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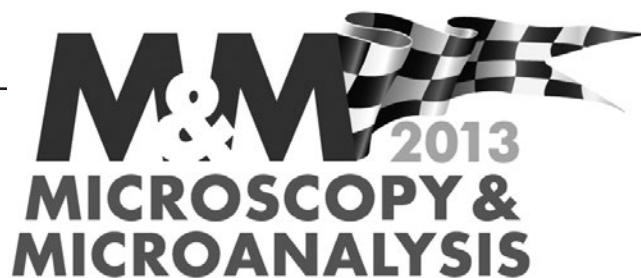


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- 194 *Alternative Fixation Procedures for the Inactivation of Dry, Bioforensic Samples for Examination by Electron Microscopy*; RM Hannah, CA Brantner, SS Lehman, MA Firmani, RK Pope; National Biodefense Analysis and Countermeasures Center
- 196 *A Systemic Triple Label Strategy for Fluorescent Microscopy of Inflammation in CNS and Non-CNS Tissue*; AJ Woolley, HA Desai, J Gaire, AL Ready, KJ Otto; Purdue University
- 198 *Focused Ion Beam Milling of Eukaryotic Cells for Determining Membrane Interaction*; L Lampert, A Barnum, J Jiao; Portland State University
- 200 *Functionalization of Agave Cellulose Nanoparticles and Its Characterization by Microscopy and Spectroscopy Techniques*; C Ponce, J Chanona; Instituto Politecnico Nacional, Mexico; V Garibay, E Palacios; Instituto Mexicano del Petroleo; G Calderon; Instituto Politecnico Nacional, Mexico; R Sabo; U S Department of Agriculture, Madison
- 202 *Validation by Scanning Electron Microscopy of Three-Dimensional Coating of PCL/PLLA Scaffolds with Electrospun PLLA Nanofibers for Tissue Engineering*; PE McClellan, WJ Landis; University of Akron

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- 204 *Is it Rheumatic Aortitis, Fatty Streaking or Both?*; S Siew; Michigan State University
- 206 *Current Trends in the Diagnosis of Primary Ciliary Dyskinesia*; E Wartchow; Children's Hospital Colorado
- 208 *First Nucleotide Sequence Data from an Electron Microscopy Based DNA Sequencer*; C Own; Voxa; A Bleloch, W Lerach, C Bowell, M Hamalainen, J Herschleb, C Melville, J Stark, M Andregg, W Andregg; Halcyon Molecular
- 210 *Trafficking Mechanism of Fungal Effector Proteins Inside Rice Cells*; C-H Khang, EA Richardson, Y Hernandez-Rodriguez, LH Chen; University of Georgia; T Todd, B Valent; Kansas State University
- 212 *Formation of Mitochondrial Spheroid in Response to Oxidative Stress*; M Li, MP Goheen, X-M Yin; Indiana University
- 214 *Autophagy Exacerbates the Lysosomal Dysfunction of Late-Stage Atherosclerosis*; WG Jerome, CD Netherland-Van Dyke, CE Romer; Vanderbilt University
- 216 *Delivery of a Novel Connexin-43 Mimetic Peptide Enhances Wound Healing*; K Moore, Z Bryant, A Vandergriff; University of South Carolina; G Ghatnekar; First String Research, Inc; R Gourdie; Virginia Tech Carillion; J Potts; University of South Carolina

- 218 *Size-Dependent Thermotherapy of Iron Oxide Nanoparticles on Human Breast Adenocarcinoma Cancer Cells*; T Mustafa, Y Xu, F Watanabe; University of Arkansas, Little Rock; Y Zhang; National Center for Toxicological Research, US Food and Drug Administration; M Asar; University of Arkansas, Little Rock; R Little; Howard University; A Karmakar, M Mahmood, K Hudson, A Biris; University of Arkansas, Little Rock
- 220 *45 Years of Electron Microscopy and Infectious Diseases, 37 Years at the “Bench” with Negative Stain Processing: What Did I Learn?*; CD Humphrey; Home
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- 224 *High Resolution Electron Microscopy Analysis of the Helicobacter pylori Cag Type IV Secretion System*; JA Gaddy; Vanderbilt University; TL Cover; U.S. Department of Veterans Affairs
- 226 *Characterization of Yeast Biofilm by Cryo-SEM and FIB-SEM*; K Dobranska; Institute of Scientific Instruments ASCR, Czech Republic; J Nebesarova; Biology Center ASCR, Czech Republic; F Ruzicka; Masaryk University, Czech Republic; J Dluhos; TESCAN, Czech Republic; V Krzyzaneck; Institute of Scientific Instruments ASCR, Czech Republic

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- 230 *Encephalitozoon cuniculi Infection in a Kidney Transplant Recipient*; CS Goldsmith, GS Visvesvara, M de Almeida, SR Zaki, CD Paddock; Centers for Disease Control
- 232 *TEM Training and Practice through a Specimen Sharing Program: CSI for EM Laboratories*; CA Radi; Wisconsin Veterinary Diagnostic Laboratory; SE Miller; Duke University; CS Goldsmith; Centers for Disease Control; K Kurth-Toohey; University of Wisconsin
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- 236 *High-Resolution Contrast-Enhanced Cone-Beam Computed Tomography as a New Resource for In Vivo Quantitation of Intimal Hyperplasia*; L Strittmatter, T Flood, IMJ van der Bom, AL Kühn, AK Wakhloo, M Gounis, G Hendricks; University of Massachusetts Medical School
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- 240 *A Comparison of Reflectance and Attenuated Total Internal Reflection Infrared Microspectroscopic Imaging Techniques for the Analysis of Kidney Stones*; C Ling; Miami University; JC Williams, AP Evan; Indiana University School of Medicine; AJ Sommer; Miami University
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- 254 *Electron Microscopy Studies Reveal a Physiological Basis of Body Size Determination by TGF- β Signaling*; RD Schultz; Texas A&M University Health Science Center; EA Ellis; Texas A&M University; TL Gumienny; Texas A&M University Health Science Center
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- 260 *Cryo-Electron Microscopy: Attempts to Watch the Formation of Dilute Emulsion via Microemulsion*; H Lee; University of Minnesota; ED Morrison; Segetis; AV McCormick; University of Minnesota
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298 *Two Optical Techniques for Observing Hair Cuticles in the Classroom*; GM Cohen; Troy University

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304 *High-Resolution TEM/STEM by Means of Advanced Instrumentation*; M Haider, H Mueller, P Hartel; CEOS GmbH, Germany

306 *Visualization of Optical Wave Propagation in Femtosecond Photoemission Electron Microscopy*; R Koenenkamp, RC Word, JPS Fitzgerald; Portland State University

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314 *A Monochromatic, Aberration-Corrected, Dual-Beam Low Energy Electron Microscope for DNA Sequencing and Surface Analysis*; M Mankos, K Shadman; Electron Optica; H Persson; Stanford Genome Technology Center; A N'Diaye, A Schmid; Lawrence Berkeley National Laboratory; R Davis; Stanford Genome Technology Center

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- 330 *Characterization of a Double-tip Field Emission Source Using Inline Axial Holography*; J Ciston, C Song, C Ophus; Lawrence Berkeley National Laboratory
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- 334 *Electrical Activity of Defects in CdTe Solar Cells via Aberration-Corrected STEM*; C Li; Oak Ridge National Laboratory; Y Wu; The University of Toledo; AR Lupini, A Mouti, J Poplawsky; Oak Ridge National Laboratory; W Yin, N Paudel; The University of Toledo; MA Jassim; National Renewable Energy Laboratory; Y Yan; The University of Toledo; SJ Pennycook; Oak Ridge National Laboratory
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- 458 *Fabrication of a Lift-Out Grid with Electrical Contacts for Focused Ion Beam Preparation of Lamella for In Situ Transmission Electron Microscopy*; M Mecklenburg, M Brodie; The Aerospace Corporation; W Hubbard, ER White; University of California, Los Angeles; A Bushmaker; The Aerospace Corporation; E Deionno; University of California, Los Angeles; B Foran; The Aerospace Corporation; BC Regan; University of California, Los Angeles
- 460 *Progress toward Operando TEM Using EELS*; BK Miller, PA Crozier; Arizona State University
- 462 *Atomic-Scale Imaging of Pt and Pd Nanoparticle Catalysts during CO Oxidation at 1 Bar Reaction Conditions*; SB Vendelbo; Delft University of Technology, Netherlands; CF Elkjaer; Haldor Topsøe A/S, Denmark; I Puspitasari, FJ Creemer; Delft University of Technology, Netherlands; P Dona, L Mele; FEI Company; B Morana; Delft University of Technology, Netherlands; BJ Nelissen; Albemarle Catalyst Company BV, Netherlands; S Roobol; Leiden University, Netherlands; R van Rijn; Leiden Probe Microscopy BV, Netherlands; S Helveg; Haldor Topsøe A/S, Denmark; PJ Kooyman; Delft University of Technology, Netherlands
- 464 *In Situ SEM/TEM Observation of Platinum Catalysts on Carbon Support in a Gaseous Atmosphere Using a 300 kV CFE TEM/SEM*; H Matsumoto, T Sato, K Nakano, T Yaguchi, I Nagaoki, Y Nagakubo; Hitachi High-Technologies Corporation, Japan
- 466 *Oxidation Studies of Carbon Nanotubes for Applications as X-Ray Field Emitters Using an Aberration-Corrected, Environmental TEM*; AL Koh; Stanford University; E Gidcumb, O Zhou; University of North Carolina, Chapel Hill; R Sinclair; Stanford University

- 468 *In Situ Measurement of Localized Surface Plasmon Resonance of Metal Nanoparticles in Different Surrounding*; PA Lin; University of Maryland, College Park; J Winterstein; FEI Co; H Lezec, R Sharma; National Institute of Standards and Technology
- 470 *In Situ Characterization of Light Induced Ag Particle Nucleation and Growth on Anatase*; L Zhang, BK Miller, PA Crozier; Arizona State University
- 472 *Gas Mixing System for Imaging of Nanomaterials under Dynamic Environments by Environmental Transmission Electron Microscopy*; MC Akatay, Y Zvienevich; Purdue University; EA Stach; Brookhaven National Laboratory; F Ribeiro; Purdue University
- 474 *Estimating the Local Gas Pressure in a Gas Flow Cell Stage In Situ Using Electron Energy Loss Spectroscopy*; R Colby, B Kabius; Pacific Northwest National Laboratory; DH Alsem; Hummingbird Scientific

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- 476 *Development of an Integrated Platform for Cross-Correlative Imaging of Biological Specimens in Liquid using Light and Electron Microscopies*; DA Fischer, DH Alsem; Hummingbird Scientific; B Simon; Evergreen State College; T Prozorov; Ames Laboratory; N Salmon; Hummingbird Scientific
- 478 *Development of a New Type of Thin Film Phase Plate and Its Application for In Situ Observation*; H Minoda, A Yada, Y Kawana; Tokyo University of Agriculture and Technology; H Iijima, Y Konyuuba; JEOL Ltd., Japan
- 480 *In Situ WetSTEMTM Analysis of FIB Fabricated Fluidic Structures*; MP Rossi, M Castagna; FEI Company
- 482 *Atomic-Scale Observation of Lithiation Reaction Front in Single SnO₂ Nanowire*; A Nie; Michigan Technological University; L Gan, Y Cheng; King Abdullah University of Science and Technology, Saudi Arabia; HA Ardakani; Michigan Technological University; Q Li, C Dong; Zhejiang University, China; R Tao, F Mashayek; University of Illinois, Chicago; H Wang; Zhejiang University, China; U Schwingenschlogl; King Abdullah University of Science and Technology, Saudi Arabia; R Klie; University of Illinois, Chicago; R Shahbazian-Yassar; Michigan Technological University
- 484 *Novel Micro-Fabricated Chip with Micro-Channels for In Situ Observation of Liquid Samples and Processes in TEM*; E Jensen, A Burrows, K Mølhave; Technical University of Denmark
- 486 *Mechanism of Electron-Beam Induced Au Formation in Aqueous Solution*; JH Park; University of California, Los Angeles; JM Grogan, HH Bau; University of Pennsylvania; SK Kodambaka; University of California, Los Angeles; FM Ross; IBM T J Watson Research Center
- 488 *Failure Modes of Fluid Cell Chambers Used for Liquid In Situ Transmission Electron Microscopy*; E White, WA Hubbard, BC Regan; University of California, Los Angeles

- 490 *A Novel Method of Investigating Wet Bentonite Clay Particles in TEM*; Y Kuwamura; Tokyo University of Agriculture and Technology, Japan; W-A Chiou; University of Maryland, College Park; H Minoda; Tokyo University of Agriculture and Technology, Japan; R Dohrmann, S Kaufhold; Federal Institute for Geosciences and Natural Resources, Germany
- 492 *Atomic Resolution Studies of Metal-Insulator Transition in VO₂ Nanowires*; H Asayesh-Ardakani, A Nie; Michigan Technological University; PM Marley, A Stabile; University at Buffalo; K Sarkar; University of Illinois, Chicago; S Banerjee, S Ganapathy; University at Buffalo; Z Yang, RF Klie; University of Illinois, Chicago; R Shahbazian-Yassar; Michigan Technological University
- 494 *In Situ Study of Anode Reaction in Intermediate Temperature Solid Oxide Fuel Cells*; AH Tavabi, S Muto, T Tanji; Nagoya University, Japan; RE Dunin-Borkowski; Jülich Research Centre, Germany
- 496 *Witness the Explosive Cu-Si Alloying Process Inside a TEM*; M Li, D Xie, Z Shan; Xi'an Jiaotong University, China
- 498 *Internal Temperature Calibration at Nanoscale on In Situ Heating High Resolution Transmission Electron Microscopy*; Y Lan, H Wang; University of Houston; G Chen, Z Ren; Massachusetts Institute of Technology
- 500 *Analysis of Single Nanoparticle Growth Environments to Explain Abnormal Ostwald Ripening of Nanoparticle Ensembles*; TJ Woehl; University of California, Davis; C Park; Florida State University; JE Evans, I Arslan; Pacific Northwest National Laboratory; WD Ristenpart; University of California, Davis; ND Browning; Pacific Northwest National Laboratory

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- 504 *Local Current-Activated Growth of Nanometric Nickel Pillars During In Situ STM-TEM Experiments*; K van Benthem, JF Rufner, CS Bonifacio, TB Holland, RH Castro; University of California, Davis
- 506 *EELS Analyses of Gaseous Atmosphere and Heated Specimen in an ETEM*; T Yaguchi, H Kobayashi, A Watabe; Hitachi High-Technologies Corporation, Japan; T Kamino; Yamanashi University, Japan
- 508 *In Situ Studies of Catalytic Growth of SiC Nanowire*; Y Kang; University of Pittsburgh; P Lu; Xi'an Jiaotong University, China; X Zhang; Hitach HighTechnologies America, Ltd; Z Liu; Kennametal Inc; JL Sturgeon, J Mastovich; RJ Lee Group Inc; Z Shan; Xi'an Jiaotong University, China; JC Yang; University of Pittsburgh
- 510 *Development of SiN-Coated Carbon Membranes for Environmental-Cell Window*; T Kawsaki, Z Cui, N Imaeda, T Tanji; Nagoya University, Japan

- 512 *Oxidation of Nickel Particles in an Environmental TEM*; Q Jeangros; Ecole Polytechnique Federale de Lausanne; T Hansen, J Wagner; Technical University of Denmark; R Dunin-Borkowski; Julich Research Centre, Germany; C Hebert, J Van herle, A Hessler-Wyser; École Polytechnique Fédérale de Lausanne, Switzerland
- 514 *In Situ TEM Investigation on the Effect of Atmosphere on Anatase-to-Rutile Phase Transformation*; H Ghassemi, W Harlow; Drexel University; R Koc; Southern Illinois University; M Taheri; Drexel University
- 516 *3D Microstructural Analysis Using an In Situ Ultramicrotome (Gatan 3 View)*; X Zhong, T Hashimoto, MG Burke, GE Thompson; University of Manchester, United Kingdom
- 518 *Electrical Properties of Pristine and Electron Irradiated CNT Yarns at Small Length Scales: An Electron Microscopy Study*; F Sola; NASA Glenn Research Center
- 520 *In Situ Micro Compression Testing on Polycrystalline Model Materials and Potential Nuclear Fusion Candidate Materials*; CB Howard; University of California, Berkeley; C Shin; Korea Atomic Energy Research Institute, South Korea; S Parker, D Frazer, P Hosemann; University of California, Berkeley; WB Choi, M Fluss; Lawrence Livermore National Laboratory; A Kimura; Kyoto University, Japan
- 522 *The Contribution of Back Stress to Strength in Nanomaterials*; AJ Wagner, ED Hintsala, UR Kortshagen, WW Gerberich, KA Mkhoyan; University of Minnesota
- 524 *In Situ TEM Compression of MgO Nanocubes*; ED Hintsala, AJ Wagner, PK Suri, KA Mkhoyan, WW Gerberich; University of Minnesota
- 526 *Mechanical Properties of Silicon Carbide Fibers by Spherical Indentation Technique*; JA Bencomo-Cisneros; Centro de Investigación en Materiales Avanzados, Mexico; S Young Chávez; Universidad Autónoma de Chihuahua, Mexico; JE Ledezma-Sillas, W Antúnez-Flores, A Díaz-Díaz, JM Herrera-Ramirez; Centro de Investigación en Materiales Avanzados, Mexico
- 528 *In Situ Nanoindentation of Nanocrystalline MgAl₂O₄ Agglomerates and Their Effect on Densification Behavior*; J Rufner, TB Holland, RHR Castro, K van Benthem; University of California, Davis

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- 530 *Electron Tomography Studies to Unravel the 3D Nanostructure of Zeolite Catalysts*; KP de Jong; Utrecht University, Netherlands
- 532 *Tungsten Tips as a Sample Platform for Single Atom Resolution S/TEM Tomography of Clusters and Interfaces*; P Ercius; Lawrence Berkeley National Laboratory; W Theis; University of Birmingham, United Kingdom
- 534 *3D Characterization of Nanoparticle Dispersion in Polymer Nanocomposites by TEM Tomography*; F Dalmas, E Leroy, M Roth, F Allouche; Institut de Chimie et des Matériaux Paris-Est, France; F Boué, F Cousin, J Jestin; Laboratoire Léon Brillouin, France

- 536 *Post-Specimen Cc Correction Enabled Scanning Confocal Electron Energy Loss Microscopy for High-Throughput 3-D Spectroscopic Imaging of Nanomaterials*; HL Xin, H Zheng, P Ercius; Lawrence Berkeley National Laboratory
- 538 *Depth Sensitive Atomic Resolution Spectroscopy and Imaging of Highly Strained YSZ/STO Epitaxial Heterostructures*; TJ Pennycook, L Jones; University of Oxford, United Kingdom; M Cabero, A Ribera-Calzada, C Leon; Universidad Complutense, Spain; M Varela; Oak Ridge National Laboratory; J Santamaria; Universidad Complutense, Spain; PD Nellist; University of Oxford, United Kingdom
- 540 *High-Resolution Incoherent Imaging in a Cs Corrected Electron Microscope: A New Tool for High-Resolution Electron Tomography in Life Science*; D Van Dyck, IP Lobato Hoyos; University of Antwerp, Belgium; U Lücken; FEI Company, Netherlands; H Stark; MPI for Biophysical Chemistry, Germany
- 542 *Breaking the Crowther Limit with “Sudoku” Tomography: Combining Depth-Sectioning and Tilt Series for High-Resolution, Wide-Field Reconstructions*; R Hovden; Cornell University; P Ercius; Lawrence Berkeley National Laboratory; Y Jiang, D Wang, Y Yu, HD Abruna, V Elser, DA Muller; Cornell University
- 544 *Automated Tomographic Reconstruction in the IMOD Software Package*; D Mastrorarde; University of Colorado
- 546 *Compressed Sensing Electron Tomography: Theory and Applications*; R Leary, Z Saghi, PA Midgley, DJ Holland; University of Cambridge, United Kingdom
- 548 *Developments in the Application of Zernike Phase Contrast Technologies to Cryo-Electron Tomography Studies of Bacteria*; ER Wright, RC Guerrero-Ferreira; Emory University
- 550 *Elucidating the Role of Viral Non-Structural Proteins on the Morphogenesis of Arterivirus Replication Structures*; B van der Hoeven, EJ Snijder; Leiden University Medical Center, Netherlands; K Knoop; Groningen Biomolecular and Biotechnical Institute, The Netherlands; AJ Koster, M Bárcena; Leiden University Medical Center, Netherlands
- 552 *Correlative Light and Electron Microscopic Imaging of Gap Junction Life Cycle Dynamics Using the EM Protein Tags and Phospho-Specific Antibodies*; A Cone; University of California, San Diego; J Martell; Massachusetts Institute of Technology; T Deerinck, G Cavin, C Ambrosi; University of California, San Diego; A Ting; Massachusetts Institute of Technology; M Ellisman, GE Sosinsky; University of California, San Diego
- 554 *Approaching Tissue Ultrastructure in 3D*; IU Wacker; Karlsruhe Institute of technology, Germany; NJ Zaluzec; Argonne National Laboratory; A Schertel; Carl Zeiss Microscopy GmbH, Germany; RR Schroeder; Heidelberg University, Germany

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- 556 *Distribution of the Mitochondria-Associated ER Membrane in Rat Hepatocyte Revealed by FIB/SEM Tomography*; K Ohta, R Higashi, A Togo, S Okayama, K-I Nakamura; Kurume University, Japan
- 558 *Three-Dimensional Reconstruction of Whole Synapses by STEM Tomography*; AA Sousa, J Zhang, X Chen, JS Diamond, TS Reese, RD Leapman; National Institutes of Health
- 560 *Advances in Microwave-Assisted Freeze Substitution*; DW Dorward, J Raae-Nielsen, BT Hansen, V Nair, ER Fischer; National Institutes of Health
- 562 *EELS Estimation of Ice Accumulation Rates in a Cryo-TEM Equipped with a Multi-Sample Loading Device*; A Avila-Sakar; Purdue University
- 564 *The Development of Bubblegrams is Dose Rate-Dependent*; N Cheng, W Wu, NR Watts, AC Steven; National Institutes of Health
- 566 *Electron Tomography of Hydrated Ferritin Particles Using Carbon Nanotube Liquid Cell*; C Wang, S Sinha-Ray, AL Yarin; University of Illinois, Chicago; T Shokuhfar; Michigan Technological University; R Klie; University of Illinois, Chicago
- 568 *Compressed Sensing Reconstruction of Smooth Signals in Electron Tomography*; R Leary, Z Saghi, PA Midgley, DJ Holland; University of Cambridge, United Kingdom
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- 572 *Advancing Nanotomography of Polymer Systems*; D Chen, H Friedrich, G de With; Eindhoven University of Technology, Netherlands
- 574 *Optimizing Sampling Schemes for Electron Tomography: Dual- and Multiple-Axis Tomography*; G Haberehner, R Serra, D Cooper, G Audoit, S Barraud, P Bleuet; Commissariat à l'énergie atomique, France
- 576 *Electron Tomography for 3D Nanoscale Characterization of Semiconductor Materials and Devices*; G Haberehner, P Bayle-Guillemaud, G Audoit; Commissariat à l'énergie atomique, France; MJ Smith, S Crawford, S Gradecak; Massachusetts Institute of Technology; P-H Morel, T Ernst, N Gambacorti, P Bleuet; Commissariat à l'énergie atomique, France
- 578 *Electron and X-ray Tomography of Iron/Iron Oxide Redox Reactions for Large-Scale Hydrogen Storage*; J Gluch; Technical University Dresden, Germany; S Niese; Fraunhofer Institute, Germany; C Jung; Technical University Dresden, Germany; L Röntzsch, E Zschech, B Kieback; Fraunhofer Institute, Germany

580 *Electrostatic Potentials of Nanostructures Revealed in 3D by Electron Holographic Tomography*; D Wolf; Technical University Dresden, Germany

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584 *Measuring Atoms in Oxide Heterostructures by Quantitative Aberration-Corrected Transmission Electron Microscopy*; KW Urban, C-L Jia; Research Center Juelich, Germany

586 *Automated and Objective Numerical Aberration Correction of HRTEM Complex Exit Waves of Crystal Lattices*; C Ophus; Lawrence Berkeley National Laboratory; M Linck; CEOS GmbH, Germany; J Ciston; Lawrence Berkeley National Laboratory

588 *Benefits of Chromatic Aberration Correction for Off-Axis Electron Holography*; M Linck; CEOS GmbH, Germany; U Dahmen; Lawrence Berkeley National Laboratory

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596 *Atomic Structure of Through-Thickness Steps in a Grain Boundary*; A Gautam; Lawrence Berkeley National Laboratory; F Lancon; Laboratoire de Simulation Atomistique, France; V Radmilovic; University of Belgrade, Serbia; U Dahmen; Lawrence Berkeley National Laboratory

598 *Instrumental Resolution Limit by Magnetic Thermal Noise from Conductive Parts*; S Uhlemann, H Muller, P Hartel, J Zach, M Haider; CEOS GmbH, Germany

600 *Addressing Detector Non-Uniformity in Scanning Transmission Electron Microscopy*; JM LeBeau; North Carolina State University; SD Findlay; Monash University

602 *Effects of Charge Transfer in Atomic Bonding on HAADF-STEM Image Simulation*; ML Odlyzko, KA Mkhoyan; University of Minnesota

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608 *STEM EELS Resolution Revisited*; MP Oxley; Vanderbilt University; SJ Pennycook; Oak Ridge National Laboratory

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612 *Assessment of the TEM Information Limit by Means of Tilted Illumination*; H Mueller, S Uhlemann, J Zach, P Hartel, M Haider; CEOS GmbH, Germany

614 *Imaging Very Thin Particles in ABF STEM*; P Phillips, RF Klie; University of Illinois, Chicago

616 *The Development and Use of Online Tools in Microscopy and Microanalysis Facilities*; M Apperley, J Whiting; University of Sydney, Australia; B Cribb, C Frost; University of Queensland, Australia; A Ceguerra, P Liddicoat; University of Sydney, Australia; C Aya; Intersect Australia Ltd

618 *Defects in Two Dimensional Crystals: An Ultra-High Resolution Aberration-Corrected Electron Microscopy Study*; N Alem; Pennsylvania State University; QM Ramasse; SuperSTEM Laboratory, United Kingdom; OV Yazyev; École Polytechnique Fédérale de Lausanne, Switzerland; CR Seabourne; University of Leeds, United Kingdom; CK Kisielowski; Lawrence Berkeley National Laboratory; P Hartel; CEOS GmbH, Germany; B Jiang; FEI Company; R Erni; Swiss Federal Laboratories for Materials Science and Technology Eidgenössische Materialprüfungs- und Forschungsanstalt, Switzerland; K Erickson; University of California, Berkeley; M Sarahan; SuperSTEM Laboratory, United Kingdom; M Rossell; Swiss Federal Laboratories for Materials Science and Technology Eidgenössische Materialprüfungs- und Forschungsanstalt, Switzerland; A Scott; University of Leeds, United Kingdom; S Louie, A Zettl; University of California, Berkeley

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622 *Advances in X-ray Microtomography in SEM with Submicron Spatial Resolution: Applications in Life, Earth and Material Sciences*; T Salge, S Boehm; Bruker Nano GmbH, Germany; B Pauwels, A Sasov; Bruker microCT, Belgium; J Alba-Tercedor; Universidad de Granada, Granada

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- 628 *Micro-CT for Visualization of the Internal Structure of Industrial Materials*; A Singhal, Y Zhou; GE Global Research Center
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- 710 *Measuring Lattice Parameters and Local Rotation Using Convergent Beam Electron Diffraction: One Step Further*; Y Martin; Commissariat à l'énergie atomique, France; J-M Zuo; University of Illinois, Urbana-Champaign; V Favre-Nicolin, J-L Rouvière; Commissariat à l'énergie atomique, France
- 712 *Characterizing Local Misorientation Gradients Near Grain Boundaries*; S Wright, MM Nowell, LH Chan; EDAX-TSL Inc
- 714 *Evolution of Microstructure and Microtexture in Friction Stir Welded Oxide Dispersion Strengthened Steel*; BW Baker, S Menon, LN Brewer; Naval Postgraduate School
- 716 *Quantitative, 3D Studies of the Evolution of Grain Size and Orientation in Nano-Grained, Polycrystalline Thin-Films*; AB Aebersold, C Hébert, DTL Alexander; Ecole Polytechnique Federale de Lausanne, Switzerland
- 718 *Identifying the Electronic Properties of Grain Boundaries in CdTe Thin-Film Solar Cells Using Electron Backscatter Diffraction and Electron Beam Induced Current Techniques*; J Poplawsky, C Li; Oak Ridge National Laboratory; N Paudel, Y Yan; The University of Toledo; S Pennycook; Oak Ridge National Laboratory
- 720 *Scanning Nano Beam Electron Diffraction and Applications to Characterization of High Entropy Alloys*; H Xing, K Kim, JM Zuo; University of Illinois, Urbana-Champaign; MA Hemphill, GY Wang; University of Tennessee; CW Tsai, JW Yeh; National Tsing Hua University, Taiwan; KA Dahmen; University of Illinois, Urbana-Champaign; PK Liaw; University of Tennessee

- 722 *Using Electron Backscatter Diffraction (EBSD) to Investigate Causes of Seismic Anisotropy in Earth Materials: A Case Study Using Antigorite Serpentine*; SJ Brownlee; Wayne State University; BR Hacker; University of California; GE Harlow; American Museum of Natural History; G Seward; University of California
- 724 *Improving the Accuracy of Orientation Measurements Using EBSD*; K Thomsen, NH Schmidt, A Bewick, K Larsen, J Goulden; Oxford Instruments
- 726 *Merging Monte Carlo and Dynamical EBSD Simulations*; P Callahan, M De Graef; Carnegie Mellon University
- 728 *Advanced EBSD Pattern Interpretation through Iterative Post-Processing*; G Nolze, E Payton; BAM Federal Institute for Materials Research and Testing; A Winkelmann; Max-Planck-Institut für Mikrostrukturphysik, Germany

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- 730 *A Method for the Correction of EBSPs Distorted by Lens Magnetic Fields*; CT Chou, K Thomsen, J Goulden, H Jiang; Oxford Instruments
- 732 *Strain Measurement in FinFET Structures with Epitaxially Grown SiGe on source/Drain Region by Nano Beam Diffraction (NBD) Method*; S-W Kim, D-S Byeon, H Jang, D-H Ko; Yonsei University, South Korea
- 734 *A Physics-Based Pattern Dictionary for EBSD Image Segmentation*; SU Park, D Wei; University of Michigan; M De Graef; Carnegie Mellon University; M Shah, J Simmons; US Air Force Research Laboratory; AO Hero; University of Michigan
- 736 *TEM Based Micro-texture Measurement for Twinning in a Hot-Rolled Magnesium Alloy with Astar System*; Z Zhang, E Rauch, M Veron; Grenoble Institute of Technology, France
- 738 *Monte Carlo Simulations for Applications in Electron Backscatter Diffraction*; A Winkelmann; Max-Planck-Institute of Microstructure Physics, Germany; F Salvat-Pujol, W Werner; Vienna University of Technology, Austria
- 740 *EBSD Analysis of Materials Utilizing High Temperature Protochips Aduro System in FE-SEM*; N Erdman, M Shibata; JEOL USA Inc; D Gardiner, B Jacobs; Protochips
- 742 *Impact of Friction Stir Welding on the Microstructure and Microtexture of Ferritic-Martensitic HT9 Steel*; LN Brewer, LL Ray, SK Menon; Naval Postgraduate School
- 744 *Application of Rocking Beam Tableau DF Imaging on Crystal Size Mapping*; S Wang; Micron Technology Inc
- 746 *Combined EBSD+EDS for Phase Differentiation in Zr/Steel Reaction Layers*; C Parish, KA Terrani, D Shin, BA Pint; Oak Ridge National Laboratory
- 748 *Statistics of Deformation Twinning in Cu/Nb Nano-lamellar Composites Measured Using Electron Backscatter Diffraction (EBSD)*; RJ McCabe, JS Carpenter, NA Mara, IJ Beyerlein; Los Alamos National Laboratory

- 750 *Visualization and Quantification of Plastic Strain Induced by Indentation in Polycrystalline Nickel*; S Kaboli, H Demers, N Brodusch, R Gauvin; McGill University, Canada
- 752 *Validating a New Approach to the Mapping of Phases by EDS by Comparison with the Results of Simultaneous Data Collection by EBSD*; P Statham, C Penman, J Chaldecott, S Burgess, S Sitzman, A Hyde; Oxford Instruments Inc

Advances in Data Processing in Optical and Electron Microscopy

- 754 *Open Source BioImage Informatics: Tools for Interoperability*; CT Rueden, J Schindelin, BE DeZonia, AR Grislis, MC Hiner, KW Eliceiri; University of Wisconsin, Madison
- 756 *The Role of Virtual-Tissue Computer Simulations in the Interpretation of Four-Dimensional Microscopy of Developing Tissues: The Example of Polycystic Kidney Disease*; JA Glazier, JM Belmonte, SG Clendenon, JS Gens; Indiana University; A Shirinifard; St Jude Children's Research Hospital; RL Bacallao; Indiana University; RK Mosaliganti, SG Megason; Harvard Medical School; M Swat; Indiana University
- 758 *Data Processing for Time-Domain Fluorescence Lifetime Imaging Microscopy*; PA Young, A Grislis; University of Wisconsin; PR Barber; Gray Institute for Radiation Oncology & Biology; PJ Keely, KW Eliceiri; University of Wisconsin
- 760 *Synchronous Digitization and Signal to Noise Enhancement for General Modulated Signal Analysis*; R Muir, S Sullivan, R Oglesbee, G Simpson; Purdue University
- 762 *A New Environment for Modular Image Reconstruction and Data Analysis*; M Radermacher; University of Vermont
- 764 *A Real-Time 3D Reconstruction System for Screening Icosahedral Particles under Different Conditions at the Microscope*; G Cardone, X Yan, RS Sinkovits, TS Baker; University of California, San Diego
- 766 *Marker-Free Alignment of Dual-Axis Tilt Series and Subvolume Analysis of Data from Dual-Axis Tomograms*; H Winkler, KA Taylor; Florida State University
- 768 *Filling the Missing Wedge in Tomography: A Constraint-Based Reconstruction Method for 3D TEM/STEM Imaging*; Y Jiang, R Hovden; Cornell University; P Ercius; Lawrence Berkeley National Laboratory; D Wang, Y Yu, HD Abruña, DA Muller, V Elser; Cornell University
- 770 *Advances in 2D, 3D and 4D STEM Image Data Analysis*; L Jones, PD Nellist; University of Oxford, United Kingdom
- 772 *Quantitative Crystallographic and Statistical Image Processing for Materials Science in Scanning Transmission Electron Microscopy*; QM Ramasse, MC Sarahan; SuperSTEM Laboratory, United Kingdom; DG Morgan; Indiana University; ND Browning; Pacific Northwest National Laboratory
- 774 *SEM Autofocusing and Astigmatism Correction Using FFT and GPGPU Techniques*; NH Caldwell, AJ Marshall, BC Breton, DM Holburn; University of Cambridge, United Kingdom

776 *Advanced Spectrum Analysis with Open Source Software*; P Cueva, DA Muller, R Hovden; Cornell University

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778 *Arsenic Exposure Inhibits Angiogenesis in Zebra-fish via Downregulation of both VEGFA and VEGFR2*; SG Clendenon, D Ganapathi Sankaran; Indiana University; A Shirinifard; St Jude Children's Research Hospital; CW McCollum, M Bondesson Bolin, J-Å Gustafsson; University of Houston; JA Glazier; Indiana University

780 *3D Multi-Scale Modeling of Early Stage Chick Limb Development*; J Srividhya, JS Gens, JA Glazier; Indiana University

782 *Open-Source Python Scripting and Analysis with Nion Swift*; MF Murfitt, CE Meyer, G Skone, N Dellby, OL Krivanek; Nion Co

784 *An Improved Workflow for Reproducible Processing and Analysis of Polycrystalline Electron Diffraction Patterns*; JR Minter; Eastman Kodak Company

786 *Magnetic Phase Shift Computations for Electron Tomography*; E Humphrey, M De Graef; Carnegie Mellon University

788 *Modified Transport-of-Intensity Approach for Electrostatic and Magnetic Phase Shift Separation*; E Humphrey; Carnegie Mellon University; C Phatak; Argonne National Laboratory; M De Graef; Carnegie Mellon University

790 *Comparison of Magnetic Domain Wall Images using Lorentz Microscopy and Magnetic Force Microscopy*; S Hua, M De Graef; Carnegie Mellon University

792 *SEM Real-Time Image Processing Using a GPGPU Approach*; NH Caldwell, Y Lei, BC Breton, DM Holburn; University of Cambridge

794 *Computational Structure Refinement by Hybrid Reverse Monte Carlo Simulation Incorporating Fluctuation Electron Microscopy*; J Hwang; University of California, Santa Barbara; ZH Melgarejo; University of Wisconsin, Madison; YE Kalay; Middle East Technical University, Turkey; MJ Kramer; Iowa State University; DS Stone, PM Voyles; University of Wisconsin, Madison

796 *Novel Super-Fast Three-Dimensional SEM Image Simulation*; P Cizmar, CG Frase, H Bosse; Physikalisch-Technische Bundesanstalt, Germany

798 *Measuring and Comparing Local Strain Field and Crystal Rotation at the Microscopic Scale*; F Bridier, J-C Stinville, N Vanderesse; Ecole de technologie superieure, Canada; M Lagacé; Hydro-Quebec research institute, Canada; P Bocher; Ecole de technologie superieure, Canada

800 *Dynamic Image Analysis of Glass Fibers as Industrial Fillers and Understanding the Influence of Processing Conditions on the Fiber Length and the Mechanical Properties of Polymers*; P Bajaj, C Strom; Saudi Basic Industries Corporation

- 802 *Automated Structure Detection in HRTEM Images: An Example with Graphene*; J Kling, JS Vestergaard, AL Dahl, TW Hansen, R Larsen, JB Wagner; Technical University of Denmark
- 804 *Geometry vs. Paint Models of Lattice Fringe Visibility for FCC Particles*; S Meyer, P Fraundorf; University of Missouri, St Louis
- 806 *Synchronous Digitization for Modulated Signal Analysis*; R Muir, S Sullivan, R Oglesbee, G Simpson; Purdue University

Practical Programming for Microanalysis

- 808 *Mastering the Art of Scientific Programming or Application Development as a Tool for Scientific Innovation*; JJ Donovan; University of Oregon
- 810 *Inexpensive & Non-Disruptive Retrofitting of a PDP-11 Based Microprobe System with Modern Automation Software*; RA Deist, BJ Willenberg, LA Dempere; University of Florida
- 812 *CALCZAF, TRYZAF and CITZAF: The Use of Multi-Correction-Algorithm Programs for Estimating Uncertainties and Improving Quantitative X-ray Analysis of Difficult Specimens*; JT Armstrong; Carnegie Institution of Washington; J Donovan; University of Oregon; P Carpenter; Washington University
- 814 *Random Spectrometer Motion for Removal of Time Dependent Artifacts in Spectroscopy*; P Gopon, P Sobol, J Fournelle; University of Wisconsin
- 816 *De-MA: A Web Database for Electron Microprobe Analyses to Assist Electron Microprobe Lab Manager and Users*; JM Allaz; University of Colorado, Boulder
- 818 *Programming for Microscopy and Microanalysis*; A Shiveley; UES, Inc; P Shade, M Uchic, M Groeber; Air Force Research Laboratory
- 820 *An Open Source Software for the Measurement of Deformation Fields by Means of Digital Image Correlation*; N Vanderesse; École de technologie supérieure, Canada; M Lagacé; Institut de recherche d'Hydro-Québec, Canada; F Bridier, P Bocher; École de technologie supérieure, Canada
- 822 *pyMonteCarlo: A Common Programming Interface for Running Identical Simulations Using Different Monte Carlo Programs*; PT Pinard; RWTH Aachen, Germany; H Demers, R Gauvin; McGill University, Canada; S Richter; RWTH Aachen, Germany
- 824 *The Use of Revision Control to Implement Best Practices for Experimental Microanalysis*; NWM Ritchie; National Institute of Standards and Technology
- 826 *Customization and Automation of Data Acquisition and Evaluation Using DigitalMicrograph Script*; B Schaffer; Gatan Inc
- 828 *Post Processing Hyper-Spectral Data and Generating More Information from X-ray Maps*; R Wuhrer; University of Western Sydney, Australia; K Moran; Moran Scientific Pty Ltd, Australia

- 830 *MSA/MAS/AMAS Hyper-Dimensional Spectral File Format—An Update*; A Torpy, NC Wilson, CM MacRae; CSIRO Australia; NJ Zaluzec; Argonne National Laboratory; M Kundmann; e-Metrikos
- 832 *R for X-Ray Microanalysis*; JM Davis; National Institute of Standards and Technology
- 834 *Microanalysis Software: Properties and Requirements*; U Rossek, R Terborg, M Falke, A Kaepfel, M Rohde; Bruker Nano GmbH, Germany
- 836 *Open-Source Visualization of 3D Data: From Tomography to Spectroscopy*; R Hovden, P Cueva, DA Muller; Cornell University
- 838 *Visualizing EBSD Maps with MTEX*; R Hielscher; TU Chemnitz; F Bachmann; Bergakademie Freiberg, Germany
- 840 *Removing Imaging Distortions through Automatic Stitching of EBSD Mosaics*; D Rowenhorst; The US Naval Research Laboratory
- 842 *Phase Identification by Image Processing of EBSD Patterns*; EJ Payton, L Agudo Jácome, G Nolze; Federal Institute for Materials Research and Testing, Germany
- 844 *Incorporating Inelastic Scattering into Multislice Simulation*; AA Gunawan, A Mkhoyan; University of Minnesota
- 846 *Analysis of 3D-EBSD Datasets Obtained by FIB Tomography*; P Konijnenberg, A Khorashadizadeh, S Zaefferer, D Raabe; Max-Planck-Institute for Iron Research, Germany

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- 848 *Electron Microprobe Quantitative Mapping vs. Defocused Beam Analysis*; JE Barkman; University of Oregon; P Carpenter; Washington University; J-C Zhao; The Ohio State University; JJ Donovan; University of Oregon
- 850 *Effect of the Absorption on the Shape of the Emitted $\phi(\rho z)$ Depth Distribution for Accurate Quantitative Microanalysis: Evaluation of Analytical Models and Monte Carlo Programs*; H Demers; McGill University, Canada; M Falke, R Terborg; Bruker Nano GmbH, Germany; R Gauvin; McGill University, Canada
- 852 *Simulation of Incoherent Scattering in High-Angle Annular Dark-Field Scanning Electron Microscopy*; A Dutta, C Reid, H Heinrich; University of Central Florida

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- 854 *Orion NanoFab—2nd Generation Helium Ion Microscope*; DC Joy; University of Tennessee; BJ Griffin; University of Western Australia

- 856 *Application of Helium Ion Microscope for Sample Modification at Nanoscale*; M Rudneva; Delft University of Technology, Netherlands; E van Veldhoven; Van Leeuwenhoek Laboratory, TNO, Netherlands; SK Malladi, HW Zandbergen; Delft University of Technology, Netherlands
- 858 *Nanoscale Phase Patterning in a Sr-Doped Lanthanum Cobaltite Thin Film*; DN Leonard, DA Cullen; Oak Ridge National Laboratory; K Klein; Carl Zeiss Microscopy GmbH, Germany
- 860 *Fast 3D Tomography of C4 Solder Bump by Using Xe Plasma Focused Ion Beam*; T Hrnčíř, L Hladík, J Jiruse, F Lopour; Tescan, Czech Republic
- 862 *Xe⁺ FIB Milling and Measurement of Amorphous Silicon Damage*; RD Kelley, K Song, B Van Leer; FEI Company, USA; D Wall, L Kwakman; FEI Company, Netherlands

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- 864 *EBSD Imaging of Femtosecond Laser Ablated Surfaces Using the TriBeam System*; MP Echlin, M Titus, S Kraemer, T Pollock; University of California, Santa Barbara
- 866 *New Approach for Rapid Prototyping Using the Combination of Pulsed Laser Ablation and FIB Milling*; R Salzer; Carl Zeiss Microscopy GmbH, Germany
- 868 *Advances in S/TEM Sample Preparation Using a FIB-SEM: Techniques for the Ultimate Sample*; B Van Leer, D Wall; FEI Company
- 870 *Focused Ion Beam Slice-and-View Tomography and Correlative Electron Microscopy of Multiphase Meteorite Particles*; ND Bassim, RM Stroud; US Naval Research Laboratory; K Scott; National Institute of Standards and Technology; LR Nittler; Carnegie Institution of Washington; CD Herd; University of Alberta, Canada
- 872 *Combined EBL/IBL Nanopatterning on Silicon Nitride Membranes for Time-Resolved Magnetic Transmission X-ray Microscopy Experiments*; M Urbánek, T Šikola, L Hladík; Brno University of Technology, Czech Republic; T Hrnčíř, J Jiruše; TESCAN, Czech Republic

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- 874 *Focussed Ion Beam Scanning Electron Microscopy in Biology*; C Kizilyaprak, C Loussert, J Daraspe, BM Humbel; University of Lausanne, Switzerland
- 876 *Reproducibility in Focused Ion Beam Sample Preparation—A Key Requirement for Cryo-Electron Tomography of Eukaryotic Cells*; M Schaffer, E Villa, B Engel, Y Fukuda, T Laugks, A Rigort, M Schüler, A Schwarz, F Bäuerlein, J Mahami, W Baumeister, JM Plitzko; Max Planck Institute of Biochemistry, Germany
- 878 *Ion Beam Preparation and Transmission-SEM Imaging of Frozen-Hydrated, Vitreous Lamellas Prepared by the Cryo-FIB-SEM: An All-In-One Instrument*; M De Winter, RJ Mesman, MF Hayles, CT Schneijdenberg; Utrecht University, Netherlands; C Mathisen; FEI Company, Netherlands; JA Post; Utrecht University, Netherlands

- 880 *Progress in Cryo-FIB Preparation of Biological Specimens for Cryo-TEM*; M Marko, C Hsieh, T Wagenknecht; Wadsworth Center
- 882 *The Use of Focused Ion Beam (FIB) Technology for Cell Wall Structure Elucidation*; M Blumentritt, SD Collins, SM Shaler; University of Maine
- 884 *Understanding Microstructural Changes in Metals Induced by Gallium Ion Beam Irradiation*; JR Michael; Sandia National Laboratories
- 886 *Switching of the Natural Nanostructure in Bi_2Te_3 Bulk Materials by Low Energy Ion Irradiation*; Z Aabdin, N Peranio, O Eibl; Eberhard Karls Universität Tübingen, Germany
- 888 *Applications of Focus Ion Beam Technique in the Characterization of Nanocrystal Nonvolatile Memory Devices*; J-G Zheng; University of California, Irvine
- 890 *Multi-Pore Sensing of Virus Capsids in In-Plane Nanofluidic Devices*; Z Harms, DG Haywood, L Selzer, A Kneller, A Zlotnick, SC Jacobson; Indiana University
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- 894 *Peculiarities in FIB Induced Damage of Diamond*; S Rubanov; University of Melbourne, Australia; A Suvorova; University of Western Australia
- 896 *Sputter-Induced Topography on Magnesium During Ion Beam Milling Surface Preparation*; S Kaboli, H Demers, N Brodusch, R Gauvin; McGill University, Canada
- 898 *Applications of the Hybrid Ion Milling Method to Neodymium Magnets*; T Shdiara, M Konomi, S Watanabe; Hitachi High-Technologies Corporation, Japan
- 900 *Automated TEM Sample Preparation from Smaller Device Structure Regions of Semiconductor ICs Using Inline Dual-Beam CLM+ and TEMLink 150*; RS Rai, E Chen, Y Zhang, D Nedeau, Y Chen, W Zhao, SK Lim, Z-H Mai, J Lam; Globalfoundries
- 902 *Effective Utilization of STEM Imaging Capability in FIB for Physical Failure Analysis on 20nm & 14nm Transistor Nodes in Semiconductor Wafer Foundries*; W Zhao, D Nedeau, S Kodali, J Huang, C-K Oh, S-K Lim, R Rai, Z-H Mai, J Lam; Globalfoundries
- 904 *Radioactive Sample Preparation Using Focused Ion Beam*; A Aitkaliyeva, J Madden, B Miller, T Hyde; Idaho National Laboratory
- 906 *Enhancing Ex Situ Lift-Out with EXpressLO*; LA Giannuzzi; L A Giannuzzi and Associates LLC

Advanced Atomic-Scale Imaging and Spectroscopy of Materials

- 908 *The Helium Ion Microscope—A Versatile Tool for a Wide Range of Applications*; B Goetze, C Huynh, L Stern, H Wu, D Ferranti, M Ananth; Carl Zeiss LLC

- 910 *Helium Ion Nanomachining in Membranes and Bulk Substrates*; EM Mutunga; University of the District of Columbia; AE Vldar; National Institute of Standards and Technology; LA Stern; Carl Zeiss LLC; KL Klein; University of the District of Columbia
- 912 *Wafer-Scale Ion Beam Lithography of Nanopore Devices*; J Klingfus; Raith USA, Inc; A Nadzeyka, S Bauerdick; Raith GmbH, Germany; T Albrecht, JB Edel; Imperial College London, United Kingdom
- 914 *Three-Dimensional Visualization of Murine Cardiac Tissue Using FIB-SEM Segmentation Techniques*; G Wetzel; Clemson University; JJ Clarke; Hitachi High Technologies America, Ltd.; J Hudson; Clemson University
- 916 *Investigating CNTs in Lung Tissue with FIB-SEM*; C Købler; Technical University of Denmark; AT Saber, UB Vogel; National Research Centre for the Working Environment; K Qvortrup; University of Copenhagen, Denmark; K Mølhave; Technical University of Denmark
- 918 *Fabrication of In-Plane Nanochannels by Focused Ion Beam Milling*; A Kneller, ZD Harms, L Selzer, A Zlotnick, SC Jacobson; Indiana University, Bloomington
- 920 *Cryogenic Focused Ion Beam Milling for Studying Wetting Hysteresis Behavior*; J Su, C Santeufemio, P Wang, H Sun; University of Massachusetts, Lowell
- 922 *Extreme High Resolution Imaging of Uncoated Cells in a DualBeamTM*; JL Riesterer; FEI Company; CS López, E Barklis; Oregon Health and Science University
- 924 *FIB Micromachining of Frozen Systems for TEM*; FI Allen; University of California; LR Comolli; Lawrence Berkeley National Laboratory; EA Marquis; University of Michigan; AM Minor; University of California
- 926 *Cryo-FIB/SEM Investigation of Mechanism of Frost Formation on Lubricant-Impregnated Surfaces*; K Rykaczewski, S Anand, S Bengaluru Subramanyam, KK Varanasi; Massachusetts Institute of Technology

Atom Probe Tomography in Correlative Investigations

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- 930 *Application of Computational Homology and Graph-Theoretic Approaches for Quantitative Chemical Imaging in Atom Probe Tomography*; S Broderick, J Peralta, S Samudrala, K Kaluskar, B Ganapathysubramanian, K Rajan; Iowa State University
- 932 *Tracing the Solute Distribution and Effects in Materials by Combining Atom Probe Tomography and Atomistic Simulation: Summary of Recent Results*; AV Ceguerra, X-Y Cui, SP Ringer; The University of Sydney, Australia
- 934 *A Level Set Evaporation Model for Heterogeneous Atom Probe Tip*; Z Xu, D Li, W Xu, A Devaraj, R Colby, S Thevuthasan; Pacific Northwest National Laboratory

- 936 *Progress in Planar Feature Spatial Reconstruction for Atom Probe Tomography*; BP Geiser, DJ Larson, TJ Prosa, TF Kelly; CAMECA Instruments, Inc
- 938 *Direct Experimental Measurement of Grain Boundary's Five-Parameters and Solute Segregations at Atomic Level*; L Yao, MK Miller; Oak Ridge National Laboratory
- 940 *Measuring Chemical Segregation at Grain Boundaries by Atom Probe Tomography*; M Bachhav, Y Chen, E Marquis; University of Michigan; B Geiser; CAMECA Instruments Inc
- 942 *Novel Insights into In-Service Oxidized Inconel 625 Engine Exhausts by a Multi-Technique Approach*; PA Bagot, PE Edmondson, GM Hughes, A Crossley; University of Oxford, United Kingdom; D De Lille; Good Fabrications Ltd
- 944 *Direct Atomic Scale Observation of the Structure and Chemistry of Order/Disorder γ/γ Interfaces in Nickel Base Superalloys*; S Meher, S Nag; University of North Texas; R Williams; The Ohio State University; R Srinivasan; ExxonMobil Research and Engineering Company; HL Fraser; The Ohio State University; R Banerjee; University of North Texas
- 946 *Coupling Atom Probe Tomography with Aberration-Corrected Scanning Transmission Electron Microscopy and First-Principles Computations to Investigate Omega Precipitation in Titanium Alloys*; S Nag; University of North Texas; A Devaraj; Pacific Northwest National Laboratory; N Gupta; University of North Texas; R Williams; The Ohio State University; S Srivilliputhur; University of North Texas; HL Fraser; The Ohio State University; R Banerjee; University of North Texas
- 948 *Combining Structural and Chemical Information on the Nanometer Scale by Correlative TEM and APT*; M Herbig, P-P Choi, D Raabe; Max-Planck-Institut fuer Eisenforschung GmbH, Germany
- 950 *Atom Counting in Atom Probe Tomography Specimens Using Quantitative HAADF-STEM*; W Lefebvre; Université de Rouen, France
- 952 *Towards Atom Probe Tomography of Hybrid Organic-Inorganic Nanoparticles*; LM Gordon, MJ Cohen, D Joester; Northwestern University
- 954 *Microencapsulation Method for Atom Probe Analysis of Powders*; DC Bell, AP Magyar, A Graham, M Baram; Harvard University
- 956 *Atom Probe Tomography of III-Nitrides Based Semiconducting Devices*; JS Speck, R Shivaraman; University of California, Santa Barbara; Y-R Wu; National Taiwan University; S Choi, R Chung; University of California, Santa Barbara
- 958 *Atom-Probe Tomographic Study of Interfacial Intermixing and Segregation in InAs/GaSb Superlattices*; Y Meng, H Kim; University of Illinois, Urbana-Champaign; D Isheim, DN Seidman; Northwestern University; J-M Zuo; University of Illinois, Urbana-Champaign
- 960 *Characterization of 3D Dopant Distribution in State of the Art FinFET Structures*; MS Hatzistergos, M Hopstaken; IBM Corporation; E Kim, L Vanamurthy; Globalfoundries; JF Shaffer; IBM Corporation

- 962 *Atom Probe Tomography of Grain Boundaries in Ion Conducting Oxides*; DR Diercks, BP Gorman; Colorado School of Mines
- 964 *Compositional and Chemical Segregation in $Li_{1.2}Ni_{0.2}Mn_{0.6}O_2$ Cathode Materials Characterized by Atom Probe Tomography and Scanning Transmission X-ray Microscopy*; A Devaraj, R Colby, M Gu, C Wang; Pacific Northwest National Laboratory; T Tyliczszak; Lawrence Berkeley National Laboratory; J Zhang, J Xiao, J Zheng; Pacific Northwest National Laboratory; I Belharouak, D Wang, K Amine; Argonne National Laboratory; S Thevuthasan; Pacific Northwest National Laboratory
- 966 *A Correlative Atom-Probe Tomography and Transmission Electron Microscope Study of a Thermally Grown Oxide on a Commercial Nickel-Based Superalloy, René N⁵ Y+⁰*; S-I Baik, X Yin, DN Seidman; Northwestern University
- 968 *Fission Products in Nuclear Fuel: Comparison of Simulated Distribution with Correlative Characterization Techniques*; B Valderrama, HB Henderson; University of Florida; L He, C Yablinsky; University of Wisconsin; J Gan; Idaho National Laboratory; A-R Hassan, A El-Azab; Purdue University; TR Allen; University of Wisconsin; MV Manuel; University of Florida
- 970 *Complementary Atom Probe Tomography and Electron Microscopy of Oxidation of Ni-Base Alloys in High-Temperature Water Environments*; DK Schreiber, MJ Olszta, SM Bruemmer; Pacific Northwest National Laboratory
- 972 *A Correlated APT and TEM Approach to Understand Nanostructured Ferritic Alloys*; MK Miller, CM Parish, L Yao; Oak Ridge National Laboratory
- 974 *Combining Atom-Probe Tomography and Focused-Ion Beam Microscopy to Study Individual Presolar Meteoritic Nanodiamond Particles*; D Isheim; Northwestern University; FJ Stadermann, JB Lewis, C Floss, TL Daulton; Washington University; AM Davis; University of Chicago; PR Heck; Field Museum; MJ Pellin, MR Savina; Argonne National Laboratory; DN Seidman; Northwestern University; T Stephan; University of Chicago
- 976 *Mapping the Complex Phase Formation at the Surface of Supercritical CO Reacted Fayalite for Geologic Sequestration of Greenhouse Gases*; DE Perea, J Liu, B Arey, L Kovarik, R Colby, O Qafoku, T Thevuthasan, AR Felmy; Pacific Northwest National Laboratory
- 978 *Elemental and Isotopic Tomography at Single-Atom-Scale in 4000 and 2400 Ma Zircons*; DA Reinhard; CAMECA Instruments, Inc; JW Valley, T Ushikubo, A Strickland; University of Wisconsin; D Snoeyenbos, D Lawrence, I Martin, DJ Larson, TF Kelly; CAMECA Instruments, Inc; AJ Cavoise; University of Puerto Rico
- 980 *Atomic Scale Composition Profiling of Ferroelectrics via Laser-Pulsed Atom Probe Tomography and Cross-Correlative Transmission Electron Microscopy*; R Kirchhofer, DR Diercks, BP Gorman; Colorado School of Mines; GL Brennecka; Sandia National Laboratories
- 982 *Understanding Mineral Carbonate Formation under Supercritical Conditions using Electron Microscopy and Atom Probe Tomography*; BW Arey, DE Perera, L Kovarik, RJ Colby, O Qafoku, AR Felmy; Pacific Northwest National Laboratory

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- 984 *Atom Probe Tomography: Beyond the Microscope, a Breakthrough Backdoor for Chemical, Physical and Functional Characterization at the Nanometer Scale*; F Vurpillot, A Gaillard, L Arnoldi, A Vella, L Rigutti, V Tognetti, B Deconihout; Université de Rouen, France
- 986 *Multi-Region Data Simulation for Detection Limit Investigations in IVASTM*; RM Ulfig, BP Geiser, TJ Prosa, DJ Larson; CAMECA Instruments, Inc; J Leroux, B Dupont; CAMECA Société par Actions Simplifiée (SAS), France
- 988 *The Effects of Detector Efficiency on Distinguishing Solute Atoms in Random Solid Solution and Solute Clusters*; MK Miller, L Yao; Oak Ridge National Laboratory
- 990 *Voltage and Laser-Assisted Mode Atom Probe Tomography of Gallium Nitride*; N Dawahre, G Shen, SM Kim, P Kung; University of Alabama
- 992 *Gaussian Kernel Density Estimator for Voxel Size Selection in Atom Probe Tomography*; K Kaluskar, K Rajan; Iowa State University
- 994 *Improved Mass Resolving Power and Yield in Atom Probe Tomography*; DJ Larson, TJ Prosa, JH Bunton, DP Olson, DF Lawrence, E Oltman, SN Strennin, TF Kelly; CAMECA Instruments, Inc
- 996 *A Weibull Perspective on the Fracture of Atom Probe Specimens*; B Gault; Elsevier Ltd; O Bouaziz; ArcelorMittal Research
- 998 *Simulation-Enhanced Atom Probe for Complete 3D Atomistic Imaging*; MP Moody; University of Oxford, United Kingdom; AV Ceguerra, AJ Breen; University of Sydney, Australia, B Gault, Elsevier Ltd, United Kingdom; XY Cui, LT Stephenson; University of Sydney, Australia; RK Marceau; Max-Planck-Institut für Eisenforschung GmbH, Germany; R Powles, SP Ringer; University of Sydney, Australia
- 1000 *Using Spatial Distribution Maps to Estimate APT Efficiency*; BP Geiser, DJ Larson, TJ Prosa, TF Kelly, RM Ulfig; CAMECA Instruments, Inc
- 1002 *An Integrated Data Driven Reconstruction and Molecular Dynamics Simulation for Lattice Structure in Atom Probe Tomography*; J Peralta, K Kaluskar, C Loyola, K Rajan; Iowa State University
- 1004 *Electric Field Induced Changes in Surface Bonding: Integrating First Principles and Atom Probe Tomography*; C Loyola, J Peralta, S Broderick, K Rajan; Iowa State University
- 1006 *Stability of Oxygen-Enriched Nanoclusters and Helium Bubbles in Fe-Based Alloys under Extreme Conditions*; MK Miller, C-L Fu, X Chen, Q Li; Oak Ridge National Laboratory
- 1008 *Influence of Co Underlayer Thickness on Mass Resolving Power in Field Evaporated Cu/Co Bilayer*; K Tippey, BC Hornbuckle, B Fu, GB Thompson; University of Alabama

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- 1012 *Characterization of the Influence of Grain Boundary Character on Oxidation of Nickel Using Atom Probe Tomography*; SL Welsh, JL Evans; University of Alabama, Huntsville
- 1014 *Atom Probe Tomography Analysis of a Gallium-Nitride-Based Commercial Light-Emitting Diode*; TJ Prosa, D Olson, AD Giddings; CAMECA Instruments, Inc; W Lefebvre; Université de Rouen, France; PH Clifton, DJ Larson; CAMECA Instruments, Inc
- 1016 *Atom Probe Tomography Characterization of a White Etching Area in a Bearing Steel*; J Kang; University of Cambridge, United Kingdom; C Williams; University of Oxford, United Kingdom; B Hosseinkhani; SKF; PE Rivera Diaz del Castillo; University of Cambridge, United Kingdom; PA Bagot, MP Moody; University of Oxford, United Kingdom
- 1018 *Atom Probe Tomography Characterization of Catalyst Nanoparticles*; PA Bagot; University of Oxford, United Kingdom; T Li; University of Sydney, Australia; E Tsang, G Smith, MP Moody; University of Oxford, United Kingdom
- 1020 *Atom Probe Characterization of Corroded Alloy 600*; B Gault; Elsevier Ltd, United Kingdom; F Scenini; University of Manchester, United Kingdom; MP Moody; University of Oxford, United Kingdom; JH Huang, GA Botton; McMaster University, Canada; D Mangelinck, M Descoins; Université Aix-Marseille, France; RC Newman; University of Toronto, Canada
- 1022 *New Applications in Atom Probe Tomography*; DJ Larson; CAMECA Instruments Inc; JW Valley, T Ushikubo; University of Wisconsin; MK Miller; Oak Ridge National Laboratory; H Takamizawa, Y Shimizu; Tohoku University, Japan; LM Gordon, D Joester; Northwestern University; D Giddings, DA Reinhard, TJ Prosa, DP Olson, DF Lawrence, PH Clifton, RM Ulfig, I Martin, TF Kelly; CAMECA Instruments Inc
- 1024 *Atom-Probe Tomographic Study of Precipitation in an Ultrafine-Grained Al-Zn-Mg-Cu Alloy (Al 7075)*; H Wen, K Ma; University of California, Davis; D Isheim, DN Seidman; Northwestern University; JM Schoenung, EJ Lavernia; University of California, Davis
- 1026 *3D Characterization Study of High-k Dielectric on GaN Using Atom Probe Tomography*; B Mazumder, X Liu, UK Mishra, JS Speck; University of California, Santa Barbara
- 1028 *Application of Atom Probe Tomography to Atomic Layer Deposited Thin Films*; AD Giddings, TJ Prosa, TF Kelly, DJ Larson; CAMECA Instruments, Inc
- 1030 *Atom Probe Tomography Study of In-Doped ZnO*; M Baram; Harvard University; MN Bachhav, AH Hunter, EA Marquis; University of Michigan; DC Bell, X Liang, DR Clarke; Harvard University
- 1032 *Methods for Micro-to-Nanometer Correlative Tomography*; S Gerstl, M Lucas, E Mueller, P Gasser, RA Wepf; ETH Zürich, Switzerland

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- 1036 *Microstructural Analysis of Crept Martensitic Steels*; S Swaminathan, M Karadge, T Vishwanath, R Oruganti; GE Global Research
- 1038 *Investigation of δ -ZrH_{1.66}/ α -Zr Interface in Zr-Based Cladding Materials with Aberration-Corrected Scanning Transmission Microscopy*; S Rajasekhara, PG Kotula, DG Enos, BL Doyle, BG Clark; Sandia National Laboratories, Albuquerque
- 1040 *Rapid Design of an Annealing Heat Treatment through a Combination of Microanalysis and Modeling*; LA Deibler, AA Brown, JD Puskar; Sandia National Laboratories, Albuquerque
- 1042 *Characterization of Dislocations Found in an Array at a Mixed Character Small Angle Boundary of a Cross Rolled and Annealed Aluminium Sample*; M Shamsuzzoha; University of Alabama
- 1044 *Optimizing Fuel Cell Materials through Electron Microscopy and Microanalysis*; DA Cullen, HM Meyer, KS Reeves, DW Coffey, KL More; Oak Ridge National Laboratory
- 1046 *Quantitative Differentiation of Three Iron Oxides by EDS*; J Konopka; Thermo Fisher Scientific
- 1048 *Quantitative Analysis of Carbon in Carbon Steel Using SEM/EDS Followed by Error Correction Approach*; L Zou, Q Zhou; Dalian University of Technology, China
- 1050 *Examination of Polycrystalline Diamond Compact Cutter Used in Drilling Tools in the Oil Industry*; JN Williard, DK Colbert; Baker Hughes, Inc.
- 1052 *Single Crystal Elastic Constants of TWIP Steel Determined from Nanoindentation*; DT Pierce; Vanderbilt University; K Nowag, A Montagne; Swiss Federal Laboratories for Materials Science and Technology; JA Jimenez; Centro Nacional de Investigaciones Metalurgicas, Spain; JE Wittig; Vanderbilt University; R Ghisleni; Swiss Federal Laboratories for Materials Science and Technology
- 1054 *Discovery: Under the Microscope at Kennedy Space Center*; PM Howard; NASA Kennedy Space Center
- 1056 *Understanding Complex Material Systems Using Multiple Characterization Techniques*; S Addepalli, S Thimmegowda; GE Global Research, India
- 1058 *Integrated Nonlinear Optical Microscope for Crystal Centering on a Synchrotron X-ray Beamline*; JA Newman, SJ Toth, CM Dettmar; Purdue University; M Becker, RF Fischetti; Argonne National Laboratory; GJ Simpson; Purdue University
- 1060 *Low kV Imaging Using Charge Balancing*; M Bolorizadeh, K Png; Carl Zeiss Microscopy Ltd, United Kingdom
- 1062 *Microscopy Method for Characterization Oil Uptake in Fried Foods*; DM Williams, J Guo, R Fletcher; Dow Chemical Company

- 1064 *Understanding the Effects of Wear Particles: Lessons Learned from Postmortem Retrievals*; DJ Hall, RM Urban, JO Galante, JJ Jacobs; Rush University Medical Center
- 1066 *Use of an Automated SEM to Detect Laboratory Contamination*; AP Lindstrom, NW Ritchie, DE Newbury; National Institute of Standards and Technology
- 1068 *Quantitative X-ray Photoelectron Spectroscopy Imaging for Small Feature Compositional Screening*; DJ Surman, SC Page, AJ Roberts, SJ Coultas; Kratos Analytical Ltd, United Kingdom
- 1070 *Ultra-Thin Iridium as a Replacement Coating for Carbon in High Resolution Quantitative Analyses of Insulating Specimens*; JT Armstrong, KL Crispin; Car-negie Institution of Washington
- 1072 *Focused Electron Beam and Elemental Mapping of Palm-Top EPMA (Scanning) Equipped with CL Spectrometer (Projection)*; S Imashuku, N Fuyuno, A Imanishi, K Hanasaki, K Ohira, J Kawai; Kyoto University, Japan
- 1074 *Getting Back to the Basics. Parameters That Must Be Considered Before Attempting Quantitative EDS Analysis in the TEM*; N Rowlands; Oxford Instruments, Concord M; EF Schumacher; McCrone Associates Inc; AW Nicholls; Universtiy of Illinois, Chicago
- 1076 *Nanometer-Scale Characterization Tools for Strain-Engineered Semiconductor Devices*; VB Ozdol; Lawrence Berkeley National Laboratory; CT Koch; Ulm University, Germany; AM Minor; Lawrence Berkeley National Laboratory
- 1078 *Quantitation of Overlapping Core Edges in EFTEM Spectrum Imaging of Cells*; RD Leapman, MA Aronova; National Institutes of Health
- 1080 *Determination of the Optical Properties of Carbonaceous Aerosols by Monochromated Electron Energy-Loss Spectroscopy*; J Zhu, PA Crozier, JR Anderson; Arizona State University
- 1082 *Electron Microscopy of Graphene Materials Produced by Combustion Synthesis*; KV Manukyan, S Rouvimov, AS Mukasyan; University of Notre Dame
- 1084 *Direct High Resolution Cryo-TEM Imaging of Liquid Crystals*; M Gao, C Zhang, H-S Park, A Jakli, OD Lavrentovich; Kent State University
- 1086 *Forensic Gemmology in Forensic Practice*; M Kotrly, I Turkova; Institute of Criminalistics Prague
- 1088 *Low Voltage Silicon Drift Detector Microanalysis of the Mineral Tourmaline: Examples From the Black Hills, South Dakota*; CS Schwandt; McCrone Associates, Inc
- 1090 *Where is the Plutonium?: Detection and Location of Plutonium-Containing Particles in Tank 18 Waste Using Scanning Electron Microscopy (SEM), Energy Dispersive Spectroscopy (EDS), Wavelength Dispersive Spectroscopy (WDS), and X-Ray Diffraction (XRD)*; H Ajo, M Hay, D Missimer, P O'Rourke; Savannah River National Laboratory

- 1092 *High-Performance DyBa₂Cu₃O_{7-x} Superconducting Coated Conductors Grown by Inclined Substrate Deposition with I_c Exceeding 1000 A cm⁻¹*; Z Aabdin, M Dürschnabel, O Eibl; Eberhard Karls Universität Tübingen, Germany
- 1094 *Influence of Atomic Scale Compositional Gradients on Colossal Ionic Conductivity in Highly Strained YSZ/STO Heterostructures*; DW McComb, FJ Scheltens; The Ohio State University; J Santamaria, C Leon, A Rivera; Universidad Complutense de Madrid, Spain
- 1096 *Extensive Analysis of Structure-Property Relationships in Thin-Film Solar Cells Using Scanning Electron Microscopy in Combination with Focused Ion Beam*; D Abou-Ras; Helmholtz-Zentrum Berlin, Germany; K Tsyrlin; Carl Zeiss Microscopy GmbH, Germany; N Schäfer, M Nichterwitz, H Kropf, S Harndt, R Caballero; Helmholtz-Zentrum Berlin, Germany; H Schulz; Carl Zeiss Microscopy GmbH, Germany; F Bauer; Oxford Instruments GmbH, Germany

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- 1098 *Procedure for TEM Measurement of Nano-particles*; WG Stratton, MI Buckett, S McKernan; 3M
- 1100 *The Importance of Scanning Electron Microscopy (SEM) and X-Ray Microanalysis (EDS) in Determination of Gunshot Residues (GSR) in Human Hands*; PH Aragao; Universidade Estadual de Londrina, Brazil; LG Bucharles; Polícia Científica de Parana, Brazil; JC Spadotto, AR Rodrigues, VB Motta, BM Biazin, AG Oliveira Junior, CG Jesus Andrade; Universidade Estadual de Londrina, Brazil
- 1102 *In Situ Analytical Electron Microscopy Study of the Lithiation of TiO₂ Nanowires Used in Li-Ion Batteries*; M Gu, B Li, W Wang, V Sprengle, C-M Wang; Pacific Northwest National Laboratory
- 1104 *Identifying Minerals of Environmental Concern in Soils from Smelter Operations Using Multiple Microanalytical Methods*; HA Lowers, DJ Bove, SA Morman; US Geological Survey
- 1106 *Auger Electron Spectroscopy of Carbon Diffusion Profiles in Low Temperature Carburized Stainless Steels*; W Jennings, A Avishai, B Cowen, H Kahn, F Ernst, AH Heuer; Case Western Reserve University
- 1108 *Cathodoluminescence-Based Quantitative Analysis of Radiation Damage in Powellite Single Crystals*; I Jozwik-Biala, J Jagielski, G Gawlik, P Jozwik; Institute of Electronic Materials Technology, Poland; R Ratajczak; National Centre for Nuclear Research, Poland; G Panczer, N Moncoffre, N Bererd; Université de Lyon, France; M Swirkowicz; Institute of Electronic Materials Technology, Poland
- 1110 *Characterization of Graphite Inclusions in Cast Iron by Cathodoluminescence and X-Ray Microanalysis*; SA Wight; National Institute of Standards and Technology; JR Hitchings; Comanche Technologies
- 1112 *Morphological Study on Electrochemical Sensor Based Polypyrrole by Scanning Electron Microscopy*; G Gonzalez-Mancera; Universidad Nacional Autonoma de Mexico; JL Reyes, Q Camacho; Universidad Veracruzana, Mexico

- 1114 *Confocal and SEM Studies of Protist Parasites on Fresh Produce*; GR Bauchan; U S Department of Agriculture, Beltsville; D Macarasin; University of Maryland; M Santin, R Fayer; US Department of Agriculture, Beltsville
- 1116 *Improved Specimen Preparation and SEM Imaging Reveal the Morphology of a West African Sorghum Resistant to Storage Insects*; MW Pendleton, EA Ellis; Texas A&M University; BB Pendleton; West Texas A&M University; NY Diarisso; Institut D'Economie Rurale, Mali
- 1118 *Reducing Charging Issues in Silicon on Insulator Cross Sections Under SEM*; M Ordway; University of Missouri, St Louis
- 1120 *Fork Method Stabilization of Fiber Embedded Ceramics for TEM Observation*; SW Ordway; University of Missouri, Saint Louis
- 1122 *An Effective Approach to Extract Cross-Sectional Information from Top-Down SEM for 20nm & 14nm Transistor Nodes in Semiconductor Wafer-Foundries*; W Zhao, Y Wei, C-K Oh, S Kodali, T Schaeffer, S-K Lim, R Rai, Z-H Mai, J Lam; Globalfoundries, Singapore

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- 1124 *High Energy Resolution Monochromated EELS-STEM System*; OL Krivanek, TC Lovejoy, NJ Bacon, GJ Corbin, N Dellby, P Hrcirik, MF Murfitt, G Skone, ZS Szilagy; Nion Co; PE Batson; Rutgers University; RW Carpenter; Arizona State University
- 1126 *Ultra High Energy Resolution EELS Map Employing an Aberration-Corrected STEM Equipped with a Monochromator*; M Mukai, E Okunishi, M Ashino, K Omoto, T Fukuda, A Ikeda, K Somehara, T Kaneyama; JEOL Ltd, Japan; T Saitoh, T Hirayama; Japan Fine Ceramics Center, Japan; Y Ikuhara; University of Tokyo, Japan
- 1128 *Quantifying Oxygen Vacancies in Fuel-Cells Materials Using Atomic EELS Analysis*; P Longo; Gatan, Inc; MF Chisholm, M Varela, AR Lupini; Oak Ridge National Laboratory; RD Twesten; Gatan, Inc
- 1130 *Atomic-Scale Optical and Vibrational Spectroscopy with Low Loss EELS*; P Cueva, D Muller; Cornell University
- 1132 *A Method to Estimate the Range of Validity of the Thin Film Approximation for Dielectric Function Determination in Nanostructures*; J Zhu, PA Crozier, JR Anderson; Arizona State University
- 1134 *Analysis of the Light Element Sensitivity and Measurement Time of the Multiple EDX Pole Shoe Detector "Rococo2"*; A Liebel; PNSensor GmbH, Germany; M Bornschlegl, R Eckhardt, S Jeschke, A Niculae; PNDetector GmbH, Germany; H Soltau; PNSensor GmbH, Germany
- 1136 *Detection of Lithium X-rays by EDS*; L Xiaobing, J Holland, S Burgess, S Bhadare, S Yamaguchi; Japan; D Birtwistle, P Statham; Oxford instruments, United Kingdom; N Rowlands; Oxford Instruments Inc
- 1138 *Ultrahigh Resolution EDX Spectrum Imaging: Nuclear Materials Applications*; E Francis, S Haigh, G Burke, A Gholinia, M Preuss; University of Manchester, United Kingdom

- 1140 *Resolving Ambiguities at the Bi₂Te₃/GaAs Interface with Atomic Resolution EDS*; JH Dycus; North Carolina State University
- 1142 *Using Windowless EDS Analysis of 45-1000eV X-ray Lines to Extend the Boundaries of EDS Nanoanalysis in the SEM*; S Burgess, H James, P Statham, L Xiaobing; Oxford instruments, United Kingdom
- 1144 *Multi-Detector STEM-EDS Mapping of Ion-Irradiated Nanostructured Ferritic Alloys*; C Parish; Oak Ridge National Laboratory; RM White, JM LeBeau; North Carolina State University; Y Zhang, MK Miller; Oak Ridge National Laboratory
- 1146 *Development of a Laser Phase Plate for Zernike Phase Contrast in Electron Microscopy*; M Xu, E Sohr, B Shevitski; University of California, Berkeley; R Glaeser; Lawrence Berkeley National Laboratory; H Mueller; University of California, Berkeley
- 1148 *Development of a Contact-Potential-Type Phase Plate*; H Tamaki, H Kasai, K Harada, Y Takahashi; Hitachi, Ltd, Japan; R Nishi; Osaka University, Japan
- 1150 *Active Pixel Sensors for Direct Imaging of Electrons from 10 keV up to Several MeV with Large Dynamic Range for TEM Applications*; L Strueder, G Lutz, S Aschauer, P Majewski; PNSensor GmbH, Germany; J Treis, K Hermenau; PNDetector GmbH, Germany; H Ryll, H Soltau; PNSensor GmbH, Germany
- 1152 *Implementing Direct Electron Detection Camera K2 and Dose Fractionation for Near Atomic Resolution Single Particle CryoEM*; X Li; University of California San Francisco; S Zheng, DA Agard; Howard Hughes Medical Institute; Y Cheng; University of California San Francisco
- 1154 *Movie Mode Dynamic Transmission Electron Microscope: Revealing Material Processes at Nanometer and Nanosecond Scales with Multi-Frame Acquisition*; T LaGrange, BW Reed, JT McKeown, MK Santala, WJ Dehope, G Huete, RM Shuttlesworth, GH Campbell; Lawrence Livermore National Laboratory
- 1156 *Capturing Irreversible Reactions with Nanosecond-Scale Dynamic TEM Movies: Measuring Crystal Growth Rates During Laser Annealing of Phase Change Materials*; MK Santala, BW Reed; Lawrence Livermore National Laboratory; S Raoux; IBM T J Watson Research Center; T Topuria; IBM Almaden Research Center; T LaGrange, GH Campbell; Lawrence Livermore National Laboratory
- 1158 *Photoelectron-Pulse Properties from Free-Free Transitions in Ultrafast Transmission Electron Microscopy*; DJ Flannigan; University of Minnesota
- 1160 *Results of a pnCCD Based Ultrafast Direct Single Electron Imaging Camera for Transmission Electron Microscopy*; H Ryll; PNSensor GmbH, Germany; K Müller; University of Bremen, Germany; S Ihle, H Soltau; PNSensor GmbH, Germany; I Ordavo; PNDetector GmbH, Germany; A Liebel, R Hartmann; PNSensor GmbH, Germany; A Rosenauer; University of Bremen, Germany; L Strüder; PNSensor GmbH, Germany
- 1162 *High Brightness Photocathodes for Ultrafast TEM: A New Paradigm*; BL Rickman, JA Berger, AW Nicholls, WA Schroeder; University of Illinois, Chicago

- 1164 *Progress in Electrons Vortex Creation and Application in a Transmission Electron Microscope*; J Verbeeck, A Beche, L Clark, G Guzzinati, R Juchtmans; University of Antwerp, Belgium; A Lubk; University of Dresden, Germany; H Tian, R Van Boxem, G Van Tendeloo; University of Antwerp, Belgium
- 1166 *Addition, Subtraction, and Analysis of Orbital Angular Momentum in Electron Vortex Beams*; T Yahn, JS Pierce, TR Harvey, BJ McMorran; University of Oregon
- 1168 *Production of Vortex Beam Modes from a Magnetic Spiral Phase Plate*; AM Blackburn, JC Loudon; Cambridge University, United Kingdom
- 1170 *Reducing Transient Electric Fields Effect in Ultrafast Electron Diffraction Using Multiple Laser Pulse Train*; Y Hu, J Li, J-M Zuo; University of Illinois, Urbana-Champaign
- 1172 *The Contribution of Thermally Scattered Electrons to Atomic Resolution Elemental Maps*; REA Williams; The Ohio State University; BD Forbes, AJ D'Alfonso; University of Melbourne, Australia; R Srinivasan; The Ohio State University; DO Klenov, B Freitag; FEI Company, Netherlands; HL Fraser; The Ohio State University; LJ Allen; University of Melbourne, Australia; D McComb; The Ohio State University
- 1174 *Developments in Environmental Transmission Electron Microscopy for Catalysis Research*; EA Stach, D Zakharov; Brookhaven National Lab; MC Akatay; Purdue University; P Baumann; University of Applied Sciences of Northeastern Switzerland; F Ribeiro, Y Zvienevich; Purdue University; Y Li, A Frenkel; Yeshiva University
- 1176 *High Contrast BSE Imaging under Ultra Low Voltage Condition by FE-SEM with Energy Filtering*; Y Hashimoto, T Matsuzaki, H Ito, M Konno, S Takeuchi; Hitachi High-Technologies Corporation, Japan
- 1178 *Conical Diffraction Based Super-Resolution System for Fluorescence Microscopy: System Description and Demonstration Visualizing Biological Objects*; GY Sirat; Bioaxial SAS, France; S Shorte; Institut Pasteur, France; LPO Braitbart; Bioaxial SAS, France; L Moisan; Université Paris Descartes, France; JY Tinevez; Institut Pasteur, France; J Caron, C Fallet; Bioaxial SAS, France
- 1180 *Position-Sensitive STEM Detectors for High-Sensitivity Phase Detection*; TJ Pennycook, L Jones, PD Nellist; University of Oxford, United Kingdom
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- 1186 *Electron Orbital Angular Momentum Transfer to Nanoparticle Plasmon Modes*; TR Harvey, JS Pierce, TS Yahn; University of Oregon; PA Ercius; Lawrence Berkeley National Laboratory; BJ McMorran; University of Oregon
- 1188 *High Efficiency Electron Diffractive Optics*; JS Pierce, TR Harvey, TS Yahn, BJ McMorran; University of Oregon
- 1190 *Evaluation of a Multi-Pixel CMOS Photon Detector*; JH Chuah; University of Malaya, Malaysia; DM Holburn, BC Breton, N Caldwell; University of Cambridge, United Kingdom
- 1192 *The Development of a Large-Area Windowless Energy Dispersive X-ray Detector for STEM-EDX Analysis*; K Tamura, R Namekawa; Hitachi High-Technologies Corporation, Japan; R Buchhold, B Hammell, A Sandborg; EDAX Inc; T Sato, M Konno, H Inada, K Nakamura, Y Taniguchi, T Hashimoto; Hitachi High-Technologies Corporation, Japan
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- 1196 *Estimation of Energy Acceptance of SE Detectors in Scanning Electron Microscopy*; K Kumagai, T Sekiguchi; National Institute for Materials Science, Japan
- 1198 *How Flat is Your Detector? Non-Uniform Annular Detector Sensitivity in STEM Quantification*; KE MacArthur, L Jones, PD Nellist; University of Oxford, United Kingdom
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- 1202 *Evaluating Long-Term Stability and Transient Disturbances of a TEM*; M Malac; National Institute for Nanotechnology, Canada; RA McLeod; University of Alberta, Canada; Y Taniguchi; Hitachi High-Technologies Corp, Japan; M Bergen; National Institute for Nanotechnology, Canada; D Hoyle; Hitachi High Technologies Canada, Inc.
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- 1212 *Pros and Cons of Low-kV Transmission Electron Microscopy*; R Egerton; University of Alberta, Canada
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- 1226 *Direct Mapping of Stacking Structure in Rotated Bilayer Graphene Using Aberration-Corrected Transmission Electron Microscopy*; JM Yuk, HY Jeong, NY Kim, MJ Lee; Ulsan National Institute of Science and Technology, Republic of Korea; JY Lee; Institute for Basic Science, Republic of Korea; Z Lee; Ulsan National Institute of Science and Technology, Republic of Korea
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- 1230 *Spectroscopic Studies on Nitrogen-doped Multi-Walled Carbon Nanotubes Using Monochromated STEM-EELS at Low-Voltage*; R Arenal; Universidad de Zaragoza, Spain
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- 1234 *Contrast Enhancement in Low-kV Zero-loss Filtered Imaging of Frozen-Hydrated Biological Specimen*; E Majorovits; Carl Zeiss Microscopy GmbH, Germany; G Hofhaus; Universität Heidelberg, Germany; I Angert, G Benner; Carl Zeiss Microscopy GmbH, Germany; U Kaiser; Universität Ulm, Germany; RR Schröder; Universität Heidelberg, Germany

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1238 *Atomic-Scale Analysis of Chemical Bonding of Delaminated Graphene at Faceted SiC by Aberration-Corrected Scanning Transmission Electron Microscopy*; G Nicotra; Istituto per la Microelettronica e Microsistemi, Italy; QM Ramasse; The Science and Technology Facilities Council, Daresbury, United Kingdom; I Deretzis, C Bongiorno, C Spinella, F Giannazzo; Istituto per la Microelettronica e Microsistemi, Italy

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1244 *Quantitative SEM/EDS, Step 1: What Constitutes a Sufficiently Flat Specimen?*; DE Newbury, NW Ritchie; National Institute of Standards and Technology

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1250 *Effect of the Probe Size and Interaction Volume on Quantitative X-ray Maps across Interfaces of a Cu-Al Roll Bonded Laminate*; H Demers; McGill University, Canada; R Wuhrer; University of Western Sydney, Australia; K Moran; Moran Scientific Pty Ltd., Australia; R Gauvin; McGill University, Canada

1252 *Testing Analytical Precision Using Adaptive Shaping at High Throughput*; RB Mott, OE Healy; PulseTor LLC; NW Richtie, AP Lindstrom; National Institute of Standards and Technology

1254 *Bridging the Gap between EPMA and AEM: The Performance of High Resolution Field-Emission Electron Microprobes in the Analysis of Geological Materials*; JT Armstrong; Carnegie Institution of Washington; P McSwiggen; McSwiggen and Associates; C Nielsen; JEOL USA, Ltd.

1256 *Check and Specification of the Performance of EDS Systems Attached to the SEM by Means of a New Test Material EDS-TM002 and an Updated Evaluation Software Package EDS Spectrometer Test—Version 3.4*; V-D Hodoroba; BAM Federal Institute for Materials Research and Testing, Germany; M Procop; IfG—Institute for Scientific Instruments, Germany; V Rackwitz; BAM Federal Institute for Materials Research and Testing, Germany

- 1258 *Chemical State Mapping via Soft X-rays Using a Wavelength Dispersive Soft X-ray Emission Spectrometer with High Energy Resolution*; H Takahashi, N Handa, T Murano; JEOL Ltd, Japan; M Terauchi; Tohoku University, Japan; M Koike, T Imazono, N Hasegawa; Japan Atomic Energy Agency; M Koeda, T Nagano, H Sasai, Y Oue, Z Yonezawa, S Kuramoto; Shimadzu Corp, Japan
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- 1308 *Expanding the Boundaries of FIB-SEM Technology: Developments for Best Application Results*; I Schulmeyer, M Kienle; Carl Zeiss Microscopy GmbH, Germany

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- 1326 *Application of Low Energy Broad Ion Beam Milling to Improve the Quality of FIB Prepared TEM Samples*; A Pakzad, S Mick; Gatan Inc; C Vartuli, J Chung, G Lian; Texas Instruments
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- 1358 *Towards Mapping Electrostatic Potentials in Semiconductor Devices under Working Conditions Using Off-Axis Electron Holography*; S Yazdi, T Kasama; Technical University of Denmark; DW McComb; The Ohio State University; AC Harrison; Imperial College London, United Kingdom; RE Dunin-Borkowski; Forschungszentrum Jülich, Germany
- 1360 *Separation of Dopant and Mean Inner Potential Contributions to Potential Profiles Recorded from Very Highly Doped Semiconductor Layers Using Electron Holography*; D Cooper; Commissariat à l'énergie atomique, France; R Dunin-Borkowski; Forschungszentrum Jülich, Germany
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- 1498 *Analytical Electron Microscopy Investigation of Au/TiO₂ Thin Films Deposited on the Glass Substrate*; M Kawasaki; JEOL USA, Inc; M-J Chen, J-R Yang; National Taiwan University; W-A Chiou; University of Maryland; M Shiojiri; Kyoto Institute of Technology, Japan
- 1500 *An In Situ TEM Study of Ferroelastic Domain Mobility*; P Gao, J Jokisaari, C Nelson; University of Michigan; S-H Baek; University of Wisconsin, Madison; M Trassin; University of California, Berkeley; CW Bark; University of Wisconsin, Madison; R Ramesh; University of California, Berkeley; C-B Eom; University of Wisconsin, Madison; X Pan; University of Michigan
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- 1522 *Determination of Local Structure in Meteoritic Nanoscale Porous Carbon to Explain Entrapped Noble Gases*; R Stroud; Naval Research Laboratory; M Chisholm; Oak Ridge National Laboratory; S Amari; Washington University; J-I Matsuda; Osaka University, Japan

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- 1526 *STEM/EELS and Diffraction Study of Phase Transformation in FeO_{0.7}F_{1.3}/C Nanocomposites after Lithiation/Delithiation*; M Sina, N Pereira, GG Amatucci, F Cosandey; Rutgers University
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- 1566 *Effect of Mechanical Milling on the Microstructure and Morphology of Al₂O₃/SiC Nanocomposite*; C Carreno-Gallardo; Centro de Investigacion en Materiales Avanzados S C, Mexico; H Barriga-Calvillo, E Lozano-Rodriguez; Instituto Tecnologico de Chihuahua, Mexico; I Estrada-Guel, MA Neri-Flores; Centro de Investigacion en Materiales Avanzados S C, Mexico; C Lopez-Melendez; Universidad La Salle de Chihuahua, Mexico; R Martinez-Sanchez; Centro de Investigacion en Materiales Avanzados S C, Mexico
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- 1634 *Correlative Microscopy and Spectroscopy of Buried Interfaces in Tooth Enamel*; L Gordon, MJ Cohen, D Joester; Northwestern University
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- 1640 *Helium Ion Microscopy for the Imaging of Organic Matrix and Mineral Phase in Developing Tooth Enamel*; C Huyuan, J Marshman; Carl Zeiss Microscopy, LLC; J Dobeck; Forsyth Institute; B Goetze; Carl Zeiss Microscopy, LLC; FB Bidlack; Forsyth Institute

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- 1660 *Microstructure of Bimetallic Pt-Pd Nanoparticles under Working Conditions*; TR Johns, JR Gaudet, EJ Peterson; University of New Mexico; JT Miller; Argonne National Laboratory; CH Kim, MP Balogh; General Motors Global R&D; AK Datye; University of New Mexico

- 1662 *Microscopic Characterization of Heterogeneous Catalysts in 3-D and In Situ/Ex Situ*; I Arslan; Pacific Northwest National Laboratory; S Dey, JD Roehling; University of California, Davis; J Batenburg; Centrum Wiskunde and Informatica, Netherlands; BH Davis; University of Kentucky; BC Gates; University of California, Davis; A Katz; University of California, Berkeley; DE Perea; Pacific Northwest National Laboratory; J Lercher; Technische Universität München, Germany
- 1664 *In Situ Observation of the Changes in Shape and Surface Structure of Pt Nanoparticulate Catalysts in Reactant Gases by Aberration-corrected Environmental Transmission Electron Microscopy*; H Yoshida, H Omote; Osaka University, Japan; M Haruta; Tokyo Metropolitan University, Japan; S Takeda; Osaka University, Japan
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- 1668 *Time Resolved Growth of Pt From Single Atoms to Nanocrystals with HR-TEM*; P Ercius, Y Borodko; Lawrence Berkeley National Laboratory; G Somorjai; University of California, Berkeley
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- 1682 *Pt/g-Al₂O₃ Reduction and Cluster Evolution Characterized by Aberration-Corrected STEM Imaging and EXAFS*; W Sinkler, SR Bare, SD Kelly, SI Sanchez, TM Mezza, SA Bradley; UOP/Honeywell
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- 1696 *Nano-Sized Intermetallics: Unraveling Intricacies of GaPd₂ Catalysts Using Aberration-Corrected STEM*; RK Leary, F de la Pena, JS Barnard; University of Cambridge, United Kingdom; M Walls; Université Paris, France; Y Luo, M Armbruster; Max-Planck-Institut für Chemische Physik fester Stoffe, Germany; JM Thomas, PA Midgley; University of Cambridge, United Kingdom
- 1698 *The Influence of Different Mn-Co Interaction Modes in Mn/Co/TiO₂ Fischer-Tropsch Catalysts*; J Liu, TE Feltes, Y Zhao; University of Illinois, Chicago; JC Idrobo; Oak Ridge National laboratory; RF Klie; University of Illinois, Chicago; JT Miller, CL Marshall; Argonne National Laboratory; JR Regalbuto, R Meyer; University of Illinois, Chicago
- 1700 *Low-Temperature CO Conversion on 1wt%Pt/CeO₂ Nanocubes*; R Wang, R Dangerfield, D Li; Youngstown State University
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- 1706 *Direct Observation of Single Atoms in Sinter-Resistant and Bimetallic Catalyst Systems Synthesized by Atomic Layer Deposition*; K-B Low; University of Illinois, Chicago; Y Lei, J Lu, JW Elam; Argonne National Laboratory
- 1708 *Cathode Luminescence Spectroscopy of Gold Nanoparticle Catalyst in Gas Environments*; T Tanaka, N Yamamoto, T Kunio; Tokyo Institute of Technology, Japan
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- 1718 *Development of Stable Pt₃Zn/ZnO Catalyst by Epitaxial Growth*; JX Liu, YA Song; Arizona State University; BT Qiao; Dalian Institute of Chemical Physics, China; YD Huang; Harbin Institute of Technology, China; JY Liu; Arizona State University
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- 1722 *TEM Characterization of Ceria Supported Pt Catalyst for Water-Gas Shift Reaction Produced by Reactive Spray Deposition Technique*; R Jain, C-H Kuo, J Roller, SL Suib, CB Carter, R Maric; University of Connecticut
- 1724 *Atomic Level In Situ Observation of Surface Amorphization in Anatase Photocatalyst During Light Irradiation in Water Vapor*; L Zhang, BK Miller, C Peter; Arizona State University
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1732 *TEM—Now We Can Image and Identify Single Atoms; What’s Next?*; DB Williams; The Ohio State University

1734 *TEM Studies of the Oxidation of 316 Stainless Steel with In Situ Proton Irradiation*; SS Raiman, P Wang, Z Jiao, GS Was; University of Michigan, Ann Arbor

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- 1760 *Grain Size Measurement Methods: A Review and Comparison*; GF Vander Voort; Consultant—Struers Inc
- 1762 *Quantitative Microstructure Characterization by Application of Advanced SEM-Based Electron Diffraction Techniques*; S Zaefferer, N-N Elhami, P Konijnenberg, T Jäpel; Max-Planck-Institut für Eisenforschung GmbH, Germany
- 1764 *k-Space Interference of Coherent TDS Electrons for Mean Atomic Displacement Measurements*; RA Herring; University of Victoria, Canada
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- 1778 *Investigation of Secondary Hardening in MP35N Wires*; D Sorensen, BQ Li; Medtronic Neuromodulation; WW Gerberich, KA Mkhoyan; University of Minnesota
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- 1782 *Characterization of Materials by X-Ray Microanalysis and Other Techniques*; JI Goldstein; University of Massachusetts
- 1784 *Solidification Kinetics of an Oxide Weld Slag Utilizing SEM and LSCM Imaging*; M Kottman; The Lincoln Electric Company; D Hovis, A Avishai; Case Western Reserve University; M James, BK Narayanan; The Lincoln Electric Company
- 1786 *Helium Ion Implantation Effects of 9Cr-ODS (Oxide Dispersion Strengthened) Steel*; C Lu; University of Michigan; Z Lu; Northeastern University, China; G Yu, L Wang; University of Michigan
- 1788 *Electro-Polishing Foil Samples for TEM with an Extremely Small Amount of Electrolyte*; H Saka; Nagoya University, Japan; M Yamamoto, Y Shiraishi, M Amano, T Goto; Yamamoto Chemical Company, Ltd., Japan; T Suzuki, S Arai, K Sasaki; Nagoya University, Japan
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- 1792 *Advantage of HR-STEM for Evaluating Ultra-Fine Carbides Embedded in Steel*; K Yamada, H Nakamichi, K Sato; JFE Steel, Japan
- 1794 *EBSD Investigations on Cutting Edges of Non-Oriented Electrical Steel*; H Harstick; Volkswagen AG, Germany; M Ritter; Technische Universität Hamburg-Harburg, Germany; W Riehemann; Technische Universität Clausthal, Germany
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- 1800 *In Situ Melting Behavior Observation of an Eutectic Alloy Nano-needle*; K Sasaki, T Takahashi, S Arai, T Tokunaga, T Yamamoto; Nagoya University, Japan
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- 1804 *Efficient Lattice-Image Detection of Icosahedral Twins*; P Fraundorf; University of Missouri, St Louis; C Bishop; University of Tennessee, Knoxville
- 1806 *Microscopic Identification of Strength and Durability of Rail Steels*; H Aglan, CD Fermin; Tuskegee University

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- 1808 *Electron Probe Microanalysis Study on an Unusual Chernobyl Hot “Particle”*; P Pöml; Institute for Transuranium Elements, Germany; B Burakov; VG Khlopin Radium Institute, Russia; T Geisler; University of Bonn, Germany
- 1810 *Environment-Sensitive Behaviour of Welds: Challenges in Microstructural Characterisation*; MG Burke, S Schilling, A Welbourne; University of Manchester, United Kingdom
- 1812 *Cooling Rate Influence on Corrosion Resistance of a A383 Aluminum Alloy in Contact with E10, E30 and E100 Bio-Ethanol*; M Santos-Beltran, A Santos-Beltran, V Gallegos-Orozco; Universidad Tecnológica Junta de los Rios, Mexico; R Martinez-Sanchez, F Paraguay-Delgado; Centro de Investigación en Materiales Avanzados, Mexico; C Rodriguez-Gonzalez; Universidad Autónoma de Ciudad Juárez, Mexico
- 1814 *Microscopic Investigations of Sulfur-Rich Corrosion Products on Copper*; WK Collins, M Ziomek-Moroz; US Department of Energy
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- 1818 *RIMAPS Prediction of Etch Pit Patterns*; NO Fuentes; Comiaión Nacional de Energía Atómica, Argentina; EA Favret; Universidad Nacional de Gral, Argentina
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Physical Sciences—Nanomaterials Characterization

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- 1992 *Structural Analysis of Sulfonated Mesoporous Silica*; T Maki; JEOL Ltd, Japan; Y Tominaga; Tokyo University of Agriculture and Technology, Japan

Advanced Atomic-Scale Imaging and Spectroscopy of Materials

- 1994 *Defects in Heavy-Ion Bombarded Compound Semiconductors Due to the Elastic and Inelastic Energy Loss Regimes*; AS Khalil; Tabbin Institute for Metallurgical Studies, Cairo, Egypt; LT Chadderton, AM Stewart, DJ Llewellyn, MC Ridgway, AP Byrne; Australian National University, Canberra
- 1996 *Dynamical Control of Orbital Ordering and Ferroelectric-Induced Polar State in Metallic Manganites*; RF Klie, Q Qiao, A Gulec, PJ Phillips; University of Illinois, Chicago
- 1998 *Deep Ultra-Violet Emission from GaN/AlN Matrix Grown by Plasma-Assisted Molecular Beam Epitaxy*; J Verma, V Protasenko, A Verma, M Islam, G Xing, D Jena; University of Notre Dame

- 2000 *On the Origin of Low Thermal Conductivity in High Thermoelectric Performance in n-type BiAgSeS*; H Wu; Xi'an Jiaotong University, China; Y-L Pei; Beihang University, China; J Li; Harbin Institute of Technology, China; J Sui; Harbin Institute of Technology; L Zhao; Beihang University, China; J He; South University of Science and Technology, China
- 2002 *SEM/EDS Characterization of Radioactive Particles in Samples of PM10*; R Ramirez-Leal, H Duarte-Tagles, M Burgos-Hernandez, C Chavez-Toledo; State University of Sonora, Mexico
- 2004 *Copper (II) Remediation Using Novel Iron-Phosphate Nanoparticles*; S Rouvimov; University of Notre Dame; N Adam; University of Wyoming; J Gates, B Beachel; East Central University

Plenary

- 2006 *The Long-Lasting Struggle to Achieve Atomic-Resolution Microscopy by Correcting the Aberrations of Electron Lenses*; HH Rose; Technical University Darmstadt
- 2008 *Looking Through Paintings*; J Dik; Delft University of Technology

Technologists' Forum Special Topic: EDS Revisited—Basics and Advances

- 2010 *Sample Preparation of “Soft” Matter Materials for EDS Analysis in Both SEM and TEM*; PF Lloyd; UES, Inc
- 2012 *Sample Preparation Considerations for X-ray EDS Analysis in the Physical Sciences*; S Walck; Army Research Laboratory
- 2014 *Preparation of Life Science Samples for Electron Dispersive X-ray (EDS) Analysis*; DM Sherman; DSImaging LLC
- 2016 *Everything You Always Wanted to Know about XES*; NJ Zaluzec; Argonne National Laboratory
- 2018 *Selecting a Silicon Drift Detector*; NW Ritchie; National Institute of Standards and Technology
- 2020 *Guidelines for Microanalysis Using the Energy-Dispersive Spectrometer*; PK Carpenter; Washington University

Technologists' Forum Roundtable: EDS Revisited—Basics and Advances

- 2022 *Technologists' Forum: Roundtable Discussion of Energy Dispersive Spectroscopy*; EA Ellis; Texas A&M University
- 2024 *Anhydrous (Non-Cryogenic) Specimen Preparation of Biological Samples for Energy Dispersive Spectroscopy in the Transmission Electron Microscope*; EA Ellis; Texas A&M University; L Blubaugh; Hitachi High Technologies America, Ltd.
- 2026 *Localization of a Short Peptide Anti-microbial (AMP) in Staphylococcus aureus by Diaminobenzidine-Eosin Photo-oxidation and Visualization with STEM EDS*; GA Johnson, EA Ellis, H Kim, J-P Pellois; Texas A&M University

Physical Sciences Tutorial: Practical Processing of Spectrum Imaging Datasets by Multivariate Statistical Analysis: Advantages and Disadvantages

2028 *Practical Processing of Spectrum Images by Multivariate Statistical Analysis: Advantages and Disadvantages*; M Watanabe; Lehigh University

Physical Sciences Tutorial: State-of-the-Art Microanalysis at the nm-Scale and Smaller: Going from Pretty Pictures to Quantitative Analysis of Hyperspectral Data

2030 *A Correlative Study of Direct Atomic-Scale Imaging of Hydrogen and Oxygen Interstitials in Niobium Utilized Atom-Probe Tomography and Aberration-Corrected Scanning Transmission Electron Microscopy*; DN Seidman, Y-J Kim; Northwestern University; RF Klie, R Tao; University of Illinois, Chicago

Physical Sciences Tutorial: Practical Aspects of Atom Probe Tomography in Materials Science

2032 *State-of-the-Art Microanalysis at the nm-Scale and Smaller: Going from Pretty Pictures to Quantitative Analysis of Hyperspectral Data*; PG Kotula; Sandia National Laboratories

Biological Sciences Tutorial: Correlative Imaging of Tissues, the Potential of Large Volume Array Tomography

2034 *Correlative Imaging of Tissues: The Potential of Large Volume Array Tomography*; IU Wacker; Karlsruhe Institute of Technology, Germany

Biological Sciences Tutorial: Biomedical Applications of Micro-CT in Hard and Soft Tissues—Going Beyond the Bone

2036 *Biomedical Applications of micro-CT in Hard and Soft Tissues—Going Beyond the Bone*; K Takahashi, MA Saleh, N Fleming, T Takahashi; Vanderbilt University; D Perrien; Tennessee Valley Healthcare System

Biological Sciences Tutorial: Bio-Imaging and Spectroscopy with Scanning Transmission X-ray Microscopy

2038 *Chemically Selective Imaging and Spectroscopy with Scanning Transmission X-ray Microscopy*; A Hitchcock; McMaster University, Canada; M Obst; Tuebingen University, Germany; T Tyliczszak; Lawrence Berkeley National Laboratory; S Kalirai; McMaster University, Canada; D Bazylnski; University of Nevada

Welcome from the Society Presidents

On behalf of the Microscopy Society of America, the Microanalysis Society, and the International Metallographic Society, we welcome you to the Microscopy & Microanalysis 2013 meeting and its associated Exhibition in Indianapolis, IN. Once again this year, the meeting promises to be the premier opportunity in our field to learn, to connect, and to experience all the latest innovations in the world of microscopy and microanalysis.

We are very fortunate to have, as a part of our meeting, the largest and most diverse yearly exhibition of equipment, software, and other resources for microscopy and microanalysis. In our field, researchers from universities, government labs, and industry have a unique relationship with manufacturers and suppliers of our tools. Throughout the history of microscopy and microanalysis, these researchers have worked in close partnership with suppliers to create innovations and make those innovations available to everyone in the field. This partnership is never more evident, or more powerfully felt, than at the Microscopy and Microanalysis Exhibition. Whether in the exhibit hall, the poster and platform presentations, or the social events, all attendees connect in a powerful way that moves our technology and capabilities forward in what has been unprecedented growth over the years.

Over 100 exhibitors have come to display their products and capabilities at the 2013 Exhibition. We hope you will take the time to have a conversation with each of them and learn about what they have to offer and what's new. In many cases, we know you will be renewing old friendships and mutually beneficial relationships. Also, please be sure to take advantage of the Vendor Tutorials, which will be held on Monday, Tuesday, and Wednesday from 5:45 – 6:45 PM in the Exhibition Hall. These tutorials are special, small-group product demonstrations and related educational opportunities, held in the exhibitors' booths at a quiet time after the Exhibit Hall has closed. Please note that it is necessary to sign up for the Vendor Tutorials ahead of time, which can be done at the MSA Megabooth in the center of the Exhibit Hall. We would like to thank Andreas Holzenberg of the MSA Education Committee for organizing the Vendor Tutorials.

The Meeting and Exhibition could not take place without the extremely hard work and dedication of many people. We would like to particularly thank Nicole Guy, our Meeting Manager, and Doreen Bonnema, our Exhibition Manager. We would also like to thank our Editor, Richard Edelman, who puts together the Official Exhibition & Meeting Guide.

It is our hope that you will find Microscopy & Microanalysis 2013 to be stimulating, informative, energizing, and fun. We know you will appreciate the excellent facilities that the Convention Center and hotels have to offer, and the proximity of many great restaurants and other attractions. Have a wonderful week, and we will see you next year in Hartford!



Ernie Hall
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Welcome From the Program Committee



Welcome to the 71st Microscopy & Microanalysis meeting, M&M 2013 in Indianapolis, Indiana! The Microscopy Society of America, the Microanalysis Society, and the International Metallographic Society have excelled again bringing the latest and most innovative applications and instrumental developments from investigators in the biological and physical sciences using microscopy and microanalysis techniques. M&M 2013 features more than 35 symposia covering a broad range of topics, ample educational opportunities in the form of courses and tutorials and pre-meeting events including courses, a congress and a workshop.

We are honored to have Professor Harald Rose from the University of Ulm and Professor Joris Dik from the Technical University of Delft as plenary speakers. Professor Harald Rose will open the meeting with an exciting and inspiring talk: “The long-lasting struggle to achieve atomic-resolution microscopy by correcting the aberrations of electron lenses”. Professor Rose will take us on a journey from the development of early electron microscopes with nanometer resolutions to modern sub-Ångström instruments. Professor Rose was trained as a theoretical physicist in the group of Otto Scherzer and is now a leading expert in theoretical electron optics. He has contributed to advances in aberration correction of electron lenses, energy filters for electron microscopy, and the theory of image formation by inelastically scattered electrons important in low-voltage electron microscopy. During his long and fruitful career, Professor Rose received several international awards in recognition of his accomplishments, including the MSA Distinguished Scientist Award. He is a long-standing member of the Microscopy Society of America and was inducted as an MSA Fellow in 2009. Prof. Joris Dik will show us that microscopy and microanalysis can lead to amazing discoveries when applied to the arts and humanities. Professor Dik’s lecture, “Looking through paintings,” will examine how modern instrumentation can uncover art history mysteries using examples from van Gogh and Rembrandt. Professor Dik initially studied art history and classical archaeology at the University of Amsterdam. After a year internship at the J. Paul Getty Museum in Los Angeles, he returned to the Netherlands, where he completed a Ph.D in chemistry. In 2010, he was appointed to a prestigious Antoni van Leeuwenhoek professorship.

Our named symposium this year will honor the life and work of Professor Gertrude Rempfer who passed away in the Fall of 2011: “Gertrude Rempfer Memorial Symposium on Advances in Electron Optics and Aberration Corrected Electron Microscopy.” After receiving her PhD in physics from the University of Washington in 1939, she worked both in industry and academia on electron optics and electron microscopy. Her efforts led to the development of the world’s first ultra-high vacuum photo-emission electron microscope. Gert Rempfer was a true role model for everyone, from her colleagues to students, especially female students. This symposium is intended to allure young scientists to some fast developing areas in electron microscopy.

The Executive Program Committee and the Symposia Organizers, planted the seed for M&M 2013, and we have all contributed to make it grow. Now it is time for all of us to enjoy the fruits of our efforts and actively participate in the meeting. It is also a great time to learn more about our three Societies and to inquire about possibilities of becoming a volunteer, since volunteers are the life-blood of each Society. And one day each of us might be able to say what our plenary speaker, Professor Harald Rose, said: “I consider MSA my scientific home and the home of many of my scientific friends”.

The Executive Program Committee welcomes you to a celebration of microscopy and microanalysis in the city of Indianapolis, Indiana, August 4 – August 8, 2013.

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The Long-Lasting Struggle to Achieve Atomic-Resolution Microscopy by Correcting the Aberrations of Electron Lenses

Harald Rose

Ulm University, Center for Electron Microscopy, Albert-Einstein-Allee 11, 89069 Ulm, Germany

The correction of the aberrations of electron lenses is the long story of many seemingly fruitless efforts to improve the resolution of electron microscopes by compensating for aberrations of round electron lenses over a period of 50 years. The problem started in 1936 when Scherzer [1] demonstrated that the chromatic and spherical aberrations of rotationally symmetric electron lenses are unavoidable. Moreover, the coefficients of these aberrations cannot be made sufficiently small. As a result, the resolution limit of standard electron microscopes equals about one hundred times the wavelength of the electrons, whereas modern light microscopes have reached a resolution limit somewhat smaller than the wavelength. In 1947, Scherzer found an ingenious way for enabling aberration correction. He demonstrated in a famous article that it is in theory possible to eliminate chromatic and spherical aberrations by lifting any one of the constraints of his theorem, either by abandoning rotational symmetry or by introducing time-varying fields, or space charges [2]. Moreover, he proposed a multipole corrector compensating for the spherical aberration of the objective lens.

Starting in 1948, Seeliger built and tested the Scherzer corrector during a period of about five years. He aligned the constituent elements mechanically by means of adjustment screws. However, the experiments showed that this approach was a major obstacle due to insufficient stability of the mechanical alignment. As a result, the correction did not improve the resolution of the microscope because it was limited by mechanical and electromagnetic instabilities rather than by the static defects of the objective lens. Although Seeliger could not improve the resolution limit of the basic electron microscope, he could demonstrate that the corrector provided a negative spherical aberration, which could be adjusted to compensate for the spherical aberration of the objective lens [3]. In 1956, G. Moellenstedt first demonstrated experimentally the effective correction of spherical aberration by means of this corrector [4]. By employing critical illumination with a large cone angle of $2 \cdot 10^{-2} \times \text{rad}$, he enlarged the spherical aberration to such an extent that it became by far the dominant aberration, which strongly blurred the image. After compensating for the spherical aberration by means of the octopoles, the resolution improved by a factor of about seven accompanied by a striking increase in contrast.

In 1964, Deltrap built a telescopic quadrupole-octopole corrector to eliminate the spherical aberration of a probe-forming lens. Although he nullified this aberration, he failed, like his predecessors, to improve the actual resolution of the uncorrected system because at that time the resolution was not limited by the spherical aberration of the objective lens. Moreover, all correctors known at that time introduce large off-axial coma and are not suitable for transmission electron microscopes (TEMs). In order to compensate for spherical aberration, chromatic aberration and off-axial coma, a novel aplanatic corrector utilizing symmetry properties was proposed [5]. This corrector was built and tested successfully in a test microscope within the frame of the so-called Darmstadt project and it demonstrated for the first time the simultaneous correction of chromatic and spherical aberrations [6]. Unfortunately, the project was abandoned after the death of O. Scherzer in 1982, although it was successful as far as it went.

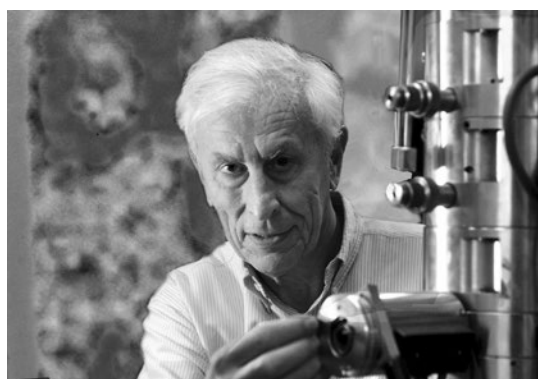
In 1972, A. Crewe and V. Beck started at the University of Chicago another attempt to correct the spherical aberration of a scanning transmission electron microscope (STEM). They built and tested over a period of six years a magnetic quadrupole-octopole corrector consisting of a symmetric quadruplet with combined quadrupoles and octopoles. Because the corrector is aimed for the STEM, the difficulties to simultaneously compensate for the off-axial coma did not arise. Although Beck and Crewe incorporated several stigmator coils for producing weak dipole and hexapole fields, they were unable to find a suitable setting. Although all fruitless experimental attempts demonstrated that correction works in principle, none of them achieved an improvement in resolution. The main reasons for these failures were: (a) the basic microscope was not stable enough, (b) the deleterious interference with the environment had been underestimated, (c) it was not possible to determine the state of alignment with the required precision, and (d) the resolution-limiting residual aberrations could not be measured with the required accuracy and eliminated within a period of time which must be shorter than the duration of the overall stability of the entire system. These obstacles were so severe that worldwide the granting agencies refused to fund the “fruitless correction projects” any longer.

In 1990, the required technology and a new corrector design consisting of two sextupoles and two round lenses became available. Because this corrector is rather simple, Haider, Urban and the author were convinced that the successful correction of the spherical aberration in a 200 kV TEM equipped with a field emission gun should be feasible. Fortunately, the Volkswagen foundation was willing to take the risk and approved funding in 1991. In July 1997, the first atomic-resolution images of gallium-arsenide were obtained after the resolution limit of the microscope was reduced by the corrector from 0.24 nm to about 0.12nm [7]. Around 1995 O. Krivanek developed at the Cavendish Laboratory in Cambridge an improved version of the Deltrap quadrupole octopole corrector which he incorporated in his 100kV VG STEM. With this corrector he achieved, in 1998, the first genuine improvement of the resolution of a STEM [8]. Owing to the unexpected success of these correction efforts, the funding situation improved considerably.

In the US the Department of Energy (DOE) approved in 2003 funding of the TEAM (Transmission Electron Aberration-Corrected Microscope) project headed by U. Dahmen (LBNL Berkeley). The required resolution limit of 0.5Å was obtained in 2009 by means of an improved version of the hexapole corrector after the information limit of the basic 300 kV TEM was lowered to about 0.4Å [9].

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Harald Rose

Harald Rose is an Emeritus Professor of the Technical University of Darmstadt and since 2009 holds a Carl Zeiss funded Senior Professorship at the University of Ulm. He received his Ph. D. for his investigation of the imaging properties of arbitrary multipole systems in the laboratory of Otto Scherzer who was a professor of Theoretical Physics at the University of Darmstadt. He continued his studies in the development of electron optical components and in the theoretical aspects of image formation by scattered electrons, holding positions at the University of Darmstadt and The New York State Department of Health and spent sabbaticals at the Fermi Institute and Cornell University. After returning to Germany in 1980, he held a professor position at the University of Darmstadt for 20 years where, in collaboration with Joachim Zach, he developed the first aberration corrector for a scanning electron microscope. Throughout his expansive scientific carrier, he has investigated means to bring the experimental resolution of electron microscopes closer to the theoretical limit. Among his developments are: the Omega energy filter; an aberration corrector for a Low Energy Electron Microscope (LEEM) using a versatile beam splitter; and an ultra-corrector that corrects all primary chromatic and geometrical aberrations. He has published more than 200 reviewed articles in scientific journals and is the inventor of 105 patents on instruments and electron optical components. His work has been recognized internationally and he is the recipient of numerous awards including the Distinguished Scientist Award of the Microscopy Society of America; the Karl Heinz Beckurts Prize; the Honda Prize and the Wolf Prize for Physics.

Looking Through Paintings

Joris Dik

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Paintings are windows into the history of human kind, our history. None of us can claim never to have set foot in a museum to appreciate these beautiful works of art. The magnificent brushwork of Velazquez, the vivid colors and light effects of el Greco, the fine and detailed work of Rembrandt; and the emotional honesty and bold colors of Van Gogh are characteristics to be admired. They are all indications of the time, place and specific cultural moment in which the artists lived. Historians have been using this information in combination with correspondence and narrative accounts to reconstruct the moments of history in which the works came to light.

For hundreds of years the public has only seen the surface of famous masterpieces by artists such as Van Gogh and Rembrandt. Now, through a melding of innovative scientific techniques and art connoisseurship, completely different paintings and important clues about the artists themselves can be uncovered one layer at a time using non-invasive technologies. Researchers can calculate how and when an artist first began working on their composition by tracing fingerprints, brushstrokes and analyzing different layers of paint pigments. Art historians are increasingly turning to particle physics to authenticate masterpieces by artists like Rembrandt and Van Gogh, as well as to explore mysterious artworks lying beneath surface paintings.

Just microns below their paint surface lay a wealth of information on Old Master Paintings. Hidden paint layers can include underdrawing, underpainting or compositional alterations by the painter, or even younger layers related to later restorations. All too often artists simply re-used their canvases and painted a new composition on top. Thus, a look through the paint layer provides a look over the painter's shoulder. These elements, once fully uncovered, sometimes reveal completely different works of art underneath the surface that were abandoned by these great artists and painted over.

Nondestructive imaging of hidden paint layers is usually realized by means of tube-based X-ray radiation transmission radiography (XRR). The absorption contrast in these images is mostly caused by the heavy metal components of pigments employed, such as lead in lead white or mercury in vermillion. Conventional XRR, however, has a number of important limitations. First of all, the observed X-ray absorbance is a summation of all element-specific absorbancies, which reduces the contrast of weakly absorbing elements. Second, lead white primer raises the overall background of the absorption image derived from the paint layers. Finally, the polychromatic character of an X-ray tube further reduces the contrast in radiographic images. As a result, conventional XRR imaging of paintings frequently provides only a fragmentary view of their substructure, which can severely hamper the readability of hidden compositions [1]. In addition to using the absorption of primary X-rays as an imaging method, one can also record the intensity of secondary radiation, emitted by the atoms in the painting while a pencil beam of energetic X-rays is scanned over the surface. This X-ray radiation fluorescence (XRF) technique has the added advantage that the emitted X-ray radiation is element specific. The covering surface layers will not significantly attenuate the high-energy fluorescence signals from heavy elements in the hidden layers; in this manner, the distribution of both minor and major components in the painting can be visualized. The use of high intensity X-ray beams, coupled with high count rate detectors, reduces the dwell time for data acquisition to such an extent that large, decimeter sized areas can be scanned in a reasonable time frame. In order to learn about the chemical binding of a specific element, X-ray absorption near edge structure (XANES) measurements can be performed at either the element's K- or L-edge at the most interesting points of the hidden layer.

The application of this technology to work "Patch of Grass" by Van Gogh has revealed the head of a woman in a hidden paint layer [2]. We succeeded in visualizing the hidden face with unprecedented detail. In particular, the distribution of Hg and Sb in the red and light tones, respectively, enabled an approximate color reconstruction of the flesh tones. This reconstruction proved to be the missing link for the comparison of the hidden face with Van Gogh's known paintings.

The research into the painting "Old Man with Beard" to determine its attribution determined that the small panel was painted by Rembrandt around 1630, at the end of his time in Leiden. In addition, a self-portrait was revealed when the painting was scanned at the European Synchrotron Radiation Facility (ESRF) in Grenoble and at the Brookhaven National Laboratory (BNL) in New York using Macro-scanning X-Ray Fluorescence spectrometry (MA-XRF). The presence of the self-portrait of Rembrandt aided the authentication process [3].

These microscopy and microanalysis techniques have also found a niche in the art conservation field. Over the past years a number of studies have described the instability of the pigment cadmium yellow (CdS). We have shown how cadmium sulfide on paintings by James Ensor oxidizes to CdSO₄·H₂O [4]. The degradation in the painting "Flowers in a blue vase"

by Vincent van Gogh was initially caused by oxidation of the original CdS pigment, similar as Ensor's paintings. However, additional degradation occurs due to the presence of an overlying varnish. The resulting opaque anglesite compound in the varnish, in combination with the underlying CdC₂O₄ layer at the paint/varnish interface, account for the orange-gray crust that is disfiguring the painting on a macroscopic level [5].

This presentation will show past successes, present developments and the future potential of these techniques in the realm of art conservation, preservation, authentication and discovery.

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Joris Dik

Joris Dik holds an Antoni van Leeuwenhoek chair at the Dept. of Materials Science and Engineering at the Delft University of Technology since 2011. He studied art history and classical archaeology at the University of Amsterdam and obtained his Masters of Arts in 1997. After spending a year as a graduate intern at the Paul Getty Museum in Los Angeles, he returned to Holland, where he joined the laboratory of Henk Schenk in the University of Amsterdam Chemistry department. He received his Ph. D. in 2003 for his studies of Naples yellow, a pigment that has existed for thousands of years. He joined the Delft University of Technology leading a research group in Materials in Art and Archaeology and is a member of the Young Academy of the Royal Netherlands Academy of Arts and Sciences (KNAW). Initially, he focused on the authentication and conservation of paintings and worked for auction houses such as Christie's. Currently, his research interest is the study of materials relating to cultural heritage, their origin and conservation, and the development of new analysis methods, including new visualization techniques to study 17th century paintings. He brings a unique perspective to the study of paintings and masterworks, combining insights from both the science and the art worlds. The transportable atomic particle accelerator, he recently developed, will permit many of the world's great masterworks to be examined in situ, without having to be transported to public laboratories.

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Secretary	Ian M. Anderson		Mark A. Sanders
Treasurer	JoAn S. Hudson		Bill Russin
			Elizabeth R. Wright
		Director, Local Affiliated Societies	Alice Dohnalkova

Appointed Officers

Archives	Michael Marko	<i>Microscopy and Microanalysis</i>	
Awards Committee Chairs	Frances Ross, Esther Bullitt	Editor in Chief	Robert L. Price
Bylaws	Janet Woodward	Program, Exhibition Guide Editor	Richard E. Edelmann
Certification Board Chair	Pat Kysar	Proceedings Editor	John P. Shields
		<i>Microscopy Today</i> Editor	Charles E. Lyman
Education Committee Chair	Caroline A. Miller		
Fellows Committee Chair	Jeanette Killius	M&M Annual Meeting	
Finance Committee Chairs	JoAn Hudson, Peter Crozier	Program Chair 2013	Teresa Ruiz
Focused Interest Groups		Program Chair 2014	David Bell
Focused Interest Group Chair	Lynn M. DiMemmo	Program Chair 2015	Mark Sanders
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Cryopreparation	Kent L. McDonald	Publications Committee Chairs	Janet Woodward, Ernie Hall, Jeanette Killius
Diagnostic Microscopy	Cindy Smith	Nominating Committee Chair	Janet Woodward
Electron Crystallography and Automated Mapping Techniques	Sergei Rouvimov	Placement Office	Pamela F. Lloyd
Environmental TEM	Eric Stach	Sustaining Members Chairs	Stephen Mick, Tom Nuher, Jeff Streger
Facilities Management & Operations	Thomas Williams	Technologists' Forum	John Chandler
Focused Ion Beam	Brian Gorman		
Aberration-Free Electron Microscopy	Phil Batson	Managing Director	Liz Kasabian, Robert Dziuban, The Drohan Group
Pharmaceuticals	James DiOrio	Meeting Management	Nicole Guy, Conference Managers
Information Technology Chair	Nestor Zaluzec	Exhibition Management	Doreen Bonnema, Corcoran Expositions, Inc
International Committee Chair	Raynald Gauvin		
Membership Committee Chair	Bryan Majkrzak		

MSA 2013 Society Awards

Past Award Winners

MSA Distinguished Scientist Awards

Biological Sciences

1975 Keith Porter
1976 L.L. Marton
1977 Robley C. Williams
1978 Thomas Anderson
1979 Daniel C. Pease
1980 George E. Palade
1981 Sanford L. Palay
1982 Richard M. Eakin
1983 Hans Ris
1984 Cecil E. Hall
1985 Gaston Dupouy
1986 F.O. Schmitt
1987 Marilyn G. Farquhar
1988 Morris J. Karnovsky
1989 Don W. Fawcett
1990 Audrey M. Glauert
1991 Hugh E. Huxley
1992 Fritiof Sjöstrand
1993 Jean-Paul Revel
1994 Andrew P. Somlyo
1995 Shinya Inoue
1996 Myron C. Ledbetter
1997 S.J. Singer
1998 Avril V. Somlyo
1999 Sir Aaron Klug
2000 K. Tokuyasu
2001 Patrick Echlin
2002 Marc Adrian
2003 Joachim Frank
2004 Robert M. Glaeser
2005 Richard Henderson
2006 Joseph S. Wall
2007 Nigel Unwin
2008 Alasdair Steven
2009 Jacques Dubochet
2010 George Pappas
2011 Ueli Aebi
2012 Tim Baker

Physical Sciences

Robert Heidenreich
Albert Crewe
James Hillier
Vernon E. Cosslett
John M. Cowley
John M. Cowley
Vladimir K. Zworykin
Benjamin M. Siegel
Otto Scherzer
Sir Charles Oatley
Ernst Ruska
Peter Hirsch
Jan B. LePoole
Hatsujiro Hashimoto
Elmar Zeitler
Gertrude F. Rempfer
Archie Howie
Oliver C. Wells
Kenneth C.A. Smith
Dennis McMullan
David B. Wittry
John Silcox
Peter R. Swann
Michael J. Whelan
Takeo Ichinokawa
S. Amelinckx
Thomas Mulvey
Ryuichi Shimizu
Harald Rose
Raymond F. Egerton
Sumio Iijima
John C.H. Spence
Terence E. Mitchell
Ondrej L. Krivanek
Robert Sinclair
Michael S.
Hannes Lichte
Ulrich Dahmen

MSA Burton Medal

1975 James Lake
1976 Michael S. Isaacson
1977 David D. Joy
1978 Robert Sinclair
1979 Norton B. Gilula
1980 John C.H. Spence
1981 Barbara J. Panessa-Warren
1982 Nestor J. Zaluzec
1983 Ronald Gronsky
1984 David B. Williams
1985 Richard D. Leapman
1986 J. Murray Gibson
1987 Ron A. Milligan
1988 A.D. Romig, Jr.
1989 Laurence D. Marks
1990 W. Mason Skiff
1991 Joseph R. Michael
1992 Kannan M. Krishnan
1993 Joseph A.N. Zasadzinski
1994 Jan M. Chabala
1995 Joanna L. Batstone
1996 Vinayak P. Dravid
1997 P.M. Ajayan
1998 Ian M. Anderson
1999 Zhong Lin Wang
2000 Eva Nogales
2001 Jian Min Zuo
2002 Nigel D. Browning
2003 Frances M. Ross
2004 Z. Hong Zhou
2005 David J. Larson
2006 David A. Muller
2007 Peter D. Nellist
2008 Steven J. Ludtke
2009 Eric Stach
2010 Sergei Kalinin
2011 Radostin Danev
2012 David Ginger

MSA 2013 Society Awards

MSA Outstanding Technologists' Awards

1993	Ben O. Spurlock	1999	John C. Wheatley	2005	Chris Nelson
1994	Bernard J. Kestel		John M. Basgen		John J. Bozzola
1995	Kai Chien	2000	Nancy Crise Smith	2007	Thomas Deerinck
1996	David W. Ackland	2001	Conrad G. Bremer	2009	Lynne Gignac
1997	John P. Benedict	2002	José A. Mascorro		Mary Morphew
	Stanley J. Klepeis	2003	Edward A. Ryan	2010	E. Ann Ellis
1998	Charles J. Echer	2004	Mark C. Reuter	2011	Robert Grassucci
	Hilton H. Molehauer			2012	Kunio Nagashima

Morton D Maser Distinguished Service Award Past Recipients

1992	Ronald Anderson	1993	E. Laurence Thurston	2002	Beverly Maleeff
	G.W. Bailey	1994	Richard Crang	2003	M. Grace Burke
	Frances Ball	1995	Raymond K. Hart	2004	Ralph Albrecht
	Blair Bowers	1996	José Mascorro	2005	W. Gray (Jay) Jerome
	Deborah Clayton	1997	William T. Gunning III	2006	Jeanette Killius
	Joseph Harb	1998	Nestor J. Zaluzec	2007	Robert L. Price
	Kenneth Lawless	1999	Charles Lyman	2008	Stuart McKernan
	Morton D Maser	2000	Barbara A. Reine	2010	Pamela Lloyd
	Caroline Schooley		Hildegard H. Crowley	2011	Janet Woodward
	John H.L. Watson			2012	Gina Sosinsky

MSA Sustaining Members

Advanced Microbeam, Inc.	Electron Microscopy Sciences	Navitar, Inc.
Advanced Microscopy Techniques	FEI Company	NION Company
Agilent Technologies	GA Institute of Technology,	Olympus Soft Imaging Solutions – GMBH
Applied Physics Technologies, Inc.	Materials Science and Engineering	Oxford Instruments, Inc.
Applied Precision	Gatan, Inc.	Protochips, Inc.
Australian Centre for Microscopy and Microanalysis	GlobalFoundries	PulseTor, LLC
Boeckeler Instruments Inc.	Grant Scientific Corp.	Reindeer Graphics, Inc.
Bruker-Nano Analytics	Hitachi High Technologies America	RENOVO NEURAL Inc.
CAMECA Instruments, Inc.	HREM Research Inc.	ReAlta Research Technologies
CanmetMATERIALS	ibss Group, LLC	Scientific Instrumentation Services, Inc.
Natural Resources Canada	Intl Centre for Diffraction Data	SGX Sensortech (MA), Ltd.
Carl Zeiss SMT Inc.	IXRF Systems, Inc.	SPI Supplies
Carnegie Mellon University	JEOL USA, Inc.	Technical Sales Solutions LLC
Chroma Technology Corp.	Ladd Research Industries	Ted Pella Inc.
Columbian Chemicals Co.	Lehigh Microscopy School	Tescan USA Inc.
Denton Vacuum LLC	Leica Microsystems, Inc.	Thermo Fisher Scientific
Diatome U.S.	Mager Scientific, Inc.	Topcon Positioning Systems Inc.
Duniway Stockroom Corp.	Materials Analytical Services	Tousimis Research Corporation
E.A. Fischione Instruments Inc.	Micro Star Technologies, Inc.	XEI Scientific, Inc.
EDAX Inc	Micron, Inc.	
	MTI Instruments Inc.	

MSA 2013 Society Awards

DISTINGUISHED SCIENTIST AWARDS



Biological Sciences

David DeRosier

Dr. DeRosier's interest in macromolecular complexes began while a graduate student with Bob Haselkorn at the University of Chicago. He studied two icosahedral plant viruses and then decided to try his hand at X-ray crystallography of viruses with Aaron Klug at the MRC-LMB (Cambridge, England). He soon found himself deeply involved in the development of 3D reconstruction from electron micrographs. Four years later, Dr. DeRosier moved to the University of Texas at Austin began structural studies of pyruvate dehydrogenase, a multienzyme complex. He continued this work after moving to Brandeis but was lured away to studies of the actin cytoskeleton with Lewis G. Tilney and the bacterial flagellum with Lucy Shapiro and Bob Macnab. After retiring, Dr. DeRosier returned as a postdoc in the neuroscience laboratory of Gina Turrigiano at Brandeis University. There they continue to develop super-resolution light microscopy at cryogenic temperatures to look at the organization of synaptic proteins.



Physical Sciences

C. Barry Carter

C. Barry Carter is a Professor at the University of Connecticut. He has a B.A., M.A. and Sc.D. from Cambridge University, an M.Sc. from Imperial College and a D. Phil. From Oxford University. He was a full Professor at Cornell (until 1991) and the 3M Endowed Multidisciplinary Chair at U. Minnesota (until 2007). He is a CINT Distinguished Affiliate Scientist at Sandia National Lab, NM. He has received a Guggenheim Fellowship and the Alexander von Humboldt Senior Award. He is a Fellow of AAAS, MRS, MSA, ACerS and RMS and an elected Member of CASE. He was the 1997 President of MSA and the 2003-2010 General Secretary of IFSM. He is now the 2011-14 President of IFSM. He has co-authored 700 articles plus *Transmission Electron Microscopy: A Textbook for Materials Science*, with Dave Williams and *Ceramic Materials: Science and Engineering* with Grant Norton. He is the Editor-in-Chief of the Journal of Materials Science.

MSA 2013 Society Awards



Burton Medal Award

John L. Rubinstein

John Rubinstein is a Senior Scientist at the Research Institute of the Hospital for Sick Children and an Associate Professor in the Departments of Biochemistry and Medical Biophysics at the University of Toronto. A native of Toronto, Canada, John received his BSc in Physical Sciences from the University of Guelph, Canada in 1998, and his PhD from Cambridge University in 2002 working in Medical Research Council laboratories with Dr. Richard Henderson and Sir John E. Walker. He was a Postdoctoral Research Associate at the MRC Laboratory of Molecular Biology before returning to Canada for a National Cancer Institute of Canada (NCIC) postdoctoral fellowship at the Banting and Best Department of Medical Research. He joined the Research Institute of The Hospital for Sick Children in 2006. John has received a New Investigator Award from the Canadian Institutes of Health Research and an Early Researcher Award from the government of Ontario.



Albert Crewe Award

Lena F. Kourkoutis

Lena F. Kourkoutis received a Diploma in Physics from the University of Rostock, Germany in 2003. Her career as an electron microscopist started shortly after, when she joined the electron microscopy group lead by David A. Muller at Cornell University. Her work focused on interface phenomenon in complex oxide heterostructures studied by advanced electron microscopy and spectroscopy methods. She was awarded a PhD from Cornell University in 2009. As a Humboldt Research Fellow Kourkoutis spent 2011-2012 exploring cryo-electron microscopy in the Molecular Structural Biology Group lead by Wolfgang Baumeister at the Max Planck Institute of Biochemistry in Martinsried, Germany. She returned to Cornell as a Postdoctoral Associate in 2012 and joined the Applied and Engineering Faculty in 2013.



Morton D. Maser Distinguished Service Award

Caroline Miller

Caroline Miller has been involved with microscopy for 44 years and is currently the Assistant Director and Manager of the Electron Microscopy Center for the Indiana University School of Medicine. The Center is a full service research facility and is in its 7th year as an International Research Core for the Polycystic Kidney Disease Foundation.

Caroline has been MSA certified and member since 1985. As a MSA Biological Director from 2008-2010, she also served on the fellowship and nomination committees and was liaison to the Educational Committee. Since finishing her term on MSA Council in 2010, she has been the Chair of the Education Committee.

She helped establish FIGs for Cryo Preparation and Diagnostic Imaging, is currently on the Editorial Board for *Microscopy Today* in Specimen Preparation and has co-chaired several symposiums. She is especially proud to have co-chaired the George E. Palade Memorial Symposium. She has been involved with the Sunday short courses and has chaired the Short Course in Immunolabeling Technology for Light and Electron Microscopy for the last 4 years. Caroline has also served at the Local level in 2 different LAS's, was a Charter member of the Indiana Microscopy Society from 2004-2010 and is now the President-Elect of the Microscopy Society of the Ohio River Valley.

MSA 2013 Society Awards



Hildegard H. Crowley
Outstanding Technologist
Award for Biological
Sciences

Robyn Roth

Robyn Roth received training in electron microscopy at Southwest Missouri State University. Following graduation in 1980, Mrs. Roth began work with the Electron Microscopy Center for Basic Cancer Research, at Washington University School of Medicine in St. Louis (WUSM). In 1981, Mrs. Roth transferred into the lab of Dr. John Heuser, inventor of techniques related to Quick Freeze Deep-etch Electron Microscopy (DEEM), Department of Cell Biology and Physiology, WUSM. She currently continues the Heuser Lab mission, "Visualization of everything from whole cells to individual molecules by DEEM", as a service for investigators at WUSM and throughout the country. Her DEEM micrographs appear widely in journals and textbooks.



Chuck Fiori Outstanding
Technologist for Physical
Sciences

K. Shawn Reeves

Shawn Reeves is a Master Technician in the Microscopy Group in the Materials Science and Technology Division at the Oak Ridge National Laboratory (ORNL). Shawn has been at ORNL for 20 years - she started her career as a student intern from the Tennessee Technological University, where she studied Chemistry. After completing her bachelor's degree, Shawn went on to graduate school in the Materials Science and Engineering Department at North Carolina State University, where she qualified for the Ph.D. program, and returned to Oak Ridge to conduct her Ph.D. research at ORNL on a DOE fellowship. During Shawn's career at ORNL, she has developed and demonstrated unmatched skills related to the innovative preparation of difficult materials for TEM and STEM. Shawn has gained an international reputation in the "niche field" of microscopy of materials for polymer electrolyte membrane fuel cells (PEMFCs), where she has trained and mentored students and other senior technicians. Shawn is internationally known for integrating ultramicrotomy as the primary preparation method for characterizing fuel cell membranes and membrane electrode assemblies.

MSA 2013 Society Awards

MSA Fellows

2009

M. Adrian	D.W.Fawcett	D.C. Joy	H. Rose	G. Thomas
R. Anderson	J. Frank	M. J. Karnovsky	F. O. Schmitt	K. Tokuyasu
J. Bentley	R.M. Glaeser	A. Klug	C. Schooley	N. Unwin
M.G. Burke	A.M.Glauert	O. L. Krivanek	R. Shimizu	J. S. Wall
R.W. Carpenter	R.K. Hart	M. C. Ledbetter	J. Silcox	O. Wells
C.B. Carter	H. Hashimoto	D. McMullan	R. Sinclair	M. J. Whelan
A.V. Crewe	R. Henderson	J. R. Michael	S. J. Singer	N. J. Zaluzec
M. De Graef	P.B. Hirsch	S. E. Miller	F. Sjostrand	E. Zeitler
V.P. Dravid	A. Howie	T. E.Mitchell	K. C.A. Smith	Y. Zhu
J. Dubochet	H.E.Huxley	T. Mulvey	A. V. Somlyo	
P. Echlin	T. Ichinokawa	D. E. Newbury	J. C.H. Spence	
R.F. Egerton	S. Iijima	G. Rempfer	A. Steven	
M.G.Farquhar	S. Inoue	J-P. Revel	P. R. Swann	

2010

R. M. Albrecht	E. A. Ellis	M. K. Miller	J. P. Petrali
L.F. Allard, Jr.	J. I. Goldstein	G. Pappas	Z. L. Wang
K. H. Downing	M.S. Isaacson	S. J. Pennycook	D. B. Williams

2011

P.E. Batson	J.A. Eades	W.G. Jerome
P.G. Calarco	B.J. Griffin	R.D. Leapman
P.A. Crozier	W.T. Gunning III	C.E. Lyman

2012

U. Dahmen	W. Landis	R. L. Price
M.A. Goldstein	J. Liu	F.M. Ross
M.J. Kim	B. Maleeff	D.N. Seidman

2013

N.D. Browning	M. Radermacher
H.L. Fraser	D.J. Smith
D. A. Muller	E.A. Stach



Microanalysis Society

Established 1968

Officers 2013

Executive Council

President Kristin L. Bunker
 President Elect Thomas F. Kelly
 Past President John F. Mansfield
 Secretary Heather A. Lowers
 Treasurer Daniel T. Kremser
 Directors John J. Donovan
 Rhonda M. Stroud
 Patrick P. Camus
 Elaine F. Schumacher
 Jeffrey M. Davis
 Brian P. Gorman

Appointed Officers and Committee Chairs

Archivist John H. Fournelle
 Valerie Woodward
 Paul G. Kotula
 Nicholas W.M. Ritchie
 Vernon E. Robertson
 Inga Holl Musselman
 Thomas F. Kelly
 Edward P. Vicenzi
 Karen Wright
 Masashi Watanabe
 Heather A. Lowers
 Ian M. Anderson
 Lucille A. Giannuzzi
 Paul K. Carpenter

Affiliated Regional Societies and Tour Speaker
 Awards Committee Chair
 Computer Activities Chair
 Corporate Liaison
 Education Committee Chair
 Finance Committee Chair
 International Liaison
 Membership Services
 Microscopy and Microanalysis Ed Board
 MicroNews Editor
 Strategic Planning Chair
 Sustaining Members Chair
 Topical Conferences Chair

MAS Past Presidents

1968 L.S. Birks	1980 O.C. Wells	1991 J.T. Armstrong	2002 G.P. Meeker
1969 K.F.J. Heinrich	1981 J.R. Coleman	1992 D.B. Williams	2003 E.S. Etz
1970 R.E. Ogilvie	1982 R.L. Myklebust	1993 T.G. Huber	2004 P.K. Carpenter
1971 A.A. Chodos	1983 R. Bolon	1994 J.A. Small	2005 I.H. Musselman
1972 K. Keil	1984 D.C. Joy	1995 J.J. McCarthy	2006 R. Gauvin
1973 D.R. Beaman	1985 D.E. Newbury	1996 D.E. Johnson	2007 P.G. Kotula
1974 P. Lublin	1986 C.G. Cleaver	1997 J.R. Michael	2008 I.M. Anderson
1975 J.W. Colby	1987 C.E. Fiori	1998 R.B. Marinenko	2009 C. Johnson
1976 E. Lifshin	1988 W.F. Chambers	1999 J.J. Friel	2010 E.P. Vicenzi
1977 J.I. Goldstein	1989 D.B. Wittry	2000 C.E. Lyman	2011 J.H.J. Scott
1978 J.D. Brown	1990 A.D. Romig, Jr	2001 R.W. Linton	2012 J.F. Mansfield
1979 D.F. Kyser			

MAS Sustaining Members

Advanced MicroBeam, Inc.	Hitachi High Technologies America, Inc.	Oxford Instruments, Inc.
Bruker Nano	Hysitron, Inc.	Probe Software, Inc.
CAMCOR, University of Oregon	IBSS Group	PulseTor, LLC
CAMECA Instruments, Inc.	IXRF Systems, Inc.	SEMTEC Laboratories, Inc.
Carl Zeiss Microscopy, LLC	JEOL USA, Inc.	SEMTEch Solutions, Inc.
EDAX, Inc.	L.A. Giannuzzi & Associates, LLC	South Bay Technology, Inc.
Electron Microscopy Sciences/DiATOMÉ	Lehigh University	SPI Supplies/Structure Probe, Inc.
FEI Company	Leica Microsystems, Inc.	Ted Pella, Inc.
Gatan, Inc.	Materials Analytical Services, LLC	Thermo Fisher Scientific, Inc.
Geller MicroAnalytical Laboratory, Inc.	Micron, Inc.	

MAS Awards

All MAS awards are recommended by the Awards Committee for approval by either the President or Council.

Peter Duncumb Award for Excellence in Microanalysis

Sponsored by Bruker Nano. The Duncumb Award recognizes outstanding achievement over a sustained period of time in the field of microanalysis through technical accomplishment, leadership, and educational and professional activities. The award winner is chosen through nomination by the MAS membership and selection by vote of MAS Council.

Presidential Service Award

This award honors a member of MAS for outstanding volunteer service to the society over a sustained period of time. The award winner is chosen annually by the MAS President.

Presidential Science Award

This award honors a senior scientist for outstanding technical contributions to the field of microanalysis over a sustained period of time. The award winner is chosen annually by the MAS President.

K. F. J. Heinrich Award

This award honors a scientist under the age of forty for distinguished technical contributions to the field of microanalysis. The award winner is chosen annually by the MAS President.

M&M Student Awards

These awards are presented annually to students presenting high quality technical papers with significant microanalysis content at the annual meeting. The award is comprised of meeting registration and up to \$1,000 to defray travel expenses to attend the meeting. Application is accomplished by requesting consideration for a student award during the paper submission process. Qualified applicants must be full-time students at an accredited educational institution, must be first author of the paper submitted for consideration, and must present the paper in person at the meeting. M&M Student Award winners receive invitations to attend MAS-sponsored functions throughout the week of the annual meeting, including the Presidents' Reception and the MAS Social. The award winners are chosen annually by the MAS President.

MAS Outstanding Paper Awards

These awards are presented annually to the authors of outstanding papers from the previous annual meeting in each of four categories. The four awards are as follows:

- Birks Award, for best contributed paper – Sponsored by JEOL USA, Inc.
- Macres Award, for best instrumentation or software paper – Sponsored by Oxford Instruments, Inc.
- Cosslett Award, for best invited paper – Sponsored by MAS
- Castaing Award, for best student paper. – Sponsored by CAMECA Instruments, Inc.

Candidates for the MAS Outstanding Paper Awards are nominated, through consultation with symposium organizers and the MAS membership, by the MAS Directors in their final year of service at the time of the meeting, then approved by vote of MAS Council.

2013 Society Awards

Previous Winners

Presidential Science

1977 R. Castaing
1978 K.F.J. Heinrich
1979 P. Duncumb
1980 D.B. Wittry
1981 S.J.B. Reed
1982 R. Shimizu
1983 J. Philibert
1984 L.S. Birks
1985 E. Lifshin
1986 R.L. Myklebust
1987 O.C. Wells
1988 J.D. Brown
1989 J. Hillier
1990 T.E. Everhart
1991 J.I. Goldstein
1992 G.W. Lorimer & G. Cliff
1993 D.E. Newbury
1994 D.C. Joy
1995 G. Bastin
1996 A.V. Somlyo & A.P. Somlyo
1997 D.B. Williams
1998 F.H. Schamber
1999 R.A. Sareen
2000 R.F. Egerton
2001 P.E. Batson
2002 K. Keil
2003 P.E. Russell
2004 J.T. Armstrong
2005 M. Slodzian
2006 B.J. Griffin
2007 R.D. Leapman
2008 T.F. Kelly
2009 J.R. Michael
2010 J.J. Donovan
2011 P.J. Statham
2012 N.J. Zaluzec
2013 P. Echlin

Presidential Service

1977 P. Lublin
1978 D.R. Beaman
1979 M.A. Giles
1980 A.A. Chodos
1981 R.L. Myklebust
1982 J. Doyle
1983 D.E. Newbury
1984 J.I. Goldstein
1985 M.C. Finn
1986 V. Shull
1987 D.C. Joy
1988 C.G. Cleaver
1989 W.F. Chambers
1990 C.E. Fiori
1991 T.G. Huber
1992 E.S. Etz
1993 H.A. Freeman
1994 J.L. Worrall
1995 R.W. Linton
1996 P.F. Hlava
1997 J.A. Small
1998 J.J. McCarthy
1999 T.G. Huber
2000 R.B. Marinenko
2001 C.E. Lyman
2002 J.F. Mansfield
2003 I.H. Musselman
2004 J.R. Michael
2005 G.P. Meeker
2006 H.A. Freeman
2007 P.K. Carpenter
2008 L.M. Ross
2009 V. Woodward
2010 S.A. Wight
2011 D.T. Kremser
2012 C. Johnson
2013 J.J. McGee

K.F.J. Heinrich

1986 P.J. Statham
1987 J.T. Armstrong
1988 D.B. Williams
1989 R.D. Leapman
1990 R.W. Linton
1991 A.D. Romig, Jr.
1992 S.J. Pennycook
1993 P.E. Russell
1994 J.R. Michael
1995 E.N. Lewis
1997 R. Gauvin
1998 V.P. Dravid
1999 J. Bruley
2000 H. Ade
2001 C. Jacobsen
2002 D.A. Wollman
2005 M. Watanabe
2006 M. Toth
2007 G. Kothleitner
2008 P.G. Kotula
2009 Dominique Drouin
2010 H. Demers
2011 L.N. Brewer
2012 E.A. Marquis
2013 J.M. LeBeau

Peter Duncumb Award for Excellence in Microanalysis

2007 D.B. Williams
2008 J.I. Goldstein
2009 D.E. Newbury
2010 D.C. Joy
2011 J.R. Michael
2012 J. Bentley
2013 E. Lifshin

MAS 2013 Awards



**Duncumb Award
for Excellence
in Microanalysis**
Eric Lifshin

Eric Lifshin is currently a full professor at the College of Nanoscale Science and Engineering (CNSE), University at Albany, State University of New York. He had a long career at GE Global Research starting in 1963 where he served in various positions including Manager of the Characterization and Environmental Technology Laboratory which he held for 25 years prior to his retirement in 2000.

Throughout his career he has been extensively involved with research relating to many aspects of electron microprobe analysis and scanning electron microscopy. Some of these activities included early work on microprobe automation for the analysis of diffusion couples, specimen current imaging in the SEM, Monte Carlo calculation to better understand spatial resolution for chemical analysis, and he was one of the first people to interface an energy dispersive spectrometer to an SEM. He used the latter to both measure absolute x-ray production efficiencies and determine the shape of the x-ray continuum and thus develop models needed for background subtraction.

He is most appreciative of the many colleagues at GE who worked with him over the years. In his current work he is developing advanced deconvolution techniques for image restoration in the SEM and various types of microanalysis.

Eric Lifshin has published dozens of papers over the course of his career and has received various awards from MAS as well as from elsewhere including two IR100 awards and a best paper award from ISTFA. He also served as Past-President of MAS and as a national tour speaker. He currently teaches courses in microscopy and microanalysis at CNSE and has been a lecturer at the Lehigh SEM courses since their founding more than 40 years ago. Eric is a co-author of the popular text developed for the general SEM course.



W.F.J. Heinrich Award
James LeBeau

James LeBeau earned his B.S. in Materials Science & Engineering from Rensselaer Polytechnic Institute in 2006. Then, working with Prof. Susanne Stemmer, he received his Ph. D. from the University of California Santa Barbara in 2010. After his graduate work, he joined the Department of Materials Science and Engineering at North Carolina State University as a faculty member in January 2011. His research focuses on applying and developing transmission electron microscopy techniques to determine the atomic structure and chemistry of material defects. Having shown that HAADF images from experiment agree quantitatively with simulations, the LeBeau group is interested in exploring details in the image intensities to provide information about materials without the need for calibration standards. The materials currently being investigated cover a range of topics including advanced thermoelectrics, topological insulators, and materials for high temperature applications.

For his research, James has been honored with numerous awards. He was presented a MAS Distinguished Scholar award and the MAS Birks Award for Best Contributed Paper at M&M 2008 in Albuquerque, NM. In 2010, he received the Oak Ridge Associated Universities Ralph E. Powe Junior faculty award, and the Appalachian Regional Microscopy Society's Young Investigator Award in 2012. Since 2006, he has co-authored 26 journal articles and has given numerous invited talks in the United States and around the world.

MAS 2013 Awards



**2013 Presidential
Science Award**
Patrick Echlin

Patrick Echlin was a lecturer in the Department of Plant Sciences and Director of the Multi-Imaging Centre, School of Biological Science, University of Cambridge until he retired in 1999. He has taught for more than thirty-five years at the Lehigh University Microscopy School and is the author and co-author of eight books on scanning electron microscopy and x-ray microanalysis. He was Editor in Chief for the *Journal of Microscopy*, reviving the journal after years of neglect. He is Past President, an elected Fellow, and an Honorary Fellow of the Royal Microscopical Society and received the Distinguished Scientist Award in Biological Sciences from the Microscopy Society of America in 2001. He was made a Fellow of the Microscopy Society of America in 2009. His research has focused on imaging and microanalysis of biological materials at cryogenic temperatures, spanning important aspects of specimen handling, preparation, and artifacts as well as instrumentation including the scanning electron microscope and scanning transmission electron microscope equipped with energy-dispersive x-ray spectrometers.



**2013 Presidential
Service Award**
James J. McGee

James McGee received a B.S. in Geology from University of Notre Dame and a M.S. in Geochemistry from SUNY-Stony Brook. Jim was a Research Geologist at the U.S. Geological Survey (USGS) for 18 years, specializing in lunar sample studies and microanalysis of geologic materials, and served as Chief of the Electron Microprobe Project at the USGS-Reston, VA headquarters. Jim then joined the University of South Carolina's Geosciences Department, continuing research on lunar samples and revitalizing the Electron Microprobe facility. Jim then joined the Knolls Atomic Power Laboratory in Schenectady NY, where he carried out material characterization and laboratory/project management.

Jim joined the Microbeam Analysis Society in 1979, co-organized the Fifty years of Electron Probe Microanalysis Symposium and its *Microscopy and Microanalysis* special issue. He served as MAS Director (2003–2005) and Treasurer (2007–2010). As Treasurer, he redefined the Treasurer, business office, and accounting functions, thereby reducing Society operating expenses. He also helped define the funding procedures for MAS Topical Workshops and M&M Meeting co-sponsor funding, simplified/clarified financial reporting to the membership, and helped channel more funds for student support.

Jim considered it a privilege and very rewarding to be able to serve MAS in these capacities in order to aid in advancing the Society's promotion of scientific/technical knowledge for its members and for the entire microanalysis community.

International Metallographic Society

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1979–1981	P.M. French	1991–1993	Ian LeMay				

2013 IMS Society Awards

President's Award (Service to IMS)

1977 Carus K.H. DuBose
1978 Richard D. Buchheit
1979 Arthur E. Calabra
1980 James L. McCall
1981 E. Daniel Albrecht
1982 James H. Richardson
1983 Robert J. Gray
1984 Japnell D. Braun
1986 P. Michael French
1987 George F. Vander Voort
1988 Robert S. Crouse
1989 Ian Le May
1990 William E. White
1991 Chris Bagnall
1992 Gary W. Johnson
1993 Donald W. Stevens
1994 MacIntyre R. Louthan, Jr.
1995 Gunter Petzow
1996 James Nelson
1997 John Wylie
1998 John W. Simmons
1999 William Forgeng, Jr.
2000 Nat Saenz
2001 William W. Scott, Jr.
2002 George Blann
2003 Jeff Stewart
2004 Elliot A. Clark
2005 Chris Bagnall
2006 Art Geary
2007 Richard K. Ryan
2008 Thomas S. Passek
2009 David & Dale Fitzgerald
2010 Jaret J. Frafjord
2011 Donald F. Susan

Henry Clifton Sorby Awards

1976 Georg L. Kehl
1977 Cyril Stanley Smith
1978 Adolph Buehler
1979 Frederick N. Rhines
1980 Len E. Samuels
1981 Robert J. Gray
1982 Gunter Petzow
1983 William D. Forgeng
1984 Ervin E. Underwood
1985 Alan Price
1986 Robert W. K. Honeycombe
1987 Gareth Thomas
1988 Franz Jeglitsch
1989 Tanjore R. Anantharaman
1990 E. Daniel Albrecht
1991 W. C. Leslie
1992 Charles S. Barrett
1993 Raimond B. Castaing
1994 F. Brian Pickering
1995 Erhard Hornbogen
1996 Peter Duncumb
1997 Robert T. DeHoff
1998 Kay Geels
1999 Joseph Goldstein
2000 Hans Eckhart Exner
2001 Brian Ralph
2002 Walter Mannheimer
2003 Enrica Stagno
2004 George F. Vander Voort
2005 Iain LeMay
2006 Arlan Benscoter
2007 McIntyre R. Louthan, Jr.
2008 Lawrence E. Murr
2009 Chris Bagnall
2010 Albert C. Kneissl
2011 David B. Williams
2012 Michael Pohl

Jacquet-Lucas Award For Excellence in Metallography

1946 G.R. Kuhn
1947 R.H. Hays
1948 E.C. Pearson
1949 D.H. Rowland
1950 S.O. Modin
1951 H.P. Roth
1952 H. Griffin
1953 B.C. Leslie, R.J. Gray
1954 R.D. Buchheit, J.E. Boyd,
A.A. Watts, F.C. Holden
1955 F.M. Cain, Jr.
1956 D. Mannas
1957 T.K. Bierlein, B. Mastel
1958 J.C. Gower, E.P. Griggs,
W.E. Denny, J.E. Epperson,
R.J. Gray
1959 F.M. Beck
1960 G.C. Woodside
1961 J.F. Radavich, W. Coutts, Jr
1962 D. Medlin
1963 W.C. Coons
1964 B.C. Leslie, R.J. Gray
1965 W.C. Coons, A. Davinroy
1966 D.M. Maher, A. Eikum
1967 J.F. Kisiel
1968 R.M.N. Pelloux, Mrs. H. Wallner
1969 R.H. Beauchamp, R.P. Nelson
1970 D.R. Betner, W.D. Hepfer
1971 R.J. Gray
1972 C.J. Echer, S.L. Digiallonardo
1973 M.S. Grewal, B.H. Alexander,
S.A. Sastri
1974 M.P. Pinnel, D.E. Heath,
J.E. Bennett, G.V. McIlharagie
1975 W.C. Coons
1976 L.E. Soderqvist
1977 R.H. Beauchamp, D.H. Parks, N.T.
Saenz, K.R. Wheeler
1978 C. Bagnall, R. Witkowski
1979 M.J. Bridges, S.J. Dekanich
1980 R.H. Beauchamp, K. Fredriksson
1981 F. Kurosawa, I. Taguchi,
H.G. Suzuki
1982 M.J. Carr, M.C. Mataya,
T.O. Wilford, J.L. Young
1983 V. Carle, E. Schmid
1984 R.H. Beauchamp, N.T. Saenz,
J.T. Prater
1985 U. Taffner, R. Telle
1986 N.T. Saenz, C.A. Lavender,
M.T. Smith, D.H. Parks,
G.M. Salazar

2013 IMS Society Awards

Jacquet-Lucas Award For Excellence in Metallography- (continued)

1987 S.A. David, J.M. Vitek, C.P. Haltom, A.G. Barcomb	1994 J.W. Simmons, B.S. Covino, Jr., S.D. Cramer, J.S. Dunning	2004 R. Unocic, P.M. Sarosi, M.J. Mills
1988 A. David, J.M. Vitek, A. Boatner, G.C. Marsh, A.B. Baldwin	1995 Kamal, K. Soni, R. Levi-Setti, S. Shah, S.J. Gentz	2005 K. Kimura, S. Hata, S. Matsumura, T. Horiuchi
1989 G. Hoerz, M.C. Kallfass	1996 R.L. Bodnar, S.J. Lawrence	2006 R. Deacon
1990 A. David, J.M. Vitek, A.B. Baldwin	1997 J. Yewko, D.L. Marshall	2007 K.A. Unocic, G.S. Daehn
1991 M.R. Jones	1998 R. Pereyra, E.G. Zukas	2008 T. Nizolek
1992 G.F. VanderVoort	1999 K.R. Luer	2009 B. Gerard
1993 T. Leonhardt, F. Terepka, M. Singh, G. Soltis	2000 D.J. Lewis, S. Allen	2010 C. Roberts, H. Colijn
	2001 D. Chakrapani	2011 Christopher Marvel, Will Lenthe, John Logan
	2002 F.F. Noecker, II	2012 Zhiping Luo
	2003 F.F. Noecker, II	

History of the IMS Awards

HENRY CLIFTON SORBY AWARD—The Sorby Award was established to recognize outstanding contributions to the field of metallography by an internationally recognized senior figure in the field of metallography. This award is a personalized plaque, and the recipient is honored during the M&M Conference Sorby Lecture and at the IMS Annual Meeting banquet.

PIERRE JACQUET-FRANCIS F. LUCAS AWARD—The Jacquet-Lucas Award is given each year to the International Metallographic Contest entry judged “Best in Show” by a panel of judges. This is a joint IMS/ASM award with origins dating back to 1946, and has been endowed by Buehler since 1976. The winners receive the Jacquet Gold Medal, the ASM Lucas Award, a cash award, and are honored at banquets at both the IMS Annual Meeting and the ASM Annual Event.

The 2012 International Metallographic Contest Judging Team

Chair: Alice Kilgo, Sandia National Laboratories
Local Chair: Mitch Witkowski, W.L. Gore & Associates
Brian Rose, EMCON Technologies
Coralee McNee, IMR Test Labs
Lee Garrett, Buehler
Andrea McMartin, Buehler
Ikaros Kayafas, Product Evaluation Systems, Inc.
Chris Bagnall, Product Evaluation Systems, Inc.
Amber Trees, SEMTEC Laboratories, Inc.
Steven Gentz, NASA Langley Research Center

PRESIDENT’S AWARD—This award is presented to an individual deemed deserving of special recognition by the Society. This award is a plaque personalized for the recipient.

BUEHLER TECHNICAL PAPER MERIT AWARD—This award shall be given annually to the authors of the technical paper published that year in the journal *Materials Characterization* that was determined most outstanding by a panel of IMS judges. A plaque and cash award is given to the recipients each year by Buehler.

PAST-PRESIDENTS AWARD—This award shall be presented by the Board of Directors to the out-going Past-President in recognition of their contributions to the Society. This award is a plaque personalized for the recipient.

PRESENTATION OF THE IMS AWARDS—The awards are presented at the annual banquet on Wednesday, August 1, 2012, at 6:30 PM.

We would like to thank the IMS Members who helped organize the M&M 2013 Conference

Jaret Frafford, *M&M 2010 IMS Co-Chair*
Don Susan, *M&M 2011 IMS Co-Chair*
Dustin Turnquist, *M&M 2012 IMS Co-Chair*
Coralee McNee, *M&M 2013 IMS Co-Chair*
Alice Kilgo, *International Metallographic Contest Chair*
Brian Rose, *International Metallographic Contest Local Chair*
James Martinez, *Symposia Co-Chair*
George Vander Voort, *Symposia Co-Chair*
Daniel Dennies, *Symposia Co-Chair*
Brett Miller, *Symposia Co-Chair*
John Sauer, *Symposia Co-Chair*
Richard Chinn, *Symposia Co-Chair*
Gabriel Lucas, *Symposia Co-Chair*

2013 IMS Awards



President's Award
Sarina Pastoric

Sarina Pastoric is currently serving as Affiliates Administrator for ASM International's five Affiliate Societies: International Metallographic Society, Electronic Device Failure Analysis Society, Heat Treating Society, Thermal Spray Society and International Organization on Shape Memory and Superelastic Technologies. Her role includes administration of all governance and protocol activities including budgets, strategic plans, board and committee meetings, and numerous volunteer programs. She works closely with the Board of Directors, committees and volunteers.

She has been with ASM International her entire career and has served in numerous positions which included responsibility for several activities including events, awards, committees, education services, and customer service.



Jacquet-Lucas Award
Zhiping Luo

Dr. Zhiping Luo is an Associate Professor of the Department of Chemistry and Physics, and Manager of the Electron Microprobe Facility, Fayetteville State University, North Carolina. He received his Ph.D. from the Chinese Aeronautical Establishment in 1994, and then worked as a Principle Investigator at Beijing Institute of Aeronautical Materials, China. From 1996-1997, he spent two years in Okayama University of Science, Japan, as a postdoctoral researcher studying electron microscopy with Professor Hatsujiro Hashimoto. In 1998, he moved to Materials Science Division, Argonne National Laboratory, as a Visiting Scholar and was then promoted to Assistant Scientist. From 2001-2012 he worked at Texas A&M University as a Research Scientist of the Microscopy and Imaging Center, and a Graduate Faculty member of the Materials Science and Engineering Program.

Dr. Luo's research interest is mainly in the field of metallurgy, focusing on the novel nanostructured materials with enhanced performance, material structures revealed through electron microscopy, and material structure-property correlations. He has published over 130 papers on peer-reviewed journals, and over 60 papers on conference proceedings and book chapters. As community service, he served as a reviewer for over 30 journals and some grant agencies, and an editorial board member of several journals. He received the DuBose-Crouse Award from the International Metallographic Society and ASM International, and the Professional Technical Staff Award from the Microscopy Society of America in 2008. He has made a wide range of collaborations with other investigators to study the material structures using electron microscopy.

2013 IMS Awards



**Henry Clifton
Sorby Award**
Arun M. Gokhale

Dr. Arun M. Gokhale

Professor of Materials Science and Engineering
Georgia Institute of Technology

Professor Gokhale received his B Tech (1970) and M Tech (1972) in Metallurgical Engineering from Indian Institute of Technology, Kanpur, and PhD (1977) in Materials Science from University of Florida. He is internationally renowned for his contributions in the development and applications of quantitative metallography, stereology, and digital image processing for mathematical representation of materials and biological microstructures; modeling and simulations of microstructures for materials design, and applications of quantitative fractography for characterization of fracture.

Professor Gokhale has been an active member in the metallurgical community as Vice President, International Society for Stereology (1992-1995), the Vice Chair (2005-2006), and Chair (2006-2007), Materials Characterization Committee (EPD Congress) of TMS. He was an Invited Member of the US delegation to Germany to participate in NATO Science Forum meetings on research partnerships (2000). He has also Served on the Editorial Boards of three international journals, namely, Metallurgical and Materials Transactions, Journal of Microscopy (Oxford), and Materials Characterization.

Professor Gokhale has received many awards including Fellow of American Society for Metals (ASM) International, Sustained Research Award from Sigma Xi Society (2000), Research Leadership Award from American Foundry Society (2000), Twice received Special Creativity Based Research Award from National Science Foundation (1996 and 2001), ASM-IIM Distinguished Visiting Lecturer Award (2002), and the Kamani Gold Medal by Indian Institute of Metals (1985). Professor Gokhale has published more than 200 scientific research papers in archival journals and conference proceedings, written chapters in ASM Metals Handbook Vol. 9 (Failure Analysis and Prevention, 2002 edition), and Vol. 11 (Metallography and Microstructures, 2004 edition), and has Co-edited conference proceedings for TMS.

He continues to improve and promote the metallurgical community by teaching more than 25 continuing education short courses, contributing to outreach through organization (as Co-PI) of National Science Foundation sponsored Summer Undergraduate Research Fellowship (SURF), Research Experience for School Teachers (RET) and International Research Experience (IRE) programs at Georgia Tech for more than 10 years.