimodal Analysis of Joint EELS and EDS Data*; R Twesten, J Rafaelsen, L Spillane and P Thomas
- 1074 *EELS Workshop: a Real-World Application of the Enabler Framework*; M Kundmann
- 1078 *Developments in sample preparation of advanced semiconductor devices from the bulk to nanometer-length scales*; C Bonifacio, C Downing, P Nowakowski, R Li, M Ray and P Fischione

Data Management, Version Control, and Multiformat Analysis in Electron Microscopy

- 1082 *Challenges and opportunities for data management and collaborative analysis in shared electron microscopy facilities*; J Sugar
- 1084 *Centralizing digital resources for data management, processing, and analysis for enterprise scale imaging research*; M Gendron, J-F Fontaine, B Provencher, E Yen, N Piché and M Marsh
- 1086 *Probelab ReImager: A Multi-Platform, Open Source Software for Electron Image and X-ray Map Visualization and Customization*; M Kraft and A von der Handt
- 1090 *Towards the Development of a Multi-Modal Community-Based AM Database*; R Casukhela, S Vijayan, M Jacobsen, J Fourman, K Hepler, M Shao, A Gupta and J Jinschek
- 1092 *The evolution of an open source file format: a version control story*; B Savitzky, S Zeltmann, L Rangel DaCosta, P Ercius, M Scott, A Minor and C Ophus

Unresolved Challenges in Quantitative X-ray Microanalysis

- 1096 *Electron probe microanalysis of transition metals using L-lines: the effect of self-absorption*; X Llovet, A Moy and J Fournelle
- 1098 *Universal Mean Atomic Number curves for EPMA calculated by Monte Carlo simulations*; A Moy, A von der Handt, J Fournelle, W Nachlas and J Donovan
- 1102 *Use of spectrum simulation to optimise collection parameters for accurate and efficient WDS and EDS quantitative analyses*; P Pinard, R Jones, S Burgess and P Statham
- 1106 *Using DTSA-II Tools for Electron-Excited X-ray Microanalysis of Thin Films*; D Newbury, N Ritchie, C Tarrío and R Berg
- 1108 *Abilities Towards Improved Accuracy in EPMA*; F Eggert

Biological Sciences Symposia

3D Structures: From Macromolecular Assemblies to Whole Cells (3DEM FIG)

- 1112 *Neutralizing antibodies against coronaviruses*; P Bjorkman
- 1114 *The role of the ASPL-TFE3 fusion protein in Alveolar Soft Part Sarcoma*; S Wang, A Pozner, M Neison, K Jones and P Shen
- 1118 *Cryo-EM reveals architecture and domain interactions of putative tumor suppressor ALDH1L1, a product of natural fusion of three unrelated genes*; Y Tsybovsky, V Sereda and S Krupenko
- 1120 *Cryo-EM structure of the bullet-shaped GroEL-GroES complex at 3.6 Å resolution*; E Pichkur, S Kudryavtseva, I Yaroshevich, V Muronetz, O Sokolova and T Stanishneva-Konovalova
- 1122 *Structural determination of the Dicer-2•R2D2 complex*; H Donelick, P Shen and B Bass

Michael Rossmann Memorial Symposium

- 1126 *Structural biology of large molecular complexes - what we learned from the master*; H Wu
- 1128 *Structure of the capsid size-determining scaffold of "satellite" bacteriophage P4*; J Kizziah, C Rodenburg and T Dokland
- 1130 *HBV Core-Directed Antivirals and Importin β Can Synergistically Disrupt Capsids*; C Kim, C Schlicksup, L Barnes, M Jarrold, A Patterson, B Bothner and A Zlotnick
- 1132 *Quaternary epitope landscape of Zika virus antibody complexes*; M Sevvana and R Kuhn

1134 *Structure determination of the mature Usutu SAAR-1776 virus using single particle cryo-electron microscopy*; B Khare, T Klose, Q Fang, M Rossmann and R Kuhn

Challenges and Advances in Electron Microscopy Research and Diagnosis of Diseases in Humans, Plants and Animals (FIG associated)

1136 *DeepSerialBlockFace: Machine denoising and object segmentation for volume electron microscopy*; C Sabanayagam, W Treible, J Ross and J Caplan

1138 *MAP-2 as an early marker of hippocampal damage after perinatal asphyxia and neuroprotective properties of Palmitoylethanolamide.*; F Capani, L Udovin, T Kobiec, C Menendez, TU Nicolas, C Kusnier, M Otero-Losada and MI Herrera

1140 *Utility of scanning electron microscopy backscatter imaging for serial-sections reconstruction and postembedding immunogold detection of vesicular glutamate transporter 1 (VGLUT1) in the presynaptic terminals of the cingulate cortex*; C Clarkson-Paredes, C Brantner and A Popratiloff

1142 *Electron microscopy explorations of the human brain: using immunofluorescence to address challenges*; K Micheva, M Perez, A Simhal, R Weinberg and D Madison

To Fix or Not To Fix? A Question for Biological Samples

1144 *“To fix, or not to fix” Biological Specimens at a Multi-User Electron Microscopy Facility*; D Grant and T White

1146 *Bot-graphy: an original technique for plant anatomy study based on metallography*; R Montero, F Gomez, L Setten, E Favret and D Torres

1148 *To fix or not fix biofilms to study microbial soil aggregation*; Y Zhang, J Son, Q Huang, W Chen and X-Y Yu

1150 *To Fix Or Not To Fix*; E Humphrey

Cryo-EM at Local, Regional, and National Cryo-EM Centers

1152 *High Resolution Data Collection at S2C2, a National CryoEM Center*; C Hecksel, K Zhang, G Pintilie, P Mitchell, Y-T Li and W Chiu

1156 *Real-time cryo-EM structure determination*; A Punjani

1158 *Accurately measuring ice thickness quickly and quantitatively on a screening TEM*; H Brown and E Hanssen

1162 *Cryo Electron Microscopy at the Bio21 Ian Holmes Imaging Center and in the wider Australian microscopy community*; E Hanssen

Frontiers in Fluorescence Lifetime and Super-resolution Imaging of Biological Structures and Dynamics

- 1164 *Real-Time 3D Super-Resolution Fluorescence Lifetime Imaging Microscopy, in vivo*; S Howard
- 1166 *Fluorescence lifetime imaging microscopy of early C. elegans embryo development*; R Datta, K Tweed and M Skala

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

- 1168 *Electron effective mass determination across a β -(Al_{0.2}Ga_{0.8})₂O₃// β -Ga₂O₃ interface by Kramers-Kronig analysis*; A Chmielewski, JC Idrobo, Y Zhang, A Mauze and N Alem
- 1170 *Understanding transition metal dichalcogenide absorption line widths in electron energy loss spectroscopy*; F Shao, SY Woo, N Wu, AJ Mayne, R Schneider, S Michaelis, A Arora, B Carey, J Preuß, R Bratschitsch and LHG Tizei
- 1174 *Probing Electronic Structures of Monolayer WSe₂ Stacked with hBN Using Correlative Cathodoluminescence and Electron Energy-Loss Spectroscopy*; W-C Yang, H-J Chuang, M Rosenberger, K McCreary, B Jonker and R Sharma
- 1178 *Examining Defect Creation at Interfaces in Electrocatalytically Cycled LaFeO₃-SrTiO₃ Thin Films*; B Matthews, K Yano, S Taylor, M Sassi, R Paudel, A Burton, B Farnum, R Comes and S Spurgeon
- 1180 *Denoising STEM Electron Energy Loss Spectra using Convolutional Autoencoders*; M Oxley, M Ziatdinov and S Kalinin
- 1184 *The oxidation state of Ti in hibonite at the atomic scale*; P Zanetta, Y-J Chang, T Ramprasad, V Manga, J Weber and T Zega

Defects in Materials: How We See and Understand Them

- 1188 *STEM-based analysis of functional defects in ferroelectric ErMnO₃*; ATJ van Helvoort, A Mosberg, U Ludacka, TS Holstad, DM Evans and D Meier
- 1190 *Space- and Angle-Resolved Vibrational Spectroscopy to Probe the Local Phonon Modes at Planar Defects*; X Yan, C Gadre, T Aoki, T Lovejoy, N Dellby, O Krivanek and X Pan
- 1194 *Measuring NV Centers in Diamond Nanoparticles using Electron Energy Loss Spectroscopy*; S Chang, H Wen, D Kordahl and C Dwyer
- 1196 *Combined iDPC and EELS analyses for quantifying oxygen vacancy concentration in LSMO*; A Penn, S Koohfar, D Kumah and J LeBeau
- 1198 *Generation of Ruddlesden-Popper faults in Sr doped NdNiO₃*; C Yang, R Ortiz, Y Wang, D Putzky, E Benckiser, B Keimer and PA van Aken

Quantum Materials Probed by High Spatial and Energy Resolution in Scanning/Transmission Electron Microscopy

- 1202 *Exploring electronic coupling of optical and phonon excitations at the nanoscale*; JC Idrobo, A Konečná, K Reidy, E Park, P Gallina, T Šikola, F Ross and FJ Garcia de Abajo
- 1204 *Phonon Reflections from Nanostructured Interfaces Imaged by Momentum- Averaged and Resolved Vibrational EELS*; C Gadre, X Yan, Q Song, G Chen and X Pan
- 1208 *A STEM/EELS study of interfaces in delafossite-based quantum heterostructures*; S Yoon, JM Ok, M Yoon, S Yeom, T Ichiba, FA Reboledo, A Huon, AR Lupini and HN Lee
- 1210 *Electron energy loss spectroscopy of sub-10 nm 2D MoS₂ crystals*; P Kumar, J Horwath, S Anantharaman, A Meng, JC Idrobo, E Stach and D Jariwala
- 1212 *Bayesian Inference for Materials Physics from STEM Data: The Probability Distribution of Physical Parameters from Ferroelectric Domain Wall Observations*; C Nelson, R Vasudevan, X Zhang, M Ziatdinov, E Eliseev, I Takeuchi, A Morozovska and S Kalinin

Nanoscale x-ray and Electron Microscopy Techniques and Applications in Material Science

- 1216 *The interplay among compositional heterogeneity, lattice defects, micromorphology, and redox stratification in lithium-ion batteries*; Y Liu
- 1218 *Extending lab-based X-ray nanotomography of low Z and porous materials to larger sample volumes without compromising resolution*; S Englisch, J Wirth, D Drobek, B Apeleo Zubiri and E Spiecker
- 1222 *Q.U.A.I.N.T.P.E.A.X. QUantifying Algorithmically INtrinsic Properties of Electronic Assemblies via X-ray CT*; J True, N Jessurun, D Mehta and N Asadi
- 1226 *Recovering Chemistry at Atomic Resolution using Multi-Modal Spectroscopy*; J Schwartz, Y Jiang, ZW Di, T Ma, H Zheng, S Rozeveld and R Hovden
- 1230 *High-resolution X-ray source with advanced e-beam technology: pushing the resolution limitation for lab-scale NanoCT*; E Espes and A Adibhatla

Investigating Phase Transitions in Functional Materials and Devices by In Situ/Operando TEM

- 1232 *In-situ TEM irradiation induced amorphization of Ge₂Sb₂Te₅*; T Clark, E Scott, P Lu, D Adams and K Hattar
- 1236 *Temperature-Dependent Structural Evolution of Pt-Ni Nanoparticles Observed by In Situ TEM*; X Lu and K He
- 1238 *Birth of a grain boundary: In situ TEM Observation of the Microstructure Evolution in HfO₂ Based Memristors*; R Eilhardt, A Zintler, O Recalde, D Nasiou, S Petzold, L Alff and L Molina-Luna

1240 *Investigation of Phase Transformations in Ge₄Sb₄Te₅ film using Transmission Electron Microscopy*; M Singh, C Ghosh, P Kotula, B Miller, J Watt, H Silva, CB Carter

1244 *Formation and surface melting of nanoparticle superlattices in a solution*; A Kim, C Liu, E Luijten and Q Chen

Microscopy & Spectroscopy of Energy Conversion and Storage Materials

1246 *Cryogenic imaging and spectroscopic study of electrochemically formed solid interphases - from nano to meso scale.*; YS Meng

1248 *Cryo-TEM study of solid electrolyte interphases in Li-ion batteries*; M Gu

1250 *Sweeping Potential Regulated Structural and Chemical Evolution of Solid-Electrolyte Interphase on Cu and Li as Revealed by Cryogenic Transmission Electron Microscopy*; Y Xu, H Wu, H Jia, J-G Zhang, W Xu and C Wang

1254 *Direct observation of breathing phenomenon and phase transformation in Ni-rich cathode materials by in situ TEM*; W Li, I Siachos, J Lee, SA Corr, CP Grey, ND Browning and BL Mehdi

1256 *Atomic-scale mechanisms for fluorination-enhanced cycling stability of cation-disordered rocksalt cathodes*; L Li, Z Lun, D Chen, Y Yue, W Tong, G Chen, G Ceder and C Wang

Advanced Application of Atom Probe Tomography: Specimen preparation, Instrumentation, and Data analysis

1260 *A Tomographic Atom Probe laser assisted by a flexible optical system*; J Houard, A Vella, G Da Costa, I Blum, F Delaroche, C Vaudolon, F Vurpillot and L Rigutti

1262 *Evaporation-Field Differences with Deep-UV Atom Probe Tomography*; T Prosa, D Lenz, I Martin, D Reinhard, D Larson and J Bunton

1266 *An XHV atom probe with ultra-low hydrogen background*; P Felfer, B Ott, M Heller and C Macauley

1268 *3D Nanoscale Analysis of Protein-Mineral Nanoparticle Interfaces Using Atom Probe Tomography for Understanding Amelogenesis*; S Taylor, A Devaraj, Y Shin, J Tao, G Buchko, W Shaw and B Tarasevich

1270 *Graphene encapsulation enables vitreous ice sample for APT and near-atomic reconstruction of nanoparticle-liquid interface*; S Qiu, G Gervinskias, H Venugopal, R Marceau and J Fu

Analytical Sciences Symposia

Diffraction Imaging Across Disciplines

1272 *A faster image simulation algorithm for scanning transmission electron microscopy*; P Pelz, L DaCosta, AM Rakowski, M Scott and C Ophus

- 1276 *Machine Learning Based Precision Orientation and Strain Mapping from 4D Diffraction Datasets*; R Yuan, J Zhang, L He and J-M Zuo
- 1280 *Automatic Diffraction Analysis and Lattice Fitting for Convergent-Beam Electron Diffraction Patterns in 4D-STEM*; S Wang, T Eldred, J Smith and W Gao
- 1282 *Refinement of crystal structure using 'digital' large angle convergent beam electron diffraction*; R Beanland, A Hubert and R Roemer
- 1286 *Serial Electron Crystallography: New Developments for Data Collection and Analysis*; R Bückner, P Hogan-Lamarre, P Mehrabi, E Schulz, G Kassier and RJD Miller

Microscopy and Microanalysis for Real World Problem Solving

- 1290 *The use of an XRF glass database to assign a significance to forensic evidence*; R Corzo
- 1292 *Home- and Laboratory-based Microscopy of Face Covering Materials*; E Vicenzi, S Whittaker, C Zangmeister, J Radney, M Staymates and J Weaver
- 1296 *Quantitative X-ray mapping of Au-Ag ratios in native electrum from the Fire Creek epithermal vein deposit, Lander County, Nevada (USA)*; W Nachlas, L Schranz and D Rogers
- 1300 *Shining Through: Multi-Analytical Studies of the Tiffany Hartwell Memorial Window*; A McGeachy, R Sabino, E McGoey and M Walton
- 1302 *ChemiSEM: multimodal approach for faster quantitative elemental mapping*; P Wandrol, T Tuma, J Klusacek, J Petrek, EJ Vesseur and C Stephens

New Frontiers in In-Situ Electron Microscopy in Liquids and Gases (L&G EM FIG Sponsored)

- 1306 *Describing Atomic-Level Fluxional Behavior in Nanoparticles*; R Manzorro, J Vincent, D Matteson, Y Xu and P Crozier
- 1308 *In-situ ETEM observation of intergranular oxidation of copper*; X Sun, R Garza, X Chen, M Li, S House, W Saidi, J Yang and G Zhou
- 1312 *In situ Transmission Electron Microscopy for Data-driven Modeling of Nanoparticle Evolution*; J Horwath, P Voorhees and E Stach
- 1314 *Enabling Low-dose Liquid-phase TEM with Advanced Signal Processing, Machine Learning, and Molecular Simulation*; J Smith and Q Chen
- 1316 *Surface dynamics of catalytic nanoparticles in non-vacuum conditions*; T Hansen, P Liu, WB Lomholdt, MH Leth Larsen, C Núñez Valencia, J Schiøtz and JB Wagner

Advances in Analytical STEM-in-SEM

- 1318 *Characterization of Real Materials with Low Voltage STEM (30 kV): Current State and Challenges;* N Brodusch and R Gauvin
- 1322 *An accurate Monte Carlo sampler for electron elastic scattering angular distributions between 50 eV and 300 keV;* J Villarrubia
- 1324 *30 kV STEM-SEM – The Perfect Conditions for Transmission Spectroscopy?;* S Marks, P Pinard, S Jabar, G West, G Wetzel, S Burgess and C Lang
- 1328 *Getting your Scanning Electron Microscope to Perform at Atomic Resolution Levels;* A Vladoar and K Arat

Vendor Symposium

- 1330 *Thermo Scientific™ Tundra Cryo-TEM: 100kV Cryo-TEM dedicated for Single Particle Analysis;* Z Hlavenková, D Karia, M Malínský, D Němeček, F Grollios, V Doležal, O Sháněl, A Kotecha, M Červinková, L Yu and A Mulder
- 1334 *A Novel Event-Based Active Pixel Sensor for Cryo-EM Electron Counting;* B Bammes and R Billhorn
- 1338 *Falcon 4 performance validation by single event analysis;* J Keizer, G van Hoften, J Mulder and G van Duinen
- 1340 *New electron microscopy tools for characterizing air-sensitive samples;* A Shukla
- 1342 *Semi-Automated Cryo-EM Sample Loader for TEM SPA Democratization;* V Doležal, V Prajzner, M Čechmánek, Z Hlavenková, O Sháněl, S Tománek, M Červinková, D Němeček and L Yu

Data Management, Version Control, and Multiformat Analysis in Electron Microscopy

- 1344 *Physics-guided machine learning: A new paradigm for scientific knowledge discovery;* X Jia
- 1346 *Compression and Access to Arbitrary Data: The Low-hanging Fruit;* M Kraft
- 1348 *Towards Quantum Image Processing for Electron Microscopy;* R dos Reis, V Dravid and S Ribet
- 1352 *Using py4DSTEM in GMS: Hybrid Open-Source, Commercial-Freeware Methods for Analyzing 4D STEM Datasets;* B Miller, A Pakzad, B Savitzky, C Ophus and C Czarnik
- 1356 *Aizen: Automated Big Data Processing, Management and Collaboration;* A Arad, T Harris, S Harris, L Hathon, B Birnbaum and MT Myers

Unresolved Challenges in Quantitative X-ray Microanalysis

- 1358 *Dispersed Organic Matter Analysis by Fast Soft X-Ray Mapping;* C MacRae, C Delle Paine, N Wilson, A Torpy, D Dewhurst, C Davidson, K Milliken and F Mohinudeen

- 1360 *High Resolution X-Ray Spectra for Chemical Speciation in the SEM*; K Schreiber, D McNeel, K Koehler, C Smith, B Stein, G Wagner, E Bowes, L Xu, C Fontes, E Batista, P Yang, M Rabin, M Croce and M Carpenter
- 1364 *An experimental study using SXES: Evaluation and applications for a new analysis method to study the self-absorption effects of Fe L-emission*; TD Yokoyama, H Takahashi, I Ohnishi, VE Robertson and P McSwiggen
- 1368 *Fundamental aspects of SXES in the Quantification of Minerals and Materials*; N Wilson, C MacRae and A Torpy
- 1370 *Fine structures of Fe L-emission examined by a new HR-SXES instrument*; M Terauchi, R Ebisu, Y Sato and M Koike

Biological Sciences Symposia

Michael Rossmann Memorial Symposium

- 1372 *Understanding the structure and function of spliceosome through cryo-EM*; X Li, S Liu, H Zhou and R Zhao
- 1374 *ICAM-1 induced re-arrangements of capsid and genome prime rhinovirus 14 for activation and uncoating*; D Hrebik
- 1378 *Cryo-EM structural analysis of the SARS-CoV-2 Nucleocapsid protein*; M Casasanta, GM Jonaid, L Kaylor, W Luqiu, M Solares, M Schroen, W Dearnaley, J Wilson, M Dukes and D Kelly
- 1382 *CryoEM Map-Model Scores: From Average Density to Q-scores*; G Pintilie and W Chiu
- 1386 *Adding "colors" to cryo-EM: extracting local chemical data from radiation damage*; G Abelya, LJ Campanello, R Zalk and GA Frank

Challenges and Advances in Electron Microscopy Research and Diagnosis of Diseases in Humans, Plants and Animals (FIG associated)

- 1390 *Ultrastructure of immunogenic cell death in vivo*; Z Tatarova, D Blumberg, J Riesterer, C Lopez, E Stempinski, G Mills, L Coussens, O Jonas and J Gray
- 1392 *Automated & Programmable Electron Microscopy Preparation*; S Goodman
- 1396 *Attachment of Suspension Cells for TEM Processing*; S Emrich and H Chen
- 1398 *Developing and Applying a Correlative Light and Electron Microscopy Technique to Overcome Inherent Transmission Electron Microscopy Shortcomings*; J Franks, M Calderone, N Erdman, A Watson and S Watkins

To Fix or Not To Fix? A Question for Biological Samples

- 1402 *The Good, the Bad and the Ugly: Task-Specific Fixation for Connective Tissues*; D Keene and S Tufa
- 1404 *To Cryo or Not to Cryo? A Consideration of Length Scales During Macromolecule Sample Preparation*; K Parker, J Modica, C Wilke, R dos Reis, M Mrksich and V Dravid
- 1408 *Soft Microscopy of Negative Stained Soft Materials: Balancing Dose Rate and Sample Damage*; C Lescott, R dos Reis, M Modak, E Scott and V Dravid
- 1412 *What do we know about stain distribution in cells and tissue? Using EDS to determine the quantity and distribution of common EM stains*; L Hughes, I Anderson and E Johnson
- 1416 *Autofluorescence For Rapid Visualization of Plant Anatomy Among Diverse Taxa*; T Pegg, D Gladish and R Baker

Cryo-EM at Local, Regional, and National Cryo-EM Centers

- 1420 *Connected Through Imaging: Development of a National Network Cryo-Electron Tomography Centers*; E Wright, M Larson, K Thompson, J Yang, B Sibert, K Cai and J Dickson
- 1422 *User experience: Using national Cryo EM centers towards studying lipid transport across the bacterial cell envelope*; G Bhabha, D Ekiert, N Coudray, G Isom, M MacRae and R Redler
- 1424 *Cross-Training to shared standards at the national cryoEM centers using “Merit Badges”*; C Zimanyi, E Eng, C Yoshioka, S Mulligan, C Lopez, C Hecksel, M Schmid, P Mitchell, L-M Joubert, P Shen, J Iwasa, G Jensen, F Sigworth, B Gonzalez, Y Chen, W Jiang, J Dong, X Jiang and Z Chu

Frontiers in Fluorescence Lifetime and Super-resolution Imaging of Biological Structures and Dynamics

- 1426 *MINFLUX: next generation access to the nanoscale*; F Balzarotti
- 1428 *Elucidating the nanoscale architecture of amyloid aggregates using a polarized donut point spread function*; T Ding and M Lew
- 1432 *Quantitative Assessment of Cardiac Intercalated Disk Ultrastructure and Molecular Organization by Indirect Correlative Light and Electron Microscopy*; H Struckman, N Moise, C Dagher, R Veeraraghavan and S Weinberg
- 1434 *Capturing Single Molecule Dynamics: An Advanced Microscope Combining Optical Tweezers with Fluorescence Detection Modules*; J Lin, T Simpson and A Raja

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

- 1436 *Spatial Mapping of Electrostatics and Dynamics in Quantum Materials*; A Murthy, S Ribet, R dos Reis and V Dravid
- 1440 *Quantifying the projected unit cell size variation of off-axis PtCo catalyst nanoparticles through 4D-STEM*; D Mukherjee, H Yu, C Wang, J Spendelow, D Cullen and M Zachman
- 1444 *Automated mapping of the crystallographic sample orientation from diffraction patterns in momentum-resolved STEM*; M Cattaneo, K Müller-Caspary, J Barthel, K MacArthur and M Lipinska-Chwalek
- 1446 *A robust technique to image all elements in LiNiO₂ cathode active material by 4D-STEM*; S Ahmed, A Pokle, J Belz, M Bianchini, A Beyer, J Janek and K Volz
- 1450 *Improving 4DSTEM measurements of atomic charge and electrostatic potential via energy filtration*; T Pekin, M Schloz, B Haas, W Van den Broek and C Koch
- 1454 *Observation of a charged incoherent BiFeO₃/SrTiO₃ interface*; C Addiego, D Ji and X Pan

Defects in Materials: How We See and Understand Them

- 1456 *TEMImageNet, AtomSegNet and TomoFillNet, open-source libraries and models that enable defect localization in 2D and 3D atomic resolution images*; H Xin, C Manson and C Wang
- 1458 *Virtual Electron Backscatter Diffraction for Multiscale Defect Characterization*; C Zhu, D Madisetti, J El-Awady and M De Graef
- 1460 *Automatic detection of crystallographic defects in STEM images by unsupervised learning with translational invariance*; Y Guo, AR Lupini, H Cai, K Xiao, S Krylyuk, A Davydov, Q Guo and S Kalinin
- 1464 *Deep Learning-based Computer Vision for Radiation Defect Analysis: from Static Defect Segmentation to Dynamic Defect Tracking*; R Sainju, WY Chen, S Schaefer, G Roberts, M Toloczko, D Edwards, M Li and Y Zhu

Quantum Materials Probed by High Spatial and Energy Resolution in Scanning/Transmission Electron Microscopy

- 1466 *Novel insights in optical properties of nanomaterials allowed by high resolution EELS and cathodoluminescence*; M Kociak, X Li, LHG Tizei, N Bonnet, Y Auad, L Hugo, J-D Blazit, M Tencé, O Stéphan and G Haberfehlner
- 1470 *Correlative Luminescence and Absorption Spectroscopy from Monolayer WSe₂ at the Nanoscale*; S Woo, F Shao, R Schneider, A Arora, J Preuß, B Carey, S Michaelis, R Bratschitsch and LHG Tizei
- 1474 *2-Grating Inelastic Free Electron Interferometry*; C Johnson, A Turner, FJ Garcia de Abajo and B McMorrán

1478 *Imaging Hybrid Plasmon-Phonon Modes in Mid-Infrared Antennas*; MJ Lagos, P Batson, Z Lyu and U Hohenester

Investigating Phase Transitions in Functional Materials and Devices by In Situ/ Operando TEM

1482 *Mapping metal/insulator nanodomains switching in V_2O_3 by variable-temperature electron spectromicroscopy investigations*; I Koita, X Li, LHG Tizei, JD Blazit, N Brun, E Janod, J Tranchant, B Corraze, L Cario, M Tencé, O Stéphan and L Bocher

1486 *Understanding the structural evolution and stability of a Ge-Sn alloy at the nanoscale through in situ TEM heating*; A Minenkov and H Groiss

1448 *Tensile detwinning in bi-twinned metallic nanowires*; G Cheng and Y Zhu

1492 *In-situ TEM Cryoindentation of Nanocrystalline Copper*; E Lang, M Marshall, H Padilla, B Boyce and K Hattar

1494 *In situ observations and measurements of plastic deformation, phase transformations and fracture with 4D-STEM*; Y Yang, R Zhang, S Zhao, Y Deng, Q Yu, S Zeltmann, S Yin, J Ciston, C Ophus, M Asta, R Ritchie and A Minor

Microscopy & Spectroscopy of Energy Conversion and Storage Materials

1496 *Cryogenic STEM for probing soft materials and interfaces in energy devices*; D Markovich, Y Yu, M Colletta and L Kourkoutis

1498 *Atomic-scale Insights of Cation Diffusion into Multivalent Battery Cathodes*; P Parajuli, BJ Kwon, S Kim, B Key, J Vaughey and R Klie

1502 *Investigation of structural defects and beam induced transitions in MgV_2O_4 nanocrystals using atomic resolved scanning transmission electron microscopy*; F Lagunas, L Hu, GCB Alexander, J Cabana and R Klie

1504 *Electrolyte Comparison for Li-Metal Anodes with Cryo-Laser PFIB*; K Jungjohann, L Merrill, R Gannon, S Randolph, D Long and K Harrison

1506 *Probing Microstructure-Dependent Ionic Conductivity and Stability of Garnet Solid Electrolytes through In Situ TEM with Operando Impedance Spectroscopy*; H Zheng and K He

Advanced Application of Atom Probe Tomography: Specimen preparation, Instrumentation, and Data analysis

1508 *Atom Probe Tomography of Small-Molecule Organic Materials*; J Zimmerman, A Proudian, M Jaskot, P Niyonkuru, R Bennett, J Bingham and S Vyas

- 1512 *Nanoporous metal tips as frameworks for analysing frozen liquids with atom probe tomography*; L Tegg, I McCarroll, T Sato, M Griffith and J Cairney
- 1514 *Deuterium charged grain boundaries in iron investigated at room and cryo temperatures with APT*; M Heller, C Macauley, B Ott and P Felfer
- 1516 *Development of the Operando Atom Probe: The Influence of the electric field on Fe oxidation*; S Lambeets, M Wirth, A Devaraj and D Perea
- 1518 *Prospects of mapping macromolecular structure and ionic gradients in hydrated biological specimens using Atom Probe Tomography*; D Perea and M Wirth

Physical Sciences Symposia

Diffraction Imaging Across Disciplines

- 1520 *Objective crystallographic symmetry classifications of two membrane proteins*; P Moeck
- 1522 *Microcrystal electron diffraction of the peptide Gramicidin D*; N Hofer and D McComb
- 1524 *smpr3d: an open-source toolkit for 3D phase-contrast imaging from 4D-STEM datasets*; P Pelz, H Brown, P Ercius, I Johnson, J Ciston, M Scott and C Ophus
- 1528 *Quantification of low-Z elements by energy-filtered scanning transmission electron microscopy*; S Firoozabadi, A Beyer, P Kükkelhan, D Heimes, J Lehr and K Volz
- 1530 *Optimization of STEM Moiré analysis for Two-Dimensional Strain Characterization*; MT Chang, RF Cai, S Liu and S-C Lo
- 1534 *Four-Dimensional Scanning Transmission Electron Microscopy Identification of Molecular Ordering in Organic Semiconducting Polymers*; G Calderon Ortiz, M Zhu, L Dou and J Hwang
- 1538 *Examining Site Occupancy in $Co_{1-x}Ni_xO$ Single Crystals using Dynamical Simulations of EBSD Patterns*; L Brewer and A Heczal
- 1540 *Technique and Computational Improvements in 4D STEM and Cross-Correlation Analysis*; T O'Neill, BC Regan and M Mecklenburg

Microscopy and Microanalysis for Real World Problem Solving

- 1542 *Using Ex-Situ TEM Studies to Gain Fundamental Insights into Bimetallic Nanoparticles*; C Kliewer
- 1544 *Multiple-Scale Synchrotron and Lab Source X-Ray Fluorescence 2D Mapping of Gold Mineralization Styles at the Troilus Gold Project, Frotêt-Evans Greenstone Belt, Quebec, Canada*; L Van Loon, J Alexander, M Valliant, A Iannicca, N Goszczynski, T Beattie, R Klick, B Brassard, B Hylands and N Banerjee
- 1548 *Combine TEM with TCAD Simulation - A Novel Approach in Failure Analysis*; Y Zhang, S Kodali, E Banghart, T Mitchell and F Baumann

- 1550 *Analysis and Characterization of Ultra High Molecular Weight Polyethylene (UHMWPE) subjected to reciprocating sliding and nanoindentation tests*; T De la Mora, N López Perrusquia, MA Doñu Ruiz, ED García Bustos, M Flores Martínez and I Becerril Rosales
- 1554 *In situ study of microstructure in phase transformation of pipe line steel*; C Gu, N Bassim and H Zurob
- 1556 *Hard layers based on metal borides: Microstructure and mechanical properties*; M Ortiz-Domínguez, A Cruz-Avilés, Á Morales-Robles, O Gómez-Vargas, J Solís-Romero, J Zuno-Silva and E Cardoso-Legorreta
- 1562 *Analysis of Precipitates in the Base Metal and HAZ of a 2.25Cr-1Mo Steel*; H Colijn, J Stewart and B Alexandrov
- 1564 *Analysis of Thin Film Specimens Using ToF-SIMS Wedge Protocol, A Comparison with Depth Profiling*; V Smentkowski, S Goswami, F Kollmer, J Zakel, H Arlinghaus and D Rading
- 1566 *Three-dimensional ultrastructural imaging reveals the nanoscale architecture of mammalian cells*; S Yao, J Fan, Z Chen, Y Zong, J Zhang, Z Sun, L Zhang, R Tai, Z Liu, C Chen and H Jiang
- 1570 *Synthesis of Heteroatom Rh–ReO_x Atomically Dispersed Species on Al₂O₃ and Their Tunable Catalytic Reactivity in Ethylene Hydroformylation*; M Xu, I Ro, G Graham, X Pan and P Christopher
- 1572 *The FIGMAS Online Database of Standards and Reference Materials – an Update*; E Bullock, W Nachlas, O Neill, J Allaz and A von der Handt
- 1574 *Analysis of electrochemical corrosion in metal foam of Ti-Ta-Sn and 316-L screw in hank's solution by sem*; A Mejia, L Bejar Gómez, C Aguilar, A Bejar, C Parra González and G Carreón
- 1578 *Mitigating Shadowing and Topographic Artifacts Using Dual EDS Detectors*; S Mu and J Rafaelsen
- 1582 *524 – Direct Correlation of Transmission Electron Microscopy and Optical Microscopy for Study of Fluorescent Nanodiamonds*; H Wen, C Dwyer and S Chang

Advances in Analytical STEM-in-SEM

- 1584 *STEM-in-SEM Imaging and Diffraction with Extremely Beam Sensitive Ultrathin Zeolites*; J Holm
- 1586 *Beam broadening of keV electrons in matter calculated by numerical solution of the electron transport equation*; E Müller, M Hugenschmidt and D Gerthsen
- 1590 *Microstructural defects in AISI 4000 series steel subjected to a 3% NaCl corrosion process.*; E Ordoñez-Casanova, R Romero-Dominguez, M Galicia and HA Trejo-Mandujano
- 1594 *Evaluation method of image resolution for the aberration-corrected STEM*; Y Sugigaki, Y Taniguchi, Y Kubo, K Nakamura, S Koyama and M Sato
- 1596 *Nanoscale orientation mapping made easy: a new sample preparation workflow for rapid, large-area TKD analysis*; P Trimby, I Anderson, J Lindsay, A Gholinia, T Burnett and P Withers

- 1600 *An electron mirror as an objective lens of the transmission electron microscope*; S Bimurzaev and Y Yakushev
- 1602 *Calibration-less quantitative 4D-STEM imaging of amorphous samples*; R Skoupy and V Krzyzanek
- 1604 *STEM-in-SEM highly deformed structure investigation with focus on electron-transparent specimen preparation*; P Nowakowski, C Bonifacio, J Wiezorek, M Ray and P Fischione
- 1608 *Mean Angular Deviation Minimization To Determine Lattice Parameters in Transmission Kikuchi Diffraction*; XY Ling, J Lodico, BC Regan and M Mecklenburg

Full System and Workflow Automation for Enabling Big Data and Machine Learning in Electron Microscopy

- 1610 *Customized Automation of Routine EPMA Analyses Using Vendor-Supplied APIs*; D Ruscitto, N McKeever and A Santamaria-Pang
- 1612 *A new beam alignment method in SEM based on parallax principle*; L Han, M Boese, B Gamm and B Tordoff
- 1614 *Machine Learning for Automated Analysis of Asbestos Fibres*; M Hiscock, C Pisano and C Lang
- 1616 *Automatic Status Checks and Recovery for Tundra Microscope*; L Kubecka, J Jisa, F Grollios, R Siwy, O Svoboda and B van Knippenberg
- 1618 *Rapid and Flexible Few Shot Learning-Based Classification of Scanning Transmission Electron Microscopy Data*; S Reehl, E Kautz, M Olszta, D Hopkins, B Matthews, L Wang, Y Du and S Spurgeon
- 1620 *Bayesian Approaches to Finding the Needles in the Microscopy Haystack*; J Simpson, D Leonard and C Parish
- 1624 *Adaptive Focused Ion Beam Milling through Machine Learning Algorithm Integration*; M Turnquist, P Lewis, T Lau, E Brundage and A Magyar
- 1626 *EELSpecNet: Deep Convolutional Neural Network Solution for Electron Energy Loss Spectroscopy Deconvolution*; SS Mousavi M., A Pofelski and G Botton
- 1628 *An Information Technology Solution to Enable Remote Training and Operation of Instruments with Outdated Operating Systems*; J Carter, J Pigott, TKJ Kim and S Waring
- 1630 *Rapid Holographic Display of 3D Nanomaterials*; J Pietryga, J Schwartz, T Alothman and R Hovden

Vendor Symposium

- 1634 *Development of High Throughput Cryo Electron Microscope with Cold Field Emission Gun (CRYO ARM™ 300 II)*; A Oosaki, N Hosogi, F Makino, S motoki, I ishikawa, Y Ookura and K Kobayashi

- 1638 *Design and Construction of a Custom-Made and Inexpensive Glow Discharge System for TEM Applications*; M Redigolo, G Yakaboylu and J Meyer
- 1640 *CETA-F: Scintillator camera for Entry level 100kV Single Particle Analysis*; M Malínský, G van Hoften, O Vyroubal, V Doležal, M Červinková and L Yu
- 1642 *In situ Comparative heating and simultaneous multi-detector imaging at high and ultra-low landing energies*; A Muto, S Dogel, K Hosoya, H Hosseinkhannazer, N Mahdi and MT Postek
- 1644 *Two New Evactron® Plasma Cleaners for Small Chambers and UHV Systems*; R Vane, G Safar, E Kosmowska, B Armbruster and M Cable
- 1648 *Can an iPhone save your life? Multimodal forensic analysis of bullet damage to a smartphone*; W De Boever, J Mershon, D Miller and L Hunter
- 1650 *Plasma cleaning reliability over pressure and power ranges*; C Moore
- 1652 *Cryo-SEM as an effective method for avoiding contamination*; M Boese and L Han

Data Management, Version Control, and Multiformat Analysis in Electron Microscopy

- 1654 *H5OINA: Oxford Instruments' data exchange file format for microanalysis*; P Pinard, L Gorokhova and K Mehnert

Unresolved Challenges in Quantitative X-ray Microanalysis

- 1658 *BadgerFilm: a versatile thin film analysis program for EPMA and more*; A Moy and J Fournelle
- 1662 *Know your standards: Improvement and validation of standard materials for quantitative WDS and EDS analysis*; R Jones, S Burgess, P Pinard and M Hjelmstad
- 1666 *Orientation Adjustment of Microscale Particles for Quantitative SEM-EDS Analysis*; C Li, A Huey, J Marshall and C Milligan
- 1670 *EDS Quantification Using Fe L Peaks and Low Beam Energy*; J Rafaelsen, F Eggert and M Kawabata
- 1674 *The Detector Efficiency Question with EDS*; F Eggert, J Rafaelsen, F Reinauer, P Camus and U Gernert

Biological Sciences Symposia

3D Structures: From Macromolecular Assemblies to Whole Cells (3DEM FIG)

- 1678 *CryoDiscovery™: A cryo-EM AI/ML Heterogeneity Analysis for Structural Biology*; N Kumar

- 1680 *Continuous heterogeneity analysis of CryoEM images through Zernike polynomials and spherical harmonics*; D Herreros Calero, R Lederman, J Krieger, D Myška, D Strelak, J Filipovic, I Bahar, JM Carazo and CO Sorzano
- 1684 *Cryo-EM structure of the flight muscle thick filament from the bumble bee, *Bombus ignitius*, at 6 Å Resolution*; J Li, H Rahmani, F Abbasi Yeganeh, H Rastegarpouyani, D Taylor, H Iwamoto and K Taylor
- 1688 *3-D Structure of Z-disks isolated from the flight muscle of *Lethocerus indicus**; F Abbasi Yeganeh, H Rahmani, K Taylor and D Taylor
- 1690 *Investigating gating mechanisms of ion channels using temperature-resolved cryoEM*; H Bansia, C Catalano, Z Melville, Y Guo, AR Marks and A des Georges
- 1696 *Modeling of tandem dCas9 complexes bound to DNA for nucleic acids detection*; R Novikov, J Kacher, A Gribkova, P Zaytsev, G Armeev, G Gluhov and A Shaytan
- 1700 *Structural dynamics of human FACT protein complex: electron microscopy analysis*; O Volokh, A Sivkina, M Karlova, E Kotova, V Studitsky and O Sokolova
- 1704 *Homology model of *Drosophila melanogaster* myosin filaments*; N Daneshparvar, H Rahmani and K Taylor
- 1708 *Visualization of intracellular Ebola virus nucleocapsid assembly by cryo-electron tomography*; R Watanabe, G Castillon, R Diaz Avalos, M Ellisman and E Saphire
- 1712 *Characterization of ER-mitochondria contact sites using cryo-CLEM*; R Paraan, V Hewitt, Y Hirabayashi, F Polleux, C Potter and B Carragher
- 1714 *Raman spectroscopy reveals lipids in protein-containing SMA-stabilized lipodiscs*; M Karlova, D Bagrov, M Vorobyova, K Mamatkulov, G Arzumanyan, O Sokolova and K Shaitan

Michael Rossmann Memorial Symposium

- 1716 *Structural Insights into How Protein-Protein Interaction Modulates the Action of MEK Inhibitors*; Z Khan, W Marsiglia, A Chow, A Scopton and A Dar
- 1720 *Electrochemical detection and imaging of reactive oxygen species in single living cells*; A Vaneev, R Timoshenko, V Kolmogorov, H Lopatukhina, P Gorelkin, A Erofeev, N Klyachko, Y Korchev, A Majouga and P Novak

To Fix or Not To Fix? A Question for Biological Samples

- 1722 *SEM and TEM Cross-section films Study of *Chrysanthemum leucanthemum* (Asteraceae) Pollen from Costa Rica*; G González-Mancera, LE Gómez-Lizarraga and J Morales-García
- 1724 *A 3D-printed stage adapter enabling non-destructive live imaging of *Pachyclavularia violacea* coral*; P Wollerman, P Liu, A Saks, J Seventko, C Kennedy and D Reeves

- 1726 *Preserving Anaerobic Conditions of Biogeochemical Samples for Electron and X-ray Chemical Imaging*; A Dohnalkova, Y Sheng and J Richardson
- 1728 *Study of membrane defects induced by antimicrobial and hemolytic peptide Ltc1 in erythrocyte membrane*; N Orlov, O Geraskina and A Feofanov

Frontiers in Fluorescence Lifetime and Super-resolution Imaging of Biological Structures and Dynamics

- 1730 *CLSM and TIRF images from lignocellulosic materials: garlic skin and agave fibers study*; J Hernández-Varela, J Chanona-Pérez, H Calderón Benavides, S Gallegos Cerda, L Gonzalez Victoriano, M Perea Flores, M Campos López, LE Rojas-Candelas and B Arrendondo Tamato
- 1736 *Histone H3/H4 tetrasome structure: analysis by spFRET microscopy*; A Sivkina, N Maluchenko, D Malinina, A Lys, A Korovina, A Feofanov, V Studitsky and M Kirpichnikov
- 1738 *RAFA Lens for Enhanced Far Focused Probes, Imaging and Analytical Resolutions*; M Rafa and R Herring
- 1740 *Quercetin Affects Nucleosome Structure*; T Andreeva, A Lyubitelev, E Bondarenko, V Studitsky and A Feofanov
- 1742 *Novel Kv7.1 missense mutation Lys422Glu leads to the development of LQT syndrome*; M Karlova, V Rusinova, D Abramochkin, E Zaklyazminskaya and O Sokolova

Physical Sciences Symposia

Defects in Materials: How We See and Understand Them

- 1744 *Atomic electrostatic maps of sulfur vacancies in MoS₂ by differential phase contrast*; S Calderon, R Ferreira, D Taneja, J Raghavendrarao, L Zhou, D Akinwande and P Ferreira
- 1746 *On the defect structures and associated diffraction phenomena in Au nanoparticles*; S Neumann, A Rezvani, D Segets and D Rafaja
- 1748 *Structural Effect of Carbon on Mn₅Ge₃ Thin Films Grown on Ge(001) Substrates by Solid Phase Epitaxy*; A Alvidrez-Lechuga, S Olive-Méndez, L Fuentes-Cobas, J Holguín-Momaca and J Plaisier
- 1750 *Identification of interfacial defects in the layered structure of a chalcopyrite compound*; G Cheng and N Yao
- 1754 *Simulated Energy Distribution of an Electron-Beam Irradiated on Metal-Halide Perovskite Photovoltaic Devices*; YL Hsu, K Powell, C Li, Y Yan and H Yoon
- 1758 *Resolving Grain Boundary Microstructures in Garnet-Type Li₇La₃Zr₂O₁₂ using Model-Based TEM Image Simulation*; S Beckley, H Zheng and K He
- 1760 *Effect of substrate morphology on stress-tested GaN-on-GaN vertical p-n diodes*; PR Peri, K Fu, H Fu, Y Zhao and DJ Smith

1762 *Removal of MgO impurity crystals by mechanical milling exfoliation of graphene obtained by CO₂ atmosphere synthesis method*; E Cuadros-Lugo, D Lardizabal-Gutiérrez, C Carreño-Gallardo, I Estrada-Guel, J Herrera-Ramirez and C López

Nanoscale x-ray and Electron Microscopy Techniques and Applications in Material Science

1766 *3D multi-scale study on metal/polymer nano-composites*; M Goubet, C Matei, Z Saghi, B Viala and JH Tortai

1770 *Characterization of Mn oxides using “flank” method in SEM-SXES system*; Y Kojima and N Erdman

1772 *Biocompatibility of New High-Entropy Alloys with Non-Cytotoxic Elements*; P Socorro-Perdomo, N Florido-Suarez, I Voiculescu and J Mirza-Rosca

1776 *Reducing Decoherence in Fluctuation Electron Microscopy*; A Zjajo, I Matzkevich, H Du, R Dunin-Borkowski, A Rezikyan and M Treacy

1778 *Methylene Blue removal using a leached graphite prepared by a green mechanochemical process*; G Tarango-Rivero, P Pizá-Ruiz, CG Garay-Reyes, I Estrada-Guel and R Martínez-Sánchez

1780 *In situ visualization of superior nanomechanical flexibility of individual hydroxyapatite nanobelts*; M-L Qi, Z Huang, W-T Yao, F Long, M Cheng, B Song, D Banner, R Shahbazian-Yassar, Y-P Lu and T Shokuhfar

1782 *Superparamagnetism in pure and Mn doped CuO nanofibers, originated by oxygen vacancies.*; M Piñón-Espitia, MA Garza-Navarro and MT Ochoa-Lara

1786 *Characterization of Intermetallic Precipitates Observed in 7XXX Series Aluminum Alloys Containing Manganese Using Aberration Corrected STEM*; REA Williams

Analytical Sciences Symposia

Diffraction Imaging Across Disciplines

1788 *4D-STEM: Combining Pair Distribution Mapping and Multivariate Statistic Analysis to Quantify Structures in Complex Nanoscale Glasses*; X Mu, L Chen and C Kuebel

1792 *Structural and Morphological Characterization of Novel Organic Electrochemical Transistors via Four-dimensional (4D) Scanning Transmission Electron Microscopy*; A Herzing, L Flagg, L Richter, J Ontorato and C Luscombe

1796 *Mapping Polarization of Perovskite Oxides across Scales Using 4D STEM with Improved Spatial Resolution*; T Eldred, J Smith, S Funni, E Dickey and W Gao

1798 *4D-STEM analysis of an amorphous-crystalline polymer blend: combined nanocrystalline and RDF mapping*; J Donohue, KC Bustillo, SE Zeltmann, C Ophus, B Savitzky, MA Jones, GF Meyers and A Minor

1802 *Diffraction imaging of organic materials in extreme environments*; Y Xie, R Zhang, C Ophus, A Minor, H Zheng, P Ercius and P Hosemann

Microscopy and Microanalysis for Real World Problem Solving

1804 *Semi-Quantitative Analysis of Iron Nodules in Equilibrium Refining Catalysts by Artificial Intelligence-Augmented Scanning Electron Microscopy*; KB Low, J Shi, MC Mastry, V Komvokis and B Yilmaz

1806 *Structural Evolution in Zeolite Fluid Cracking Catalyst*; A Meng, KB Low, J Wei, N Favate, T Gegan, I Petrovic and E Stach

1808 *Electron Microscopy Contributions to Producing an Effective Germicide Photocatalyst*; R Herring, S Pazdernick, Z Hadisi, M Akabari, E Humphrey and V Moradi

1810 *Nanoparticle characterization by automated acquisition and analysis of images and EDS data in the TEM*; R Maddalena, H Lemmens, Y Rikers, L Jiang, M Wu, M Hukeri and M Wirix

1812 *Electron Microscopy of Co-catalyst CuO on Bi₂O₃-TiO₂ Structures*; D Guerrero-Araque, D Ramírez Ortega, H Calderon, J Saniger and R Gomez

1814 *Phase Identification in Aged Catalysts Using STEM Depth Sectioning and Electron Energy-Loss Spectroscopy*; CH Li and J Jinschek

Advances in Analytical STEM-in-SEM

1816 *Diffraction contrast analysis of dislocations in 2D materials using true dark-field and 4D-STEM in SEM*; P Denninger, P Schweizer, C Dolle and E Spiecker

1820 *Contrast and spatial resolution enhancement with the transmission mode in SEM*; U Golla-Schindler, B Schindler and G Schneider

1824 *A 4D STEM-in-SEM Analysis of Hexagonal Boron Nitride*; J Holm and E Mansfield

1826 *Phase Retrieval Imaging for Soft Materials at Low-Voltage*; K Parker, B Kimmel, M Mrksich, R dos Reis and V Dravid

1830 *STEM-in-SEM and Cryo-EM Comparison using Simulation and Experiments for Interleukin 17A-FAB Complexes on Graphene*; J Carpena-Núñez, C Hampton, S Koppell, M Kasevich and L Drummy

Vendor Symposium

1832 *Large area EBSD mapping using a tilt-free configuration and direct electron detection sensor*; J Holzer, A Marshall, P Stejskal, C Stephens and T Vystavěl

1836 *Advances in EBSD sample preparation by broad ion beam milling*; L Palasse and P Nowakowski

- 1840 *Dynamic Electron and X-ray Imaging is a Moving Experience*; S Burgess, H Mansour, A Hyde, P Pinard, P Statham, C Lang and M Hjelmstad
- 1842 *Ensuring High Throughput in All Aspects of Automated Particle Analysis*; M Hiscock and R Mclaughlin
- 1844 *Developments in controlled environmental transfer for Li-based battery materials: From sample preparation to SEM investigation*; P Nowakowski, C Bonifacio, M Ray and P Fischione

Moon Dust, Minerals and Microscopy

- 1846 *Deciphering extreme mineral records; microstructural phase heritage of shocked materials*; T Erickson, N Timms, A Cavosie, M Pearce and C Cayron
- 1850 *Structural Ordering and Composition of Warner Mountains Obsidian and its Microlites*; E Kennedy, B Sari and M Scott
- 1854 *Evidence for highly depleted lower continental crust using an integrated microanalytical reconstitution approach*; R Emo and B Kamber
- 1856 *Combined Geochemical and Mineralogical Investigation of Gold Mineralized Quartz Veins at the Vertigo Target, White Gold District, Yukon, Canada*; J Alexander, L Van Loon and N Banerjee
- 1860 *Comprehensive Automated Thin-Section Characterization Combined with Quantitative Major-Trace Element Analysis on a Single SEM*; R Jones, M Hiscock, P Trimby, R Gardner, R Mclaughlin and S Burgess

Unresolved Challenges in Quantitative X-ray Microanalysis

- 1864 *Approach for Quantifying Rare Earth Elements at Low keV*; H Lowers
- 1868 *EDS of Lithium Materials from 0.5 to 30 keV*; R Gauvin, N Brodusch, F Voisard, N Dumaresq, K Zaghbi, H Demers and M Trudeau
- 1870 *Quantifying Trace Element Variations in Chrysocolla by Clustering FEG-EPMA Hyperspectral Maps*; A Torpy, R Fan, N Wilson, C MacRae and P Austin
- 1874 *Unresolved challenges in the microanalysis of actinides and nuclear materials*; P Pöml

Biological Sciences Symposia

Michael Rossmann Memorial Symposium

- 1878 *Structural Studies of Giant Viruses by Michael Rossmann*; C Xiao
- 1880 *Structures of the capsid and the tail of Myoviridae bacteriophage TaPaz, revealed by cryo-EM*; A Moiseenko, Y Wang, M Shneider, A Popova, K Miroshnikov and O Sokolova

- 1884 *Determining the Patchwork Lattice of Ebola and Marburg Virus Matrix Layers Using Cryo-Electron Tomography*; W Wan, M Clarke, M Norris, L Kolesnikova, A Koehler, Z Bornholdt, E Saphire, S Becker and J Briggs
- 1886 *Tracking structural intermediates during Chikungunya virus membrane fusion using cryo-electron tomography and sub-tomogram averaging*; V Mangala Prasad, J Blijleven, J Smit and K Lee
- 1890 *Technological improvements for whole cell cryo-ET of respiratory syncytial virus infected cells*; B Sibert, J Kim, J Yang and E Wright

Challenges and Advances in Electron Microscopy Research and Diagnosis of Diseases in Humans, Plants and Animals (FIG associated)

- 1894 *Imaging the structure of the plasma membrane with platinum replica and cryogenic electron microscopy and tomography of unroofed cells*; J Taraska and K Sochacki
- 1896 *Biofilm integrity and cytomorphology of Candida albicans after exposure to UV-light on ZnO thin films: SEM Analysis*; C Arzate-Quintana, C Leyva-Porras, M Favila-Pérez, AR Castillo-González, CM Quiñonez-Flores and A Faudoa-Arzate
- 1900 *Visualization of extracellular polymeric substances in Aspergillus niger biofilms using lectin-conjugates and confocal laser scanning microscopy (CLSM)*; A Shailaja, J Kerrigan, T Bruce and P Gerard
- 1902 *Expansion Pathology: Nanoscale Imaging of Clinical Specimens with Optical Microscopy*; Y Zhao, F Fu and O Bucur

Cryo-EM at Local, Regional, and National Cryo-EM Centers

- 1904 *Image collection strategies for single particle cryoEM*; F Jalali-Yazdi and E Gouaux
- 1908 *Structural and functional analysis of p47 cofactor binding on the p97 disease mutant*; P Nandi, PL Chiu, TF Chou, YP Poh, F Wang, S Li, R Columbres, D Williams and A Malyutin
- 1912 *User access to Cryo-EM at EMSL: Opportunities Linking Omics and Structural Biology*; T Moser, I Novikova, A Parvate, S Powell and J Evans
- 1914 *Overview of Pacific Northwest Center for Cryo-EM (PNCC): State-of-the-art electron microscopy and computational resource access free-of-charge for bioscience community*; I Novikova and J Evans

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

- 1916 *Analytical STEM for metal-organic frameworks (MOFs) and MOF composites*; S Collins
- 1918 *Fluence-dependent electron energy loss spectroscopy mapping for beam-sensitive polymers*; R Colby and D Carpenter

- 1922 *3D Spatial Mapping of the Nanomorphology of Polymer:Fullerene Blends by Highly Selective, Homogeneous Copper Staining*; Y Li, M Čalkovský, E Müller, C Sprau, A Colsmann and D Gerthsen
- 1926 *Characterizing Multivalent Metal Anodes with Cryogenic Electron Microscopy*; D Long, S McClary, P Kotula, K Zavadil and K Jungjohann
- 1930 *Transmission ion microscopy and time-of-flight spectroscopy*; M Mousley, W Moeller, P Philipp, O Bouton, N Klingner, E Serralta, G Hlawacek, T Wirtz and S Eswara

Evaluation of Materials for Nuclear Applications

- 1934 *The formation of high burnup structure in U-Mo fuels*; C Smith, B Miller, S Biswas, D Keiser, A Aitkaliyeva, B Kombaiah and D Frazier
- 1938 *Laboratory-based 3D X-ray microscopy of unirradiated U-10Zr fuel*; N Cordes, L Sudderth, M Butt, J Jewell, M Meyer and S McDeavitt
- 1940 *Cryo-TEM Characterization of the Early Stages of the Uranium Oxalate Growth Evolution*; K Kruska, S Tripathi, G Hall and E Buck
- 1942 *Three-Dimensional Characterization of Oxide Fuel Utilizing Focused Ion Beam Tomography*; C McKinney and A Aitkaliyeva

Defects in Materials: How We See and Understand Them

- 1944 *Probing the Strain Fields of Single-Atom Defects in 2D materials with Sub-Picometer Precision*; CH Lee, A Khan, D Luo, T Santos, C Shi, B Janicek, S Kang, N Sobh, W Zhu, A Schleife, B Clark and P Huang
- 1946 *Real-time imaging of atomic electrostatic potentials in 2D materials with 30 keV electrons*; S de Graaf, M Ahmadi, I Lazić, EGT Bosch and BJ Kooi
- 1948 *A new planar defect in SiGe nanopillars*; H Yang, S Ren, E Turner, S Singh, K Jones, P Batson, D Vanderbilt and E Garfunkel
- 1950 *Quantitative Mapping of Strain Defects in Multidomain Quantum Materials*; M Smeaton, I El Baggari, D Balazs, T Hanrath and L Kourkoutis
- 1954 *Analysis and Dynamics of Extended Atomic Defects in Coalesced WS₂ Monolayer Films*; D Reifsnyder Hickey, S Bachu, L Miao and N Alem

Investigating Phase Transitions in Functional Materials and Devices by In Situ/Operando TEM

- 1956 *In-situ Observation of Ordering Transformations in θ -Al₂O₃*; L Kovarik, K Khivantsev, M Bowden and J Szanyi

- 1958 *In-situ Atomic-Scale Visualization of Atomic-Step Induced NiO growth during the Oxidation of Ni*; X Chen, J Wang, X Sun, D Zakharov, S Hwang and G Zhou
- 1960 *Interaction of dislocations with twinning boundary in bi-twinned metallic nanowires*; G Cheng and Y Zhu
- 1964 *Probing the Dynamics of Phase Transformation in Nanostructures by STEM Imaging and Spectroscopy*; W Gao, P Tieu and X Pan
- 1968 *In-situ TEM investigations on temperature-induced structural transition from monoclinic-to-cubic phase of ball-milled yttria*; BR Vaishnavi Krupa, SK Sinha, C Ghosh, A Dasgupta, P Guha and PV Satyam

Microscopy & Spectroscopy of Energy Conversion and Storage Materials

- 1970 *In-Situ Environmental TEM Study of Solid-Gas Interfacial Process in Energy Materials*; L Zou and C Wang
- 1972 *In Situ TEM Investigation of the Spontaneous Hollowing of Alloy Anode Nanocrystals*; M Boebinger, O Yarema, M Yarema, K Unocic, R Unocic, V Wood and M McDowell
- 1974 *Multi-Length Scale Characterization of Graphite Anodes from Fast-Charge Lithium-Ion Cells*; S Pidaparthi, D Abraham, MT Rodrigues and JM Zuo
- 1976 *Understanding Degradation Processes in MXene Anodes by In-situ Liquid Cell STEM*; J Lee, D Spurling, O Ronan, W Li, I Siachos, V Nicolosi and BL Mehdi
- 1978 *Structural Investigation of NCM-Cathode-LLZO-Electrolyte Composites as Promising Candidates for All-Solid-State Batteries Using (Cryo) STEM and PED*; T Demuth, T Fuchs, A Pokle, A Beyer, J Janek and K Volz

Analytical Sciences Symposia

Diffraction Imaging Across Disciplines

- 1980 *From Convergent Beam Electron Diffraction to 4D-STEM: New opportunities for revealing structure at the atomic scale*; J Etheridge, W Chao, B Esser, W Li, H Mann, T Petersen and C Zheng
- 1982 *Comparison Between Moiré Sampling Scanning Transmission Electron Microscopy Geometrical Phase Analysis Strain Characterization Method and Dark-Field Electron Holography*; A Pofelski, V Whabi, S Ghanad-Tavakoli and G Botton
- 1986 *Crystal Lattices Reconstruction from Moiré Aliased Scanning Transmission Electron Microscopy Electron Micrograph*; A Pofelski and G Botton
- 1990 *Studying clustering in Al alloys by 4D-STEM*; E Thronsen, A Lervik, D Peng, CD Marioara, J Friis, S Andersen, P Nakashima and R Holmestad
- 1994 *Dose-efficient strain mapping with high precision and throughput using cepstral transforms on 4D-STEM data*; KP Harikrishnan, D Yoon, YT Shao, L Mele, C Mitterbauer and D Muller

Microscopy and Microanalysis for Real World Problem Solving

- 1998 *Understanding moisture-induced mesopore formation in metal organic framework $Cu_3(btc)_2$ using three-dimensional FIB/SEM analysis*; R Colby, J Falkowski, G Majano and Y Joshi
- 2000 *Impact of Network Architecture on the Microstructure of PDMS/PMMA Hybrid Elastomers*; J Beebe, T Heyl, A Silvaroli, D Ahn, S Mangold, M Lee, A Fielitz, K Shull and M Wang
- 2002 *Analysis of the profile roughness of core-shell microparticles by electron microscopy*; D Hülägü, C Tobias, A Gojani, K Rurack and VD Hodoroaba
- 2006 *Multimodal Characterization of Hierarchically Porous Nanocomposite Materials: The Case Study of the PEARL Membrane*; S Ribet, B Shindel, R dos Reis, V Nandwana and V Dravid
- 2010 *Migration of Erucamide in Polyethylene Films at Elevated Temperatures*; J Ngunjiri, P Michaelen and S Rahul
- 2012 *The Influence of Interfacial Chemistry on Bonding During High-velocity Impact of Microparticles*; X Chen, A Tamiyu, C Schuh and J LeBeau

Advances in Analytical STEM-in-SEM

- 2016 *Methods of the electron induced cleaning in SEM*; I Müllerová, I Konvalina and E Materna Mikmeková
- 2018 *Challenges and perspectives of Transmission Kikuchi Diffraction for nanocrystalline materials characterization*; A Fanta
- 2020 *Determining Lattice Parameters by Curve-Fitting Transmission Kikuchi Diffraction Patterns*; Y Chen, J Lodico, BC Regan and M Mecklenburg
- 2022 *Quantification and Mitigation of Electron-Beam-Induced Carbon Contamination*; M Hugenschmidt, K Adrion, A Marx, E Müller and D Gerthsen

Vendor Symposium

- 2026 *The novel approach to correlative microscopy using AFM-in-SEM and CPEM technology*; V Hegrova, J Horak, Z Novacek, M Pavera and J Neuman
- 2028 *3D Correlative Microscopy for Real World Problem Solving*; B Winiarski, A Brinek, A Chirazi and D Lichau
- 2032 *Safe and Quantitative Analysis of Nuclear Materials From the Milli to Nano-Scale*; R Ulfig, D Reinhard, AS Robbes, P Peres and D Larson
- 2036 *Time resolved dynamic micro-CT imaging of food products in the lab*; F Coppens, W De Boever and J Dewanckele
- 2038 *Challenges in Atom Probe Tomography Instrumentation and Reconstruction*; D Reinhard, D Larson, B Geiser, D Lenz, I Martin, T Prosa, P Clifton, R Ulfig and J Bunton

Moon Dust, Minerals and Microscopy

- 2042 *Quantitative Compositional Mapping of Particles from the Apollo 17 Core 73002*; S Valencia, E Bullock, C Cari, N Curran, B Cohen and ANGSA Science Team
- 2044 *STEM-EELS-EDS Analysis of Space Weathering Features of ANGSA Lunar Soil Samples*; B Cymes, K Burgess and R Stroud
- 2048 *Coordinated analyses on space weathering signatures on a Fe-sulfide grain from asteroid Itokawa*; L Chaves, M Thompson and S Shuvo
- 2052 *Investigating space-weathering on the moon using APT*; J Greer, S Rout, D Isheim, D Seidman, R Wieler and P Heck

Unresolved Challenges in Quantitative X-ray Microanalysis

- 2056 *NeXL: A Platform for Innovation in Microanalysis*; N Ritchie and D Newbury
- 2060 *Improved quantitative chemical analyses of Cu(In,Ga)Se₂ solar cells performed by STEM/EDXS*; X Jin, R Schneider, D Hariskos, A Bauer, W Witte, M Powalla and D Gerthsen
- 2064 *A New Method for the XEDS ζ -factor Measurement Through Modulation of Beam Current*; R Webster, S Chang and R Tilley
- 2068 *Chemical Shift Detection with Energy Dispersive Spectroscopy (EDS)*; R Jin, B Zutter, BC Regan and M Mecklenburg
- 2070 *First Light on the Argonne PicoProbe and The X-ray Perimeter Array Detector (XPAD)*; N Zaluzec

Biological Sciences Symposia

Cryo-electron Tomography: Present Capabilities and Future Potential

- 2076 *Molecular views into cellular functions by in-cell cryo-electron tomography*; J Mahamid
- 2078 *Waffle Method for optimizing cryo-FIB-milling*; K Kelley, P Jaroenlak, A Raczkowski, E Eng, G Bhabha, C Potter, B Carragher and A Noble
- 2082 *New hardware for a streamlined cryo focused ion beam milling workflow*; S Tacke, Z Wang, M Grange and S Raunser
- 2088 *Democratising in situ structural biology: when a field becomes a tool*; A de Marco, S Gorelick, C Taveneau, X Cheng, D Dierickx and G Buckley

Challenges and Advances in Electron Microscopy Research and Diagnosis of Diseases in Humans, Plants and Animals (FIG associated)

- 2090 *Electron Microscopy Research in Musculoskeletal Infection*; B Li

- 2092 *Custom Cryo-Chips as a method of enriching and imaging disease-related oncoproteins*; M Solares, GM Jonaid and D Kelly
- 2096 *VitroJet: advanced control and ease of use in cryo-EM sample preparation*; G Weissenberger, F Nijpels, R Henderikx and B Beulen
- 2098 *SARS-CoV-2, a Newly Emergent Coronavirus*; C Goldsmith and H Bullock

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

- 2100 *Insights into the Defect Structure Resulting from the Hydrogen Absorption in Palladium Nanocubes Using Liquid Cell Transmission Electron Microscopy*; S Betzler, C Ophus and H Zheng
- 2102 *In-situ NiO nanostructure growth during heating in water vapor atmosphere*; B Qu and K van Benthem
- 2104 *Combining in situ micro-photoluminescence and cathodoluminescence to understand defects photophysics in nanodiamonds*; N Bonnet, F Treussart, H Chang, M Kociak and LHG Tizei
- 2108 *Using in situ electron energy-loss spectroscopy (EELS) and X-ray fluorescence microscopy (XFM) to characterize Co-Pt nanoparticles*; A Foucher, N Marcella, A Plonka, A Frenkel and E Stach
- 2110 *In-Situ Transmission Electron Microscopy: Electron Beam Effects in Carbon-based Nanomaterials*; Z Ying, J Diao, S Wang, X Cai, H Liu and N Wang

Exploring Beam-sample Interactions for Uncovering the Atomic or Dynamic Nature of Matter

- 2114 *Mapping Atomic Motions with Ultrabright Electrons: Fundamental Space-Time Limits to Imaging Chemistry and Biological Processes*; RJD Miller
- 2116 *Fast electron low dose tomography for beam sensitive materials*; D Arenas Esteban, H Vanrompay, A Skorikov, A Béch e, J Verbeeck, B Freitag and S Bals
- 2120 *A flexible electron interferometer demonstrating live phase imaging and interaction-free measurements*; A Turner, C Johnson and B McMORRAN
- 2124 *Observing atomic resolution dynamics of soft materials with controlling dose rate*; FR Chen, D Van Dyck, C Kisielowski and S Helveg

Evaluation of Materials for Nuclear Applications

- 2128 *Image-driven discriminative and generative methods for establishing microstructure-processing relationships relevant to nuclear fuel processing pipelines*; E Kautz, W Ma, A Baskaran, A Chowdhury, V Joshi, B Yener and D Lewis

- 2132 *Deep Learning–Based Workflow for Analyzing Helium Bubbles in Transmission Electron Microscopy Images*; CY Wong, X Wang, Z Fan, K More, S Kalinin and M Ziatdinov
- 2134 *4D-STEM Imaging of nanostructural heterogeneities in Ni-20Cr after corrosion in molten salt*; Y Yang, W Zhou, S Yin, S Wang, Q Yu, R Ritchie, M Asta, J Li, M Short and A Minor
- 2136 *Development and Deployment of Automated Machine Learning Detection in Electron Microscopy Experiments*; KG Field, R Jacobs, M Shen, M Lynch, P Patki, C Field and D Morgan

Defects in Materials: How We See and Understand Them

- 2138 *Direct atomistic defect observations by depth sectioning and dynamic STEM*; R Ishikawa, N Shibata and Y Ikuhara
- 2140 *Point Defects and Alloy Incorporation in Ultrawide Bandgap β -(Al_xGa_{1-x})₂O₃ Films*; HL Huang, J Johnson, C Chae, AFMAU Bhuiyan, Z Feng, NK Kalarickal, S Rajan, H Zhao and J Hwang
- 2144 *Probing point and planar defects in multiferroic YFeO₃ thin films*; A Kumar, S Ning, K Klyukin, B Yildiz, C Ross and J LeBeau
- 2146 *Three-dimensional imaging of single dopants inside crystals using multislice electron ptychography*; Z Chen, YT Shao, Y Jiang and D Muller
- 2150 *Electron Beam Control of Dopants in 2D and 3D Materials*; AR Lupini, B Hudak, S Jesse, J Song, O Dyck, P Snijders and S Kalinin

Advanced Characterization of Components Fabricated by Additive Manufacturing

- 2154 *Additive Manufacturing of structural materials for nuclear application and rapid mesoscale mechanical testing*; P Hosemann, J Duckering, A Dong, J Bickel, S Maloy, T Lienert, C Lear, T Mukherjee and T DebRoy
- 2156 *Post-Irradiation Analysis of Additively Manufactured Stainless Steel 316L Specimens*; J King, R Collette, B Amin-Ahmadi, S Cheng and Y Wu
- 2160 *Advanced Characterization of Additively Manufactured 316L Stainless Steel for Nuclear Applications*; L He, L Hawkins, J Yang, X Liu, M Song, X Lou, Y Zhang, L Shao and D Schwen

Investigating Phase Transitions in Functional Materials and Devices by In Situ/Operando TEM

- 2162 *In-situ electron microscopy study of non-volatile resistive switching in Mott insulator VO₂*; S Cheng, MH Lee, X Li, L Fratino, M Rozenberg, I Schuller and Y Zhu
- 2166 *Investigations of magneto-elastic coupling in a multiferroic ferrite by in-situ precession diffraction*; S Deng, S Sun, P Miao, J Li, C Xu, W Wang, Y Zhu, J Chen and J Zhu

- 2170 *Direct observation of the perpendicular shape anisotropy and thermal stability of STT-MRAM nano-pillars examined by off-axis electron holography*; T Almeida, S Lequeux, A Palomino, N Caçoilo and A Masseur, R Sousa, O Fruchart, IL Prejbeanu, B Dieny and D Cooper
- 2174 *In situ transmission electron microscopy of magnetic transitions*; A Kovacs, L Lewis, M Charilaou, S Guo and R Dunin-Borkowski
- 2178 *Lorentz Transmission Electron Microscopy Imaging of Magnetic Textures in MnBi*; N Bagués, BL Wooten, B He, BC Sales, J Heremans and D McComb

Microscopy & Spectroscopy of Energy Conversion and Storage Materials

- 1280 *In-situ Imaging of Electro-Chemo-Mechanical Degradation of High-Ni Content Cathode Materials*; H Xin and C Wang
- 2182 *Surface Degradation Analysis of Commercial Nickel-rich Oxide Cathode Materials by Multiple Electron Microscopy Technologies*; J Zhu, X Han, J Sun, S Wang, T Hsu, Y Ma, Z Wang, C Kurtz, X Zhao, C Sun, C Wang and J Qian
- 2186 *Asymmetric Discharge-Charge Reactions in Conversion-Type Electrodes for Lithium-Ion Batteries*; S Li, Z Shadik, G Kwon, JH Lee and S Hwang
- 2188 *Resolve cathode electrolyte interphase in lithium batteries with cryo-EM*; Z Zhang, J Yang, W Huang, H Wang, W Zhou, Y Li, Y Li, J Xu, W Huang, W Chiu and Y Cui

Analytical Sciences Symposia

Diffraction Imaging Across Disciplines

- 2192 *Increased efficiency of phase plate STEM using 2D detector*; M Tsubouchi and H Minoda
- 2194 *Dynamic Diffraction Lattice Phase Imaging Using DBI*; R Herring
- 2196 *Electric field mapping in CdSeTe solar cell using 4D-STEM*; J Guo, R Pandey, A Munshi, W Sampath and R Klie
- 2200 *Probing atomic-scale symmetry breaking by rotationally invariant machine learning of 4D-STEM Data*; M Oxley, M Ziatdinov, O Dyck, AR Lupini, R Vasudevan and S Kalinin
- 2202 *In-situ 4D-STEM imaging to develop a fundamental understanding of coupled transport of vacancies*; S Mills, Y Yang and AM Minor
- 2204 *Strain Engineering in Aluminum Scandium Nitride Thin Film using Four-dimensional Scanning Transmission Electron Microscopy (4D-STEM) Technique*; P Musavigharavi, A Meng, D Wang, J Zheng, A Foucher, RH Olsson III and E Stach
- 2206 *Quantitative characterization of nanometer-scale electric fields via momentum-resolved STEM*; A Beyer, S Firoozabadi, D Heimes, T Grieb, A Rosenauer, K Müller-Caspary and K Volz

2208 *Energy dispersive micro-XRF Bragg-pattern visualization – Laue Mapping*; M Buegler, R Tagle, F Reinhardt, A Menzies and T Hill

New Frontiers in In-Situ Electron Microscopy in Liquids and Gases (L&G EM FIG Sponsored)

- 2210 *Phase transition and atomic scale dynamics in chemical reactions revealed in the solid state by electron microscopy*; J Smith and W Gao
- 2212 *Plasmon electron energy-loss spectroscopy and in-situ cooling experiments of graphene liquid cells*; L Bhatt, J Guo and R Klie
- 2216 *Tracking and Understanding Nanocatalyst Sintering and Regeneration using Deep Learning-assisted In Situ Environmental TEM*; R Sainju, S Suib, C Ding and Y Zhu
- 2218 *Compressed Sensing Inspired Line Feature Detection for In-Situ Transmission Electron Microscopy*; H Ni, A Yoon and JM Zuo
- 2220 *Decomposition behavior of III/V semiconductor precursor gases in a closed gas cell in-situ TEM holder observed by mass spectrometry*; M Widemann, D Krug, F Gruber, A Beyer and K Volz
- 2224 *Atom Detection in Time-resolved TEM Image Series: Application of Computer Vision Techniques to Noise-degraded Frames*; R Manzorro, Y Xu, J Vincent, R Rivera, D Matteson and P Crozier
- 2226 *In Situ Observation of Gold Nanoparticles Self-assembly at the Solid-Liquid Interface Using Liquid-Phase STEM*; A Bo, B Kuttich, T Kraus and N de Jonge
- 2228 *Formation mechanism of dominant kinks in GaP nanowires grown in an in-situ (S)TEM gas cell holder investigated by SPED and SNBED*; D Krug, M Widemann, S Ahmed, F Gruber, A Beyer and K Volz
- 2232 *Automated Crystal Orientation Mapping with a Liquid-Cell TEM*; E Lang, C Taylor, S Pratt, T Nenoff and K Hattar
- 2234 *Observation of dynamic 3D motion of nanoparticles combined with 4D-STEM orientation and phase map in Liquid-Cell STEM microscopy*; A Gomez-Perez, A Galanis, P Das, S Nicolopoulos and A Demortière
- 2236 *A Machine Learning pipeline to track the dynamics of a population of nanoparticles during in situ Environmental Transmission Electron Microscopy in gases*; K Faraz, T Grenier, C Ducottet and T Epicier
- 2238 *In-situ biasing and temperature influence on the electric fields across GaAs based p-n junction via 4D STEM*; A Pokle, D Heimes, A Beyer and K Volz
- 2240 *Electron Beam Printed Hydrogels as a Hydration Source for Graphene Encapsulated Specimens*; A Kolmakov
- 2242 *In situ ETEM study of surface reconstruction formation on stepped Cu surfaces during oxidation*; M Li, M Curnan, R Garza, S House, W Saidi and J Yang

2244 *In-situ TEM Study of Oxygen Surface Exchange on Ceria, Gd-doped Ceria and Pr-doped Ceria*; M Tan, P Crozier and J Vincent

2246 *Modeling nanostructure evolution using temperature-dependent radiolysis and kinetics of nanoscale reactions in liquid cell TEM*; S Lee, N Schneider, SF Tan and F Ross

Moon Dust, Minerals and Microscopy

2250 *Nanoparticle size, shape, and concentration measurement at once – two VAMAS pre-standardization projects ready to start*; VD Hodoroaba, C Hörenz, F Pellegrino, V Maurino, B Durand and O Taché

2252 *High Resolution Geochemical Mapping of Fossil Coccospheres of Coccolithophores in Organic Chalks using Energy Dispersive Spectroscopy and Back Scatter Electrons*; D Jacobi, J Longo, F Duque and F Oyarzabal

2258 *Blueberries on Earth and Mars: Correlations between Concretions in Navajo Sandstone and Tyerra Merdiani on Mars*; A Havics, W Mahaney and D Netoff

2260 *Coordinated analysis of space weathering characteristics in lunar samples to understand water distribution on the Moon*; A Kling, M Thompson, J Greer and P Heck

2264 *Exploring the inner space of outer space: multi-length scale, multimodal characterization of Muonionalusta IVA iron meteorite*; T Abbott, S Ribet, N Kabat, P Smeets, R dos Reis and V Dravid

2268 *Record of Alteration by Heavy Ices in a Cometary Clast in a Primitive Meteorite*; K Burgess, R Stroud, L Nittler and J Trigo-Rodriguez

2272 *Application of Total Suspended Particles (TSP) analysis performed by SEM-EDS*; R Ramirez-Leal, M Cruz-Campas, O Cota-Arriola and D Morales-Romero

Biological Sciences Symposia

Challenges and Advances in Electron Microscopy Research and Diagnosis of Diseases in Humans, Plants and Animals (FIG associated)

2274 *Application of image recognition for plant virus detection*; MS Hung and YT Chiu

2278 *Extraction and Characterization of chemical constituents present in Cuphea aequipetala and their properties*; DK Tiwari, AV Coria-Tellez, D Tripathi, MO Alonso-Perez and AD Navarro-Pérez

2284 *Cell Mediated Neural Defense Against Pathogen within Olfactory Neuroepithelium of Fish*; S De, S Sarkar, S Barman and SS Hossin

2288 *Liquid-phase imaging of bone development and calcification by atmospheric scanning electron microscopy (ASEM): Application to immuno-labeling and rapid tissue observation of genetically modified mouse*; E Sakai, M Sato, N Memtily, T Tsukuba and C Sato

2290 *Localization and Quantification of Ultraviolet Radiation Absorbing Compounds in Leaves of Southern Magnolia (Magnolia grandiflora L.)*; V Ferchaud, Y Qi, V Manrique and K Chin

Cryo-EM at Local, Regional, and National Cryo-EM Centers

- 2294 *The national center for cryoem access and training : nationwide access to cryoem technology and curricula*; E Eng, E Chua, M Aragon, E Kopylov, C Castello, C Dubbeldam, C Potter and B Carragher
- 2296 *Testing and implementing a live processing workflow at the New York Structural Biology Center*; E Chua, J Mendez, R Paraan, H Kuang, K Maruthi, E Eng, S Krit, A Cheng, C Potter and B Carragher
- 2298 *National Center for In-situ Tomographic Ultramicroscopy at New York Structural Biology Center*; M Kopylov, D Bobe, A Raczkowski, E Kopylov, C Dubbeldam, A Noble, B Carragher and C Potter
- 2300 *Efficient Single Particle and Tilt Series Workflow for a Cryo-EM Core*; W Rice, B Wang and A Paquette
- 2304 *System Evacuation Metrics Collector for IGP and cryo-cycle performance management (SEMCI)*; L Alink, C Potter, B Carragher, E Eng, K Maruthi, A Cheng and R Gheorghita

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

- 2306 *An Observation and Hypothesis for Gate Leakage Mechanism in FinFET Transistor Semiconductor Device from Dies near Wafer Extreme Edge*; W Zhao
- 2308 *Mapping electrostatic potential around a Pt nanoparticle supported on TiO₂ (110)*; Y Takahashi, T Akashi, H Hojo, H Einaga, H Nakajima, T Tanigaki, H Shinada and Y Murakami
- 2310 *Design and Construction of an Optical TEM Specimen Holder*; J Martis, Z Zhang, H Li, A Majumdar, R Kim and A Marshall
- 2314 *A new generic method to extract stoichiometric and dynamic information from the exit-wave for thin sample*; D Van Dyck, FR Home, C Kisielowski and S Helveg
- 2318 *Schlieren imaging of spatial magnetic fields by hollow-cone illumination*; K Harada, H Nakajima, S Mori and Y Takahashi
- 2320 *Correction for linear and non-linear distortions of STEM images*; P Potapov and A Lubk
- 2324 *Growth mechanism of periodic nanopattern in metal-oxide composites*; Y Wen, H Abe and A Hashimoto
- 2326 *Discrimination between Coherent and Incoherent Interfaces using STEM Moiré*; J Yamanaka, D Izumi, C Yamamoto, M Shirakura, K Hara and K Arimoto
- 2328 *Oxidation of Co-Based Porous Nanoparticles Followed by HAADF/BF imaging*; R Mendoza-Cruz and F Ascencio-Aguirre
- 2330 *FCC and 4H structure coexistence in Ag nanoparticles determined through TEM imaging and a diffraction pattern indexing program (DPIP)*; L Bazán-Díaz, F Ascencio-Aguirre, R Herrera-Becerra and R Mendoza-Cruz

- 2332 *Atomic-scale imaging of flexoelectric polarization around engineered crack tips*; H Wang, H Boschker, X Jiang, Y Wang, R Stark, J Mannhart and PA van Aken
- 2334 *Understanding Ferroelectricity in Nanometric Sodium Niobate by Differential Phase Contrast*; B Canabarro, S Calderon, P Ferreira and P Jardim
- 2338 *Characterization of MoS₂ Nanorods by Electron Microscopy*; A Salazar, D Sanchez, C Kisielowski, J Wu, O Dubon and H Calderon
- 2342 *Structure and Morphology Changes of Zinc Oxide Nanoparticles*; L Hermida Montero, F Paraguay-Delgado and N Pariona Mendoza
- 2344 *In-situ TEM observation of the growth process of carbon nanomaterials by laser irradiation*; R Senga, YC Lin, S Sinha, T Kaneko, N Okoshi, T Sasaki, S Morishita, H Sawada, S Tae Park and K Suenaga
- 2346 *Controllable Growth of Copper on TiO₂ Nanoparticles Through Coupled Effects of Solution Viscosity and Photoreduction Rate*; P Tieu, D Ferrah and X Pan
- 2350 *Modern STEM EBIC: Emerging Modes and Methods*; W Hubbard, M Mecklenburg, J Lodico, B Zutter, HL Chan and BC Regan
- 2354 *Imaging Soft and Hard Dielectric Breakdown in Resistive Switching*; BC Regan, J Lodico, HL Chan, M Mecklenburg and W Hubbard
- 2356 *Atomic-scale Structural Imaging of Interfacial Defects in GaAs(001)-based Heterostructures*; A Gangopadhyay, TJ Rotter, G Balakrishnan and DJ Smith
- 2358 *Ga interstitial stability and its effect on the electronic properties of β -(Al_xGa_{1-x})₂O₃ alloy*; A Chmielewski, Z Deng, Y Zhang, A Mauze, W Windl and N Alem
- 2360 *Reducing Cracks and Delamination in Plasma-Sprayed Coatings of Calcia and Magnesia Stabilized-Zirconia*; M Hafez, S Akila, M Khder and A Khalil
- 2364 *Investigation of Defects in 2D Perovskite Oxide Nanosheets*; C Yilmaz Akkaya, T Isik, H Tan, U Unal and V Ortalan
- 2368 *Evidence of magnetic structure contribution to electron backscatter diffraction*; S Boona

Defects in Materials: How We See and Understand Them

- 2372 *Effect of thermochemical treatments on the surface hardening of a circular saw blade: A microstructure comparison of nitride layers, boride layers and TiN coating formed on ASTM A1011 steel*; I Morgado-González, M Ortiz-Domínguez, O Gómez-Vargas, E Cardoso-Legorreta, J García-Serrano, M Bárcenas-Castañeda, V Castellanos-Escamilla, G Moreno-González and J Solís-Romero
- 2376 *Microstructure and mechanical properties of borided AISI T1 high-speed steel by dehydrated paste-pack boriding*; I Morgado-González, M Ortiz-Domínguez, O Gómez-Vargas, J Nieto-Sosa, C Monroy-Palafox, M Ortiz-Ocampo and J Solís-Romero

2380 *Fatigue Analysis of AISI 8620 carburized steels using SEM*; MA Doñu Ruiz, N López Perrusquia, P Cruz Carmona and VJ Cortéz Suarez

2384 *Study of the boriding drill point subjected to machining*; VH Olmos Domínguez, N López Perrusquia, MA Doñu Ruiz and L García Vanegas

Advanced Characterization of Components Fabricated by Additive Manufacturing

2388 *Osseo-integration Improvement of Additive Manufactured Dental Alloys*; EM Stanciu, N Florido-Suarez, P Socorro-Perdomo and J Mirza-Rosca

2392 *Microstructural Characterization of WC-Co-hBN Cemented Carbide Processed Using Selective Laser Sintering*; J Agyapong, A Czekanski and S Boakye-Yiadom

Investigating Phase Transitions in Functional Materials and Devices by In Situ/ Operando TEM

2396 *Analysis of MnFe₂O₄ phase transition induced by the energy of electron beam in an iron-manganese oxide nanoparticle*; O Cigarroa-Mayorga

2400 *Cryo-Electrical Microscopy for Quantum and Advanced Energy Applications*; K Karki, DH Alsem and N Salmon

2402 *In-situ TEM on interfacial phase transition during shear-mediated grain boundary migration*; Z Fang and S Mao

2404 *Chiral spin textures in Fe/Gd based multilayer thin films*; W Parker, S Montoya, E Fullerton and B McMorran

2408 *Multiscale vacancy and dislocation-mediated surface segregation in CuNi alloy up to microsecond timescales with accelerated dynamics*; R Garza, J Lee, M Nguyen, A Garmon, M Li, D Perez, G Henkelman, J Yang and W Saidi

2412 *Reversible Phase Transformations during In-Situ Heating of Uncapped Ge₂Sb₂Te₅ Films*; C Ghosh, M Singh, P Kotula, H Silva and CB Carter

2416 *In-situ TEM observation of Ni/Al₂O₃ catalysts for dry reforming of methane*; A Hashimoto and Y Han

2418 *Microstructural Evolution of Chessboard like Nanodomains in Mn-doped ZnGaO₄ Spinel*; A Pal, AK Das, M Singh, C Ghosh, P Kotula, CB Carter and J Basu

2420 *In Situ Thermomechanical Loading for TEM Studies of Nanocrystalline Alloys*; T Koenig, H Wang, K Cole-Piepk, A Koenig, S Garg, G Tucker, P Kung, T Mewes, C Mewes, J Nogan, Y Zhu and G Thompson

2426 *In-Situ Investigation of Phase Transitions in Functional Poly-Vinylidene Fluoride*; S Kumari, T Isik, C Yilmaz Akkaya and V Ortalan

Microscopy & Spectroscopy of Energy Conversion and Storage Materials

- 2428 *Measuring Electronic and Structural Transformations in Solar Thermochemical Water Splitting Materials with Aberration-Corrected STEM-EELS*; J Trindell, J Sugar and A McDaniel
- 2430 *Morphology of Perylene Dimide based Polymer Non-Fullerene Solar Cells: Effect of Thermal Annealing*; T Wright, W Ware, J Barkley, S Han and B Gautam
- 2432 *Surface Energy and Microstructure: The effect of the underlying substrate on perovskite film formation for solar cell absorbers*; I Martin, M Rasmussen and K Crowley
- 2436 *Numerical Simulation of Plasmonic Nano-antenna ZnO for Solar Cells Applications*; A Garcia, J Plaza-Castillo and A Leyva-Diaz
- 2438 *Electron probing of the oxygen evolving $Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$* ; TH Shen, L Spillane, J Vavra and V Tileli
- 2440 *Transmission electron microscopy study of CoMnO catalyst nanoparticles*; J Guo, P Wang, J Cabana and R Klie
- 2444 *Electron Microscopy of TiO_2 -CoTiO₃ based Materials for Photocatalysis*; H Calderon, C Kisielowski, FC Robles-Hernandez and V Hadiev
- 2448 *Visualizing Zinc Dendrites in Minimal Architecture Zinc Bromine Batteries via in-house Transmission X-ray Microscopy*; JH Park, D Steingart and B Koel
- 2452 *Surface plasmon investigations by STEM-EELS mapping of Au/Ni nanoparticles on STO*; T Aarholt, K Both, V Reinertsen and Ø Prytz
- 2456 *Femto-second laser applications in energy materials characterization*; R White, T Volkenandt, S Kelly and B Tordoff
- 2458 *Electrocatalytic effects of Pt-based nanoparticles studied with advanced identical location electron microscopy*; F Ruiz-Zepeda, A Havlišič, A Pavlišič, AR Kamšek, M Gatalo, M Bele, P Jovanovič, G Dražič and N Hodnik

Advanced Application of Atom Probe Tomography: Specimen preparation, Instrumentation, and Data analysis

- 2460 *Atomic Structure of Superconducting Tunnel Junctions using STEM and APT*; E Supple, M Holtz, CJK Richardson and B Gorman
- 2464 *Directions in Atom Probe Tomography*; D Larson, D Lenz, I Martin, T Prosa, D Reinhard, P Clifton, B Geiser, R Ulfing and J Bunton
- 2468 *The Effect of Analysis Conditions on the Fidelity of Atom Probe Data of Zirconium Alloys*; B Jenkins, C Grovenor and M Moody

- 2472 *Optimal Specimen Preparation for Correlative Atom Probe Tomography and Electron Microscopy of Environmentally Sensitive Materials*; C Bonifacio, D Perea, P Nowakowski, M Ray and P Fischione
- 2476 *Matrix Composition and Fine-scale Structure Analysis of NMC Li-ion Battery Using Atom Probe Tomography*; Y Chen, P Clifton and T Prosa
- 2480 *Stoichiometric analysis of superficial Ba doped Strontium Titanium Oxide layers using APT: the case of the missing Oxygen!*; RJH Morris, M Popovici, J Meersschaut, J Scheerder, L Goux, G Kar, C Fleischmann, W Vandervorst and P van der Heide
- 2482 *Electrostatic Reconstruction Technology in Atom Probe Tomography*; B Geiser, I Martin, D Reinhard, D Lenz, T Prosa, R Ulfing and D Larson

Analytical Sciences Symposia

Diffraction Imaging Across Disciplines

- 2484 *A Ptychographic Approach for Low Dose Electron Imaging of Organic Molecules*; K Nguyen, Y Jiang, B Janicek, P Kharel and P Huang
- 2488 *Low Dose 4D Scanning Transmission Electron Microscopy of Block Copolymers and Homopolymers at 30 keV in an SEM*; C Cordoba, Y Zhang, C Ellis, R McLeod, I Manners and A Blackburn
- 2490 *Autonomous EBSD Pattern Classification Performance with Changing Acquisition Parameters*; K Kaufmann and K Vecchio
- 2494 *Reconstructing grains in 3D through 4D Scanning Precession Electron Diffraction*; P Harrison, X Zhou, S Mohan Das, N Viganò, P Lhuissier, M Herbig, W Ludwig and E Rauch
- 2496 *Analysis of Dynamical Electron Backscatter Diffraction Patterns of Ferrite and Martensite Phases in Steels*; A Heczal and L Brewer

Microscopy and Microanalysis for Real World Problem Solving

- 2498 *Engineering the Micro-texture of Zn Coating by Carbon Nanotube Incorporation for Enhanced Corrosion Resistance Behavior*; K Jyotheender and C Srivastava
- 2500 *Simulating Electrochemical Performance of Solid-State Electrolyte Bilayers Characterized by FIB Tomography*; T Hamann, J O'Neill and E Wachsman
- 2504 *Making electrodes by particle stamping for microscopic and electrochemical analysis*; J Son, XY Yu, S Riechers and E Buck
- 2508 *Transfer of lithium foil under inert conditions using CleanConnect inert gas transfer system*; KK Neelisetty, J Stetina, J Vondruška, M Trenz, T Kazda, M Hrouzek and P Wandrol
- 2510 *SEM-EDS coating thickness assessment: an insight into the accuracy of Monte Carlo simulations carried out for TiN coatings using three different freeware graphical user interface*; JPN Cruz, CM Garzon and AAC Recco

2514 *Correlating Microscopy Techniques for Understanding Root Cause of Defects in Coatings*; M Dent and T Stecko

Full System and Workflow Automation for Enabling Big Data and Machine Learning in Electron Microscopy

2516 *Deep Learning-Based Point-Scanning Super-Resolution Microscopy*; U Manor, L Fang, F Monroe, S Weiser Novak, L Kirk, CR Schiavon, SB Yu, T Zhang, M Wu, K Kastner, A Abdel Latif, Z Lin, A Shaw, Y Kubota, J Mendenhall, Z Zhang, G Pekkurnaz, K Harris and J Howard

2518 *Benchmark tests of atom-locating CNN models with a consistent dataset*; J Wei, B Blaiszik, D Morgan and P Voyles

2522 *Learning to Estimate the Composition of a Mixture with Synthetic Data*; C Ly, C Nizinski, C Vachet, L McDonald and T Tasdizen

2526 *Automated Data Labeling and Label Cleaning for Nanoparticle Classification in Electron Microscopy*; K Groschner, A Ben-Moshe, A Pattinson, W Theis and M Scott

2530 *Automated Electron Beam Manipulation for Controlled Materials Transformations*; N Creange, K Roccapriore, O Dyck, A Lupini, R Vasudevan and SV Kalinin

Moon Dust, Minerals and Microscopy

2534 *High porosity fine-grained rims in CM Murchison revealed through sub-resolution XCT imaging with Xe gas*; R Hanna, R Ketcham and D Edey

2538 *Investigating Space Weathering Effects on Carbonaceous Asteroids Using High-flux and Low-flux Ion Irradiation of the Murchison Meteorite*; D Laczniak, M Thompson, R Christoffersen, C Dukes, S Clemett, R Morris and L Keller

2542 *Determination of sulfur speciation in apatites from martian meteorite- shergotty using μ -xanes*; P Chowdhury, M Brounce, J Boyce and F McCubbin

2546 *Coordinated Electron Energy Loss and Energy Dispersive X-ray Spectroscopies of Organic Matter from Asteroids*; R Stroud, B De Gregorio and C Alexander

2548 *Compositional Analysis of Chondritic Sulfide Material: A Test of the Mass-Thickness Approach to Quantitative EDS in the TEM*; Z Thomas, S Devin, P Pinard and S Marks

Portable- and Laboratory-based Approaches to Analysis in Cultural Heritage

2552 *Advancements in portable and lab based XRF instrumentation for analysis in cultural heritage: A change in perspective*; A Shugar

- 2554 *Identification of Bronze Workshops using p-XRF and ICP-MS in Angkor Thom, Cambodia*; N Little and B Vincent
- 2556 *Elemental Mapping of Jade by pXRF and SEM-based Micro-XRF: A Comparative Study*; T Lam and E Vicenzi
- 2560 *Quantitative Analysis of Obsidian and Determination of Source Provenance Using an Analytical Dual Beam SEM*; E Vicenzi, M Sharps and T Lam

Biological Sciences Symposia

Cryo-electron Tomography: Present Capabilities and Future Potential

- 2564 *Multiscale models of bacterial cell-cell interactions*; M Pilhofer
- 2566 *Montage cryo-electron tomography: imaging a large field-of-view without sacrificing resolution*; A Peck, S Carter, S Chen, H Mai and G Jensen
- 2570 *Micropatterning of electron microscopy grids for improved cellular cryo-electron tomography throughput*; L Engel, C Vasquez, E Montabana, B Sow, M Walkiewicz, W Weis and A Dunn
- 2574 *Bridging length-scales from molecules to tissues using mouse genetics, cryoCLEM, and cryoET*; J Peukes, M Lovatt, C Leistner, D Morado, F Zhu, J Boulanger, W Kukulski, N Komiyama, S Grant, J Briggs and R Frank
- 2578 *Electron Tomography Workflows using Scipion*; J Jiménez, F De Isidro, E Fernández Jiménez, D Herreros Calero, Y Fonseca, P Conesa, A Cuervo, J Conesa, R Melero, JM Carazo and CO Sorzano

From Images to Insights: Working with Large Multi-modal Data in Cell Biological Imaging

- 2580 *Multi-Scale Imaging of Connectomes With Photons and Electrons*; WC Lee
- 2582 *Correlating analytical microscopy reveals quantitative alterations to the structure, chemistry and materials properties of tooth enamel exposed to acidic solutions*; L Hughes, I Anderson and J Moffat
- 2584 *Morphological Object Localization: A Novel Image Analysis Pipeline for Quantitative Spatial Localization of Biomolecule Signal from Fluorescence Microscopy Data*; A Soltisz, R Veeraraghavan, V Bogdanov and S Gyorke
- 2588 *MoBIE: A free and open-source platform for integration and cloud-based sharing of multi-modal correlative big image data*; C Tischer, C Pape, K Meechan, V Zinchenko, M Schorb, H Vergara, D Arendt, A Kreshuk and Y Schwab

Cryo-EM in Drug Discovery

2590 *From concept to reality: cryoEM as an integral part of drug discovery and development*; C Strickland

2592 *Real-time cryo-EM structure determination for drug discovery*; A Punjani

2594 *Small Molecule Microcrystal Electron Diffraction (MicroED) for the Pharmaceutical Industry – Results from Examining Over Fifty Samples*; J Bruhn, G Scapin, A Cheng, T Ganesh, S Dallakyan, B Read, T Nieuwsma, K Lucier, M Mayer, N Chiang, N Poweleit, P McGilvray, T Wilson, M Mashore, C Hennessy, S Thomson, C Potter and B Carragher

2600 *Integration of Cryo-EM into Drug Discovery*; S Hymowitz

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

2602 *Reaching for atomic-scale quantitative energy dispersive X-ray spectroscopy*; K MacArthur, A Yankovich, A Béché, M Luysberg, H Brown, S Findlay, M Heggen and L Allen

2604 *Evaluation of Optimum Instrument Conditions for the Best Spatial Resolution in Atomic-Column X-ray Analysis toward Quantification*; M Watanabe

2608 *Identifying Individual Atoms in Single Atom Pt/CeO₂ Catalysts*; S Porter and A Datye

2612 *Quantitative STEM for Bimetallic Catalyst Nanoparticles*; X Luo, P Nellist, S Lozano-perez, A Varambhia and D Ozkaya

2616 *Automated methods for improved characterization of alloy nanoparticle catalysts*; D Cullen, M Zachman, H Yu, D Mukherjee and S Reeves

Exploring Beam-sample Interactions for Uncovering the Atomic or Dynamic Nature of Matter

2620 *“No-dose” imaging*; H Friedrich

2624 *Investigating electron beam interactions with nanoparticle capping ligands using correlative liquid phase transmission electron microscopy and fluorescence microscopy*; T Dissanayake, M Wang and T Woehl

2626 *Radiolysis Characterization in Liquid Cell STEM Using Ultra Low-Dose Electron Energy-Loss Spectroscopy*; L Spillane, S Betzler, M Pan, R Twesten and H Zheng

2630 *Direct imaging on the deformation and sintering of polymeric particles at the nanoscale by liquid-phase TEM*; C Liu, Z Ou and Q Chen

2634 *Visualizing non-classical formation pathways of alloyed nanocrystals with liquid phase transmission electron microscopy*; M Wang, A Leff, Y Li and T Woehl

Evaluation of Materials for Nuclear Applications

2636 *In-situ Irradiation, Helium Implantation and Heating to Elucidate Mechanisms in Tungsten Alloys*; K Hattar, E Lang, WS Cunningham, S mathaudhu and J Trelewicz

2640 *In Situ Grain Growth of Nanograined Magnetite under Ion Irradiation at Room Temperature and 500°C*; R Schoell, T Kaspar, D Schreiber and D Kaoumi

2644 *In situ TEM investigation of irradiation-induced amorphization of Fe_3O_4 and γ - Fe_2O_3* ; A Lopez Morales, M Owusu-Mensah, R Schoell, K Yano, D Schreiber and D Kaoumi

2648 *Understanding Strain And Irradiation Segregation In Fusion Materials*; A London, C Hardie, T Tadić, S Das, F Hofmann and S Fazinić

Defects in Materials: How We See and Understand Them

2650 *Probing defects in nanostructures with high spatial and energy resolution*; N Alem

2652 *Show me your “Hand”: Direct determination of “handedness” in $NaCu_5S_3$ chiral crystal via aberration-corrected scanning transmission electron microscopy*; C Zhang, R dos Reis, K Poepelmeier and V Dravid

2656 *Atomic-scale deciphering the defect-related structure and doping behavior of transition metal in SnO_2 nanoparticles*; WS Jang and YM Kim

2660 *Structural defects in ZnO thin films grown by atomic layer deposition at low temperatures*; D Elam, E Ortega, A Chabanov and A Ponce

2664 *Cepstral Scanning Transmission Electron Microscopy Imaging of Disordered Crystals using Coherent Diffuse Scattering*; JM Zuo, YT Shao, HW Hsiao, R Yuan, Q Yang and Y Hu

Advanced Characterization of Components Fabricated by Additive Manufacturing

2666 *Microstructural characterization of 316L stainless steel fabricated by selective laser melting by advanced electron microscopy techniques*; S Mikmekova, J Man and I Konvalina

2670 *HR-EBSD based Characterization of Dislocations in Additive Manufactured 316L Stainless Steel*; T Ruggles, J Kacher, M Nowell and S Wright

2674 *Characterizing the influence of parent grain structures on the physical properties of additively manufactured Ti-64 alloys using EBSD*; P Trimby, I Anderson, K Mehnert, J Porter and J Wheeler

2678 *Understanding the effect of cellular structures on mechanical behavior of additively manufactured 316L stainless steel*; X Wang, B Zheng, K Yu, S Jiang, Y Zhou, E Lavernia and J Schoenung

2682 *The effect of beam scan strategies on the microstructure and mechanical properties of additive manufacturing Ti-6Al-4V builds*; M Shao, S Vijayan and J Jinschek

2686 *Segregation and Precipitation at Cell Boundaries in Rapidly Solidified Austenitic Stainless Steels*; Z Hasenbusch, D Barton, M Roze, A Deal, B Brown, D Wilson, L Nastac and L Brewer

Investigating Phase Transitions in Functional Materials and Devices by In Situ/Operando TEM

2688 *Live Mapping of Crystalline Regions During in-situ Heating (TEM and STEM)*; B Miller, A Pakzad, L Spillane, B Schaffer and C Czarnik

2692 *Early stages of phase decomposition in NiAu alloy thin films studied by in situ TEM using ultrafast quenching methods*; J Schubert, J Will, T Przybilla, M Wu and E Spiecker

2696 *In situ chip-based heating studies of metal-induced layer exchange and Si crystallization using STEM, LEND and SE imaging in SEM*; P Denninger, P Schweizer, T Schwöpe, C Dolle and E Spiecker

2700 *Electron Beam as a Probe and Stimulus: Challenges and Opportunities*; S Yazdi

2704 *Few-second EELS mapping with atomic-resolution*; B Goodge and L Kourkoutis

Fast and Ultrafast Dynamics Using Electron Microscopy

2708 *Expanding the capabilities of the RF stroboscopic TEM*; J Lau, K Callaway, HY Chao, J Cumings, H Choe, E Montgomery, C Jing and Y Zhu

2710 *Development of High-Speed Scan System for Atomic Resolution STEM*; Y Jimbo, R Ishikawa, M Terao, M Nishikawa, S Morishita, M Mukai, H Sawada, Y Ikuhara and N Shibata

2714 *High-Resolution Transmission Electron Microscopy with Bright Microsecond Electron Pulses*; P Olshin, G Bongiovanni, M Drabbels and U Lorenz

2718 *Photoinduced Topological Insulator to Dirac Semimetal Transition in ZrTe₅*; T Konstantinova, L Wu, W Yin, J Tao, G Gu, I Zaliznyak and Y Zhu

Microscopy & Spectroscopy of Energy Conversion and Storage Materials

2720 *In Situ TEM Nano Electrochemistry*; J Huang, L Zhang and Y Tang

2724 *Direct Imaging of Oxygen Sub-lattice Deformation in Li-rich Cathode Material Using Electron Ptychography*; W Song, M Osorio, J Marie, E Liberti, X Luo, C O'Leary, R House, P Bruce and P Nellist

2728 *Phase Evolution Analysis During Real-Time Solid-State Chemical Lithiation of Crystalline Thin Window Silicon Membranes Using Low-Loss STEM-EELS Imaging*; V Oleshko

- 2732 *Ex-situ Li plating detection on graphite anodes in extremely fast-charged lithium-ion batteries using simultaneous neutron and X-ray tomography*; M Yusuf, J LaManna, P Paul, D Agyeman-Budu, M Toney and J Weker
- 2736 *In Situ TEM Investigation of Lithium Intercalation in $Ti_3C_2T_x$ MXenes for Energy Storage Applications*; S Misra, M Boebinger, T Mathis, M Naguib, Y Gogotsi and R Unocic

Analytical Sciences Symposia

Microscopy and Microanalysis for Real World Problem Solving

- 2738 *Microanalysis of Cd Whiskers on Cd Plated Long-Term Used Hardware*; S Dickens, T Ruggles, R White, Z Ghanbari, D Perry and D Susan
- 2742 *Development and Application of Synthetic Hematite Reference Material for U-Pb Geochronology*; L Courtney-Davies, C Ciobanu, S Gilbert, S Tapster, M Richardson, N Cook, M Verdugo-Ihl, B Wade, K Ehrig and D Condon
- 2746 *Terahertz Imaging to Map the Microporosity Distribution in Carbonate Rocks*; S Eichmann, J Bouchard, H Ow, P O'Mullan, D Petkie and M Poitzsch
- 2750 *Carbon Nanotubes and Nano Zinc Ferrites: A Noble Combination to Enhance Biomass and Length of Sorghum Bicolor*; DK Tiwari, J Villegas, AV Coria-Tellez, CA Limón Luna, D Tripathi and P Sengar
- 2754 *Material prediction from confocal images of lasered samples*; H Choi, A Phoulady, N May, S Shahbazmohamadi and P Tavousi
- 2756 *Voice Control of the Scanning Electron Microscope Using a Low-Cost Virtual Assistant*; D Holburn, B Breton, T Rowsell and C Lam

Full System and Workflow Automation for Enabling Big Data and Machine Learning in Electron Microscopy

- 2758 *Materials and process discovery by correlated STEM imaging and spectroscopy with electrical testing*; A Wagner, J Nugent and K Virwani
- 2762 *Causal Analysis of Parameterized Atomic HAADF-STEM Across a Doped Ferroelectric Phase Boundary*; C Nelson, M Ziatdinov, X Zhang, R Vasudevan, E Eliseev, A Morozovska, I Takeuchi and S Kalinin
- 2766 *Predicting local plasmon resonances and geometries using autoencoder networks in complex nanoparticle assemblies*; K Roccapriore, M Ziatdinov, SH Cho, D Milliron, J Hachtel and S Kalinin
- 2770 *Towards Automating Structural Discovery in Scanning Transmission Electron Microscopy*; N Creange, O Dyck, C Nelson, R Vasudevan, M Ziatdinov and S Kalinin
- 2774 *4D >Crystal: Deep Learning Crystallographic Information From Electron Diffraction Images*; J Munshi, AM Rakowski, B Savitzky, C Ophus, ML Henderson, S Cholia and MKY Chan

Moon Dust, Minerals and Microscopy

- 2778 *Microstructural features in carbonates from Antarctic micrometeorites: Effective tools for analyzing the evolution of small Solar System bodies*; E Dobrica, K Ohtaki and C Engrand
- 2782 *Isotopic, Structural and Chemical Analyses of Pre-Solar Silicates from Asymptotic Giant Branch Stars and Type-II Supernova Explosions*; L Lajaunie, M Sanghani, W Rickard, S Sung-Yun Hsiao, Z Peeters, H Shang, D-C Lee, J Calvino, K Marhas and M Bizzarro
- 2786 *TEM analyses of in situ presolar grains in pristine matrix material of ordinary chondrite Semarkona*; S Singerling, L Nittler, E Dobrica, A Brearley and R Stroud
- 2790 *Coordinated Analyses of a Supernova Silicate Grain in the CO3.0 Chondrite Miller Range 07687*; L Seifert, P Haenecour, T Ramprasad and T Zega
- 2792 *Coordinated Analysis of a Metal-rich Nugget from a Calcium-aluminum-rich Inclusion.*; T Ramprasad, V Manga, L Seifert and T Zega
- 2796 *EPMA of Amphibole in Meteorites: Nakhilite Northwest Africa 13368 and Winonaite Northwest Africa 13432*; P Carpenter, A Irving and B Jolliff

Portable- and Laboratory-based Approaches to Analysis in Cultural Heritage

- 2800 *On the Surface: Reflectance FTIR Spectroscopy in Cultural Heritage Research*; J Walker, R Hodgkins and B Berrie
- 2806 *Micro reflectance imaging spectroscopy for pigment identification in painting cross sections*; M Vermeulen, K Eremin, G Rayner, K Smith, T Cavanaugh, A McClelland and M Walton
- 2810 *An in-depth look at how physical properties of cleaning materials affect the removal of soot from rough papers*; T Duncan, E Vicenzi and S Brogdon-Grantham
- 2814 *Nanoscale IR spectroscopy: From Principles to Nanoscale Imaging and Identification of Metal Soaps*; X Ma, G Pavlidis, E Dillon, K Kjoller, B Berrie and A Centrone

Biological Sciences Symposia

Cryo-electron Tomography: Present Capabilities and Future Potential

- 2816 *Explore the complexity of proteins with an expanded CryoET data processing pipeline*; M Chen, D Chmielewski, W Chiu and S Ludtke
- 2818 *Using Maskless Photopatterning for Cryo-ET of Primary Drosophila melanogaster Neurons*; J Kim, B Sibert, J Yang, S Yang, J Mitchell, J Wildonger and E Wright
- 2822 *Ultrastructural Analysis of Cytoskeletal Networks in Neuronal Growth Cones by Light and Electron Microscopy*; R Hylton, M Grillo, J Heebner and M Swulius

- 2826 *Extracellular Vesicles Modulate Formation of Transmissible Mutant Huntingtin Assemblies*; K Nunn, X Kuang, P Castellano, J Jiang, A Horgan, J Kong, Z Tan and W Dai
- 2832 *The molecular basis for sarcomere organization in vertebrate skeletal muscle*; Z Wang, M Grange, T Wagner, AL Kho, M Gautel and S Raunser

From Images to Insights: Working with Large Multi-modal Data in Cell Biological Imaging

- 2836 *Image archiving at EMBL-EBI - EMPIAR and the BioImage Archive*; G Kleywegt
- 2838 *Implementing a storage and compute server to enhance processing of big imaging data*; J Boyd, PB Goebel, M Rust and C Zugates
- 2840 *Solutions for Data management and Correlative Data Fusion by ZEISS*; M Kuttge
- 2842 *Next Generation File Formats and Platforms*; J Moore and N Sofroniew

Cryo-EM in Drug Discovery

- 2844 *Structural Studies of an Anti-SARS-CoV-2 Antibody Cocktail*; M Franklin, A Romero Hernandez, K Saotome, Y Zhou, A Baum, C Kyratsous, L Shapiro, G Cerutti and D Ho
- 2848 *Broad Neutralization of H1 and H3 Viruses by Adjuvanted Influenza HA Stem Vaccines in Non-human Primates*; Y Zhou, Y Qiu, N Darricarrère, M Kanekiyo, A Creanga, RA Gillespie, SM Moin, J Saleh, J Sancho, T-H Chou, R Zhang, S Dai, A Moody, KO Saunders, MC Crank, JR Mascola, BS Graham, C-J Wei, and GJ Nabel
- 2852 *Cryo-EM structures of human PRMT5:MEP50 complex reveal chemical basis for designing high-specificity inhibitors*; G Yadav, W Zhao, X Yang, C Li and Q-X Jiang
- 2854 *Advances in Cryo-EM structure-based methods in membrane protein drug discovery*; M Hennig
- 2856 *CryoEM in industry: challenges and opportunities*; G Scapin

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

- 2860 *Real-Time 3D Analysis During Tomographic Experiments on tomviz*; J Schwartz, C Harris, J Pietryga, H Zheng, P Kumar, A Vishratina, N Kotov, Y Jiang, M Hanwell and R Hovden
- 2864 *Automating 3D Imaging of Inorganic Nanoparticles*; T Slater, YC Wang, J McCormack, G Leteba, J Quiroz, P Camargo, R Palmer, S Haigh and C Allen

- 2868 *Promoting Protective Scale Formation at Lower Temperatures via Surface Finishing: Effects on the Establishment, Structure, and Chemistry in Haynes 214 High-Temperature Oxidation-Resistant Nickel Alloy*; S House, H Ayoola, J Lyons, B Li, J Yang and B Gleeson
- 2872 *Nano-scale imaging and spectroscopy of interfaces in (Co,Cu,Mg,Ni,Zn)O high entropy oxides*; H Vahidi, A Dupuy, J Cortez, J Schoenung and W Bowman
- 2876 *Structural and chemical properties of superconducting rare-earth barium copper oxide/BaHfO₃ nanocomposites with rare-earth mixtures*; L Grünewald, P Cayado, J Hänisch, B Holzapfel and D Gerthsen
- 2880 *Crystalline Phase Control in Sc_xAl_{x-1}N Grown by Molecular Beam Epitaxy*; A Lang, M Hardy, B Downey, E Jin, N Nepal, DS Katzer, D Meyer and R Stroud

Many Detectors Make Lights Work: Advances in Microanalysis of Light Elements in Synthetic and Natural Materials

- 2882 *Light Element Analysis in Extraterrestrial Materials using Secondary Ion Mass Spectrometry*; M Bose
- 2884 *Sample Preparation and Coordinated Analysis for Characterization of Organic Matter in Return Samples from the Carbonaceous Asteroids Ryugu and Bennu*; B De Gregorio and R Stroud
- 2886 *Adjustment to the Light Element Areal Concentration Calculation for Neutron Depth Profiles*; J Weaver and A Job
- 2890 *Advancing the in-situ characterization of light elements via X-ray absorption spectroscopy using superconducting detectors*; C Titus, W Doriese, G O'Neil, K Morgan, D Schmidt, D Swetz and J Ullom
- 2892 *Using Molecular Dynamics Simulations to Understand Electron Beam Interactions with Macromolecules in Liquid-phase Transmission Electron Microscopy*; J Smith, C Liu and Q Chen
- 2894 *Using cryo-TEM to study the effect of side-chain chemistry on the crystal motifs in polypeptoid nanosheets*; M Seidler, N Li, S Xuan, D Prendergast, R Zuckermann, N Balsara and X Jiang
- 2896 *Holey-Gold Films on Molybdenum Grids for Cryogenic Electron Microscopy Imaging of 2D Polymer Crystals*; X Jiang, S Xuan, R Zuckermann, R Glaeser and N Balsara
- 2900 *Understanding graphene's role as a protective substrate for atomic-resolution electron microscopy of small organic molecules*; B Janicek, P Kharel, Sh Bae and P Huang
- 2902 *Electron Diffraction of Graphene-covered Protein Crystals at Room Temperature*; S Keskin and N de Jonge

Evaluation of Materials for Nuclear Applications

- 2904 *Influence of Irradiation-Induced Defects on Anion Transport in Epitaxial Cr₂O₃*; K Yano, A Kohnert, T Kaspar, S Taylor, S Spurgeon, H Kim, Y Wang and D Schreiber

- 2906 *Evolution of Defect States from Different Starting States in $La_{1-x}Sr_xFeO_3$ Thin Films*; B Matthews, K Yano, S Taylor, M Sassi, Y Du, L Wang, K Hattar and S Spurgeon
- 2910 *Advanced Characterization Techniques Enabling Commercial Development of Accident Tolerant Fuel Cladding*; A Hoffman, V Gupta, M Larsen, S Nag, I Spinelli, D Ruscitto and R Rebak
- 2914 *Radiation-induced mixing and demixing behavior in metallic multilayers exhibiting limited solid miscibility*; M Radhakrishnan, T Nizolek, N Li, Y Wang, M Bachhav, B Kombariah and O Anderoglu

Defects in Materials: How We See and Understand Them

- 2916 *Dislocation imaging via the virtual dark-field technique using the precession electron diffraction data*; D Zhao and K Xie
- 2918 *An Atomic Level Study of Localized Strain Fields on Multiple Low-Index Ceria (CeO_2) Nanoparticle Surfaces*; P Haluai, EL Lawrence, T Boland and P Crozier
- 2922 *Investigation of the effect of helium ion (He^+) irradiation on the fluorescence properties of microdiamonds grown by chemical vapour deposition*; MS Maqbool, D Hoxley, B Johnson, A Stacey and B Abbey
- 2926 *Impact of Electric Fields on Grain Boundary Atomic and Electronic Structures*; B Qu, S Russell and K van Benthem
- 2928 *Twist boundary defects in penta-twinned silver nanowires*; A Eggeman, H Zhao and B Derby
- 2932 *Effect of Cation Point Defects in Doped Ceria Materials on Surface Oxygen Vacancies and Exchange Reactions*; M Tan and P Crozier

Advanced Characterization of Components Fabricated by Additive Manufacturing

- 2936 *Automated inclusion and porosity analysis of metal additive manufacturing parts*; P Pistorius
- 2938 *Three-dimensional Characterization of Selective Laser Melted Graphene Oxide-Reinforced Ti-48Al-2Cr-2Nb Alloy using FIB-SEM Tomography*; D Li, W Zhao, X Zhang, Y Liao and Y Zheng
- 2940 *High Resolution X-Ray CT Reconstruction of Additively Manufactured Metal Parts using Generative Adversarial Network-based Domain Adaptation in AI-CT*; A Ziabari, A Dubey, S Venkatakrishnan, C Frederick, P Bingham, R Dehoff and V Paquit
- 2944 *In situ dynamic X-ray micro-CT for additive manufactured parts*; J Dewanckele, F Coppens, W De Boever, M Boone and L Hunter
- 2946 *Modeling and characterization of binder jet 3D printed NiMnGa components using X-ray microscopy*; S Isacco, B Winiarski, C Bansah, M Caputo and CV Solomon

Fast and Ultrafast Dynamics Using Electron Microscopy

- 2952 *Transient lensing from an electron gas imaged by ultrafast electron microscopy*; O Zandi, A Sykes and R van der Veen
- 2954 *Photo-induced ultrafast phase transition in twisted bilayer graphene*; D Luo, D Hui, X Shen, J Yang, R Li, A Reid, B Wen, X Wang, I Arslan and J Wen
- 2958 *Ultrafast nanoimaging of the order parameter in a structural phase transition*; T Danz, T Domröse and C Ropers
- 2962 *Studying rapid solidification microstructure evolution in hypoeutectic ternary Al(Cu-Ag) alloys by fast in-situ and post-mortem TEM experiments*; Y Liu, JT McKeown and J Wiezorek
- 2968 *Photocathode Investigation for Ultrafast Electron Microscopy*; T Gage, H Liu and I Arslan

Microscopy & Spectroscopy of Energy Conversion and Storage Materials

- 2970 *From In Situ Conversion to Chemical Reaction Kinetics: Development of Truly Operando TEM and its Application to CeO₂-Supported Pt Catalysts*; J Vincent and P Crozier
- 2974 *Quantitative analysis of 3D structures in metal-oxide composites*; Y Wen, A Hashimoto, A Hirata and H Abe
- 2976 *Atomic-scale Imaging of PGM-free Catalyst Active Sites by 30 keV 4D-STEM*; M Zachman, CM O'Leary, DY Chung, H Hafiz, EF Holby, V Stamenkovic and D Cullen
- 2978 *In Situ TEM Studies on the Nucleation and Growth of Multicomponent Alloy Nanoparticles on 2D Materials*; M Tamadoni Saray and R Shahbazian-Yassar
- 2982 *Studying Charge Transport and Light Induced Structural Alterations in Ni/NiO Core-Shell Co-Catalysts on SrTiO₃ for Solar Hydrogen Evolution*; P Haluai, J Vincent and P Crozier

Analytical Sciences Symposia

Full System and Workflow Automation for Enabling Big Data and Machine Learning in Electron Microscopy

- 2986 *The role of Nanocartography in the Development of Automated TEM*; M Olszta, K Fiedler, S Spurgeon, S Rehl and D Hopkins
- 2988 *Automating Electron Microscopy through Machine Learning and USETEM*; M Xu, A Kumar and J LeBeau
- 2990 *Direct mapping of polarization fields from STEM images: A Deep Learning based exploration of ferroelectrics*; A Ghosh, C Nelson, M Oxley, X Zhang, M Ziatdinov, I Takeuchi and S Kalinin
- 2994 *A Simple Program for Fast Tilting Electron-Beam Sensitive Crystals to Zone Axes*; Y Ma and T Sun

- 2996 *Construction Zone: a software package for building complex nanoscale atomic scenes for applications in machine learning data generation pipelines*; L Rangel DaCosta and M Scott
- 3000 *AtomAI: Open-source software for applications of deep learning to microscopy data*; M Ziatdinov and S Kalinin

Portable- and Laboratory-based Approaches to Analysis in Cultural Heritage

- 3004 *NIR Luminescence and Composition of Egyptian Blue as Markers in Archaeometric Evaluations*; A Masic and M Nicola
- 3008 *Hyperspectral and Multispectral Reflectance Imaging of Paintings*; P Betts, N Barbi, G Gates, E Uffelman, H Jones and G Kemeny
- 3012 *Orpiment in Colonial Williamsburg: Challenges with the Identification of Yellow Arsenic Sulphides in Historic Housepaints*; K Moffitt
- 3014 *Novel Portable Laser Ablation Micro-Sampling in Cultural Heritage*; A Knaf, P Londero, J Nikkel, R Hark and A Bezur

Biological Sciences Symposia

Cryo-electron Tomography: Present Capabilities and Future Potential

- 3018 *Molecular architecture of the flagellar export apparatus reveals membrane remodeling and conformational changes crucial for flagellar assembly*; B Carroll, M Motaleb and J Liu
- 3020 *Form and function of the condensed bacterial nucleoid studied by cryo-ET*; D Parrell, J Olson, T Donohue and E Wright
- 3024 *Peeking into the plant cell wall using cryo-FIB milling and electron cryo-tomography*; W Nicolas, F Fassler, E Meyerowitz and G Jensen
- 3028 *Sparse cryo-STEM tomography for biological samples*; A Cossa, V Arluison and S Trépout
- 3032 *Deposition-free Cryo-FIB Lift-out Transfer for Cryo-Electron Tomography Specimen Preparation*; J Plitzko, P Erdmann and S Klumpe

From Images to Insights: Working with Large Multi-modal Data in Cell Biological Imaging

- 3036 *CEM500K – A large-scale heterogeneous unlabeled cellular electron microscopy image dataset for deep learning*; R Conrad and K Narayan
- 3038 *High-Resolution Imaging of Single-Cell Behaviors in 3D Bacterial Biofilms using Lattice-Light Sheet Microscopy and Deep Learning-Based Image Processing*; J Zhang, Y Wang, M Zhang, A Achimovich, J Wang, S Acton and A Gahlmann

3042 *Tools and Approaches for Assembly, Review, and Analysis of Large-Scale Electron Microscopy*; B Jones, J Anderson, R Pfeiffer and C Sigulinsky

Physical Sciences Symposia

Many Detectors Make Lights Work: Advances in Microanalysis of Light Elements in Synthetic and Natural Materials

3046 *Application of ζ -factor Microanalysis to Measure Phase Compositions in Ultrahard Ceramics and Complex Concentrated Alloys*; C Marvel, J Smeltzer, K Behler, BC Hornbuckle, J LaSalvia, K Darling, M Watanabe and M Harmer

3050 *Evolution of NV centers in nanodiamond using in situ heating with STEM-EELS/EDS*; B Hudak and R Stroud

3054 *Mechanisms of Li Leaching from a LiCO₃ Based Primer / Topcoat Paint System*; A Glenn, P Visser, T Hughes, S Ranade, J Laird, H Terryn, A Mol, C MacRae, N Wilson and A Torpy

3058 *Toward interpretable, wide field-of-view transmission electron microscopy techniques for imaging light atoms*; H Brown and J Ciston

Exploring Beam-sample Interactions for Uncovering the Atomic or Dynamic Nature of Matter

3062 *Nanoscale functional chemistry and opto-electronic response of organic materials*; S Collins, C Vollmer, Q Ramasse and D Kepaptsoglou

3066 *Electron beam modification of plasmonic responses of nanoparticles*; K Roccapriore, N Creange, SH Cho, D Milliron and S Kalinin

3070 *Quantifying fluxional behavior in catalytic CeO₂ nanoparticles: toward thermodynamic insight into the stability of surface atomic structures*; R Manzorro, J Vincent, Y Xu, EL Lawrence, D Matteson and P Crozier

3072 *Atomic-scale Feedback-controlled Electron Beam Fabrication of 2D Materials*; M Boebinger, S Misra, Y Yu, K Xiao, T Mathis, Y Gogotsi, AR Lupini, S Kalinin, S Jesse and R Unocic

Evaluation of Materials for Nuclear Applications

3074 *Structural Alloys in Light Water Reactor Systems: Role of Microscopy in the Mitigation of Environmentally-Assisted Cracking Through Surface Optimisation*; MG Burke

3076 *Microstructural Insights into Pb-Caustic Stress Corrosion Cracking in Alloy 690TT*; GB Mazzei, AD Horner, F Scenini and MG Burke

3080 *Advances in the Development of White-Light Interferometry for In-Situ Uranium Hydride Kinetic Data Collection*; Y Idell, W Siekhaus, K Blobaum and W McLean

- 3084 *Application of Atom Probe Tomography as a Method to Investigate Localized Thermal Transport in Actinide-Bearing Oxides*; A Sen, M Bachhav and J Wharry
- 3086 *Novel nuclear materials characterization workflows enabled by fs-laser milling*; S Kelly, R White, T Volkenandt, W Harris, B Tordoff, G Laudone, K Jones and B Veater
- 3088 *Nano-CT and Electron Microscopy Cross-correlative Study of Tritiated LiAlO₂ Pellet Nanopores*; B Matthews, A Albrecht, T Pope and D Senior

Defects in Materials: How We See and Understand Them

- 3090 *Studying clusters and nano-precipitates in Aluminium alloys using SPED and ADF-STEM*; E Thronsen, A Lervik, C Hell, CD Marioara, S Wenner, R Bjørge, J Friis, S Igmund, J Andersen and R Holmestad
- 3096 *In situ TEM Investigation of the Electroplasticity Phenomenon on Dislocation Behavior in Ti-6wt%Al*; X Li, S Zhao, R Zhang, J Turner, KC Bustillo, R Dhall and A Minor
- 3098 *Cores of 1/2<110>-type dislocations in the CrMnFeCoNi high-entropy alloy investigated by STEM, the center of symmetry and the Nye tensor mapping techniques*; M Heczko, V Mazánová, R Gröger, T Záležák, MS Hooshmand, E George, M Mills and A Dlouhý
- 3100 *Disconnection-mediated twin junction migration mechanism in FCC metals*; T Kaufman, K Chen, J Han, F Cao, M Xu, F Ye, D Srolovitz and X Pan
- 3104 *Direct electron imaging of dislocation activities in nanocrystalline molybdenum nanopillars*; H-W Hsiao and J-M Zuo

Advanced Characterization of Components Fabricated by Additive Manufacturing

- 3106 *Shear-Deformation-Induced Modification of Defect Structures and Hierarchical Microstructures in Miscible and Immiscible Alloys*; B Gwalani, M Song, J Escobar, A Yu, M Olszta, J Liu, T Liu, J Silverstein, X Ma, S mathaudhu, P Sushko, C Powell and A Devaraj
- 3110 *Utilizing a Dynamic Segmentation Convolutional Neural Network for Microstructure Analysis of Additively Manufactured Superalloy 718*; S Taller, L Scime and K Terrani
- 3114 *Direct Synthesis of ZIF-8 on Transmission Electron Microscopy Grids Allows Structure Analysis and 3D Reconstruction*; M Hugenschmidt, K Kutonova, EP Valadez Sánchez, S Moulai, H Gliemann, S Bräse, C Wöll and D Gerthsen
- 3118 *Nanostructure Evolution in AA7075 Alloy Produced by Solid State Additive Manufacturing – Additive Friction Stir - Deposition*; MY Rekha, D Avery, PG Allison, JB Jordon and L Brewer
- 3120 *Correlative Microscopy and Spectroscopy for Characterization of Laser-Based Additive Manufactured Materials*; M Freund, T Isik, C Yilmaz Akkaya and V Ortalan

Fast and Ultrafast Dynamics Using Electron Microscopy

- 3122 *Extreme Light-Matter Interactions in the Ultrafast Transmission Electron Microscope*; I Kaminer
- 3124 *Catching them in Action: Ultrafast Transmission Electron Microscopy*; V Ortolan
- 3128 *Capturing Laser Induced Dynamics of Reactive Materials via Ultrafast Transmission Electron Microscopy*; T Isik, C Yilmaz Akkaya and V Ortolan
- 3130 *Imaging of localized surface plasmonic field at nanoscale by UEM*; H Liu, T Gage and I Arslan
- 3132 *High-Q photonic chip-based temporal phase plates for electron microscopy*; A Feist, A Sajid Raja, J-W Henke, J Liu, G Arend, G Huang, FJ Kappert, RN Wang, J Pan, O Kfir, T Kippenberg and C Ropers

Microscopy & Spectroscopy of Energy Conversion and Storage Materials

- 3134 *Material Contrast Information at the limit: Imaging of energy related materials with Backscattered Electrons obtained with Field Emission and the DELTA SEM*; U Golla-Schindler, I Wacker, B Schindler, R Löffler, D Goll, G Schneider and RR Schröder
- 3138 *Development of high-temperature electrochemical TEM and its application on solid oxide electrolysis cells*; SB Simonsen, WL Dacayan, Z Ma, C Chatzichristodoulou, W Zhang and KS Mølhave
- 3140 *Electron Microscopy Characterization of Sargassum Spp. from the Mexican Caribbean for Application as a Bioconstruction Material*; LB López-Sosa, M Morales-Máximo, R Anastacio-Paulino, A Custodio-Hernández, JC Corral-Huacuz and A Aguilera-Mandujano
- 3144 *Universality and Scaling in Relations Between the Plasmon Energy and Solid-State Parameters: Viewing Nanoscale Properties of Battery Materials*; V Oleshko
- 3148 *STEM Analysis of Cycled Model Li-ion Battery Cathode Grown by MBE.*; KC Bilash, J Guo, DB Buchholz, G Evmenenko and R Klie
- 3152 *Low Dose Structural Analysis of Fragile Materials by Three-Dimensional Electron Diffraction*; Z Huang

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Microscopy and Microanalysis for Real World Problem Solving

- 3154 *A Best Known Method to Effectively Differentiate Elements with XEDS Peaks Overlapping for High-Volume Manufacturing of Semiconductor Device at Wafer Foundries*; W Zhao
- 3156 *Comparative Microstructural study of Inconel 625 used to turbochargers*; E Ordoñez-Casanova, H Reyes Blas and HA Trejo-Mandujano
- 3160 *Low-Cost Fluorescent Microvascular Visualization in *Ambystoma mexicanum**; L Bollinger and R Dickie
- 3164 *Freeze-fracturing of microbes producing biopolymers at liquid Helium temperature: cryo-SEM application in biotechnology*; K Hrubanova, K Mrázová, P Urban, V Krutil, R Skoupý, S Obruča and V Krzyzanek

- 3168 *Electron microscopy analysis of biofilms produced by Staphylococcus aureus exposed to UV-light on the surface of SnO₂ thin films*; HJ Morales-Rodriguez, J Camarillo-Cisneros, M Favila-Pérez, AR Castillo-González, CM Quiñonez-Flores, C Leyva-Porras and C Arzate-Quintana
- 3172 *3D printing of custom sample holders as a responsive and cost-effective method of sample holder generation for electron microscopy*; A Strachan, D Haspel and N Stephen
- 3176 *Compact-sized Cutting System for a Serial-block-face Scanning Electron Microscopy*; N Takagi, N Yamashita, Y Tsujimura, H Takemura, SK Chee, K Suzuki, Y Kubota and H Yokota
- 3178 *Optimization of operating parameters by SEM in HVOF deposition of NiCr coatings*; S Saucedo Martínez, J Núñez Segovia, C Parra González, L Bejar Gómez and S Lascano Farak
- 3180 *An open software ecosystem for your everyday imaging task*; T Volkenandt, T Wulff, S Rhode and M Kuttge
- 3182 *Investigation of concrete by means of micro-XRF*; A Menzies, M Buegler, R Tagle and F Reinhardt
- 3186 *Model for predicting surface properties of lasered samples*; A Phoulady, H Choi, N May, B Ahmadi, P Tavousi and S Shahbazmohamadi
- 3190 *Hyperspectral Bioindicators of Heavy Metal Exposure in Tall Fescue*; D Maes, A Finke, C Smallwood, J Timlin, M Howard and A Ruffing
- 3192 *Warp Free TEM Sample Preparation Methods Using FIB/SEM Systems*; S Cook
- 3196 *Analytical microscopy studies of nitrogen solubility in austenite and ferrite upon welding of hyper duplex steel*; G Perez, A Pimenta, JFDF de Araujo, J Pardal, S Maior Tavares, M Diniz and G Solorzano

Portable- and Laboratory-based Approaches to Analysis in Cultural Heritage

- 3200 *Comparison of quantification from field deployable pXRF and laboratory based-micro-XRF within an SEM of Cu-based alloys*; T Lam
- 3204 *Case Study of SEM-EDS Cross-Sections to Assist in Understanding pXRF Results from William H. Johnson Paintings*; T Lam, N Mendez, G Manthey, A Kerr and K Teeter
- 3208 *Microanalysis of Glass Fluid Storage Vials from The Invertebrate Zoology Collection at the National Museum of Natural History*; M Hiebert, T Lam, E Vicenzi, R Phaneuf, W Moser and C Hawks

Biological Sciences Symposia

Cryo-electron Tomography: Present Capabilities and Future Potential

- 3212 *How much can inelastically scattered electrons contribute to electron cryotomography of biological specimens?*; J Dickerson, PH Lu, D Hristov, R Dunin-Borkowski and C Russo
- 3216 *rAMI – Rapid Alignment with Moment of Inertia for Cryo-EM Image Processing*; S-C Chung, S-H Wang, C-Y Hung, W-H Chang and I-P Tu

- 3220 *Structure determination of low-molecular weight targets at near-atomic resolution using single-particle cryo-electron tomography*; H-F Liu, Y Zhou, X Du, J Bouvette, M Borgnia and A Bartesaghi
- 3224 *Distributing cryo-ET education with WebGL and WebXR technologies*; M Larson and E Wright
- 3228 *ENZEL - A cryogenic, retrofittable, coincident fluorescence, electron, and ion beam solution for the cryo-electron tomography workflow*; D Boltje, J Hoogenboom, A Jakobi, G Jensen, C Jonker, A Koster, M Last, J Plitzko, S Raunser, S Tacke, R Wepf and S Den Hoedt
- 3230 *Precise 3D-correlative FIB-milling of biological samples using METEOR, an integrated cryo-CLEM imaging system*; A Bieber, C Capitanio, O Schiøtz, M Smeets, J Fenzke, P Erdmann and J Plitzko
- 3234 *Fluorescence-guided lamella fabrication with ENZEL, an integrated cryogenic CLEM solution for the cryo-electron tomography workflow*; C Jonker, D Boltje, J Hoogenboom, A Jakobi, G Jensen, A Koster, M Last, J Plitzko, S Raunser, S Tacke, R Wepf and S Den Hoedt
- 3236 *Tracing Filaments in Simulated and Experimental 3D Cryo-Electron Tomography Maps Using a Fast Dynamic Programming Algorithm*; S Sazzed, P Scheible, J He, M Auer and W Wriggers
- 3238 *Cryo Soft X-ray Microscopy for Whole Cell Imaging - Progress in the Development of a Commercial Laboratory Scale Device*; K Fahy, T McEnroe, D Skoko, W Fyans, F O'Reilly and P Sheridan
- 3240 *STOPGAP_refine: Tilt series refinement for high-resolution subtomogram averaging*; S Khavnekar, W Wan, P Erdmann and J Plitzko

Cryo-EM in Drug Discovery

- 3242 *An expedited genes-to-drug approach using cryo-EM enabled structure based drug design*; K Borrelli, L Frye and M Radjaina
- 3246 *CryoDiscovery (TM): A Machine Learning Platform for Automated cryo-EM Class Selection for Single Particle Analysis in Structural Biology*; N Kumar and R Dehart
- 3250 *Application of Cryo-Electron Microscopy on Drug Discovery*; V Vittaladevaram and K Kuruti
- 3252 *Next generation vitrification robot*; M Kuijper, I Spee, A Koh and D Němeček
- 3256 *Thermo Scientific™ Glacios Cryo-TEM: A Versatile 200 kV Tool for Structure-Based Drug Discovery*; I Drulyte, X Zhang, R Johnson, A Koh, S Masiulis, S Unger, E Pechnikova, D Wootten, P Sexton and M Belousoff
- 3260 *Structural and Functional Analysis of the D614G SARS-CoV-2 Spike Protein Variant*; X Wang, L Yurkovetskiy, K Shen, J Luban, N Dudkina, K Pascal, C Tomkins-Tinch, T Nyalile, Y Wang, A Baum, W Diehl, A Dauphin, C Carbone, S Egri, K Veinotte, S Schaffner, J Lemieux, J Munro, A Rafique, A Barve, P Sabeti and C Kyriatsous

3264 *Thermo Scientific™ Multigrid: Automation enhanced screening and data collection*; H Raaijmakers and M Sani

Physical Sciences Symposia

Advanced Imaging and Spectroscopy for Nanoscale Materials Characterization

3266 *TEM Characterization of retained austenite on modified TRIP800 steel*; N Makris, A Kaldellis, P Tsakiridis and G Fournalis

3270 *Static Testing and Fatigue Behavior of Three High-Entropy Alloys*; N Florido-Suarez, P Socorro-Perdomo, V Geanta and J Mirza-Rosca

3272 *Effect of Dispersion of Particles Nanohybrid Reinforcing in the 6063 Aluminum Alloy*; ML Camacho-Rios, CG Garay-Reyes, D Lardizabal-Gutiérrez, I Estrada-Guel, R Perez-Bustamante, G Herrera-Perez, A Santos-Beltrán, CD Gómez-Esparza and R Martínez-Sánchez

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