Symposium Organizers
Frances Allen, University of California, Berkeley
Alex Belianinov, Oak Ridge National Laboratory
Silke Christiansen, Helmholtz Zentrum Berlin für Materialien und Energie
Shane Cybart, University of California, Riverside

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* Invited Paper

SESSION MT05.01: Overview of Emerging FIB-Based Research
Session Chairs: Frances Allen and Silke Christiansen
Monday Morning, December 2, 2019
Hynes, Level 2, Room 204

10:30 AM *MT05.01.01
Unravelling the Origins of Functionality through Correlative Multimodal Chemical Imaging
Olga S. Ovchinnikova, Anton V. Iovlev and Alex Belianinov; Oak Ridge National Laboratory, United States

11:00 AM *MT05.01.02
Exploring a FIB-SEM Research Data Ecosystem
Keana Scott, Alline Myers and Peter Bajcsy; National Institute of Standards and Technology, United States

11:30 AM *MT05.01.03
Ultra-High Precision Engineering of 2D Nanomaterials Using Energetic Focused Ion Beam Technologies
Seokil Kim; Pusan National University, Korea (the Republic of)

SESSION MT05.02: Novel FIB Sources and Nano-Fabrication
Session Chairs: Frances Allen, Alex Belianinov and Shane Cybart
Monday Afternoon, December 2, 2019
Hynes, Level 2, Room 204

1:30 PM *MT05.02.01
New Light and Heavy Ion Beams from Liquid Metal Alloy Ion Sources for Advanced Nanofabrication and Ion Implantation
Paul Mazarov1, Lars Bruchhaus1, Fabian Meyer1, Achim Nadasze1, Torsten Richter1, Ralf Jede1, Yang Yu2, Jason E. Sanabia3, Lothar Bischoff3, Wolfgang Pilz3, Nico Klinger4, Gregor Hlawacek1 and Jacques Gierak1; 1Raith GmbH, Germany; 2Raith America, Inc., United States; 3Helmholtz-Zentrum Dresden-Rossendorf, Germany; 4Centre de Nanosciences et de Nanotechnologies, France

2:00 PM *MT05.02.02
Gas Assisted Plasma FIB—A Delayering Tool
Anne Delobbe1,2, Gregory Goupil1, Sharang Sharan1 and Pascal Gouret2; 1Tescan Orsay Holding, Czechia; 2Orsay Physics, France; 3TESCAN Brno s.r.o., Czechia; 4ST Microelectronics, France

2:30 PM MT05.02.03
Comparison of Gallium and Neon Ion Beam Milling on GaAs
Deying Xia1, John A. Notte1, Ying-Bing Jiang2 and Brett Lewis1; 1Carl Zeiss, United States; 2The University of New Mexico, United States

2:45 PM MT05.02.04
Ne-FIB Fabrication of Tips for Atom Probe Tomography
Frances I. Allen1,2; 3, John A. Notte1, Paul T. Blanchard4, Norman A. Sanford4, Ruopeng Zhang1,5; Andrew M. Minor1,2 and Soeren Eyhusen1; 1University of California, Berkeley, United States; 2Lawrence Berkeley National Laboratory, United States; 3Carl Zeiss Microscopy, United States; 4National Institute of Standards and Technology, United States

3:30 PM MT05.02.05
Electro-Hydro Dynamic Ion Sources and Focused Ion Beam Machines
Jacques Gierak1, Paul Mazarov2 and Lothar Bischoff3; 1Centre de Nanosciences et de Nanotechnologies, France; 2Raith GmbH, Germany; 3Helmholtz-Zentrum Dresden-Rossendorf, Germany

4:00 PM MT05.02.06
Focused Ion Beam Preparation of Strain Microscopy Samples for Coherent X-Ray Imaging of 3D Nano-Scale Structure and Lattice Strain
Felix Hofmann1, Nicholas Phillips1, Gareth Hughes1, James Douglas2, Ross Harder2 and Wenjun Liu2; 1University of Oxford, United Kingdom; 2Argonne National Laboratory, United States

4:15 PM MT05.02.07
Comparison of Several Focused Ion Beam Fabrication Methods for Quantitative In Situ Small-Scale Mechanical Testing
Yang Yang1, Frances I. Allen1,2 and Andrew M. Minor1,2; 1Lawrence Berkeley National Laboratory, United States; 2University of California, Berkeley, United States

4:30 PM MT05.02.08
Beam Exit Cross-Sectional Polishing (BEXP) and Functional SPM—New Approach for 3D Mapping of Physical Properties of Nanostructures
Marta Mucientes1, Leonardo Forcieri1, Pamela Jurczak2, Mingcheu Tang2, Haiyun Liu2, Yipin Gong3, Tao Wang3, Samuel Jarvis1, Kunal Lulla1 and Oleg V. Kolosov1; 1Lancaster University, United Kingdom; 2University College London, United Kingdom; 3The University of Sheffield, United Kingdom
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<td><strong>SESSION MT05.03: FIB Property Engineering I</strong></td>
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<td>Tuesday Morning, December 3, 2019</td>
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<tr>
<td>*<em>9:00 AM <em>MT05.03.01</em></em></td>
<td>Local and Macroscale Property Control of Ferroic Thin-Film Materials with Ion Beams</td>
<td>Lane W. Martin, University of California, Berkeley, United States; 2Lawrence Berkeley National Laboratory, United States</td>
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<td>*<em>9:30 AM <em>MT05.03.02</em></em></td>
<td>Fabrication of Single Atom Devices by Direct Write Nanofabrication</td>
<td>Edward Blejdiej, Sandia National Laboratories, United States</td>
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<td><strong>10:00 AM BREAK</strong></td>
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<td>*<em>10:30 AM <em>MT05.03.03</em></em></td>
<td>Neuronalorphic MoS2: Memtrainsitors Fabricated by Localised Helium Ion Beam Irradiation</td>
<td>Jakub P. Jadwiszczak, Darragh Keane, Gregor Hlawacek, Hongzhou Zhang, Trinity College, Ireland; 2Institute of Ion Beam Physics and Materials Research, Germany</td>
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<tr>
<td><strong>11:00 AM MT05.03.04</strong></td>
<td>Large Scale Automated Fabrication Using a Helium Ion Microscope</td>
<td>Ethan Cho, Hao Li, Shane Cybart, University of California, Riverside, United States</td>
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<td><strong>11:15 AM MT05.03.05</strong></td>
<td>Pulsed Laser-Assisted Helium Ion Nanomachining of Monolayer Graphene—Direct-Write Kirigami Patterns</td>
<td>Cheng Zhang, Ondrej Dyck, David A. Garfinkel, Michael Stanford, Alex Belianinov, Jason D. Fowlkes, Stephen Jesse and Philip Rack, University of Tennessee, Knoxville, United States; 2Oak Ridge National Laboratory, United States; 3Rice University, United States</td>
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<td><strong>11:30 AM MT05.03.06</strong></td>
<td>Phase Transitions in He FIB-Irradiated VO2 Observed with 4D-STEM Imaging</td>
<td>Steven Zeitman, Lei Jia, Frances I. Allen, Jinxiao Wu and Andrew M. Minor, University of California, Berkeley, United States; 2Lawrence Berkeley National Laboratory, United States</td>
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<td><strong>11:45 AM MT05.03.07</strong></td>
<td>Use of Helium-FIB to Study Helium Irradiation Effects for a Tungsten Target</td>
<td>Melih Bal, Frances I. Allen and Peter Hosemann, University of California, Berkeley, United States</td>
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<td><strong>SESSION MT05.04: FIB Property Engineering II</strong></td>
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<td>*<em>1:30 PM <em>MT05.04.01</em></em></td>
<td>Nanoscale Superconducting Quantum Devices Based on High Transition Temperature Superconductor Materials Fabricated by Focused Helium Ion Beam</td>
<td>Hao Li, Ethan Cho and Shane Cybart, University of California, Riverside, United States</td>
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<td><strong>2:00 PM MT05.04.02</strong></td>
<td>Superconducting Nanoscale Detectors Fabricated Using Precision Dislocation Engineering</td>
<td>Ilya Charaev, Glenn Martinez, Denis Bandurin, Andrew Dane, Reza Baghdadi, Marco Colangelo and Karl K. Berggren, Massachusetts Institute of Technology, United States</td>
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<td><strong>2:15 PM MT05.04.03</strong></td>
<td>Ion Beam Induced Damage in MgB2 and Co-Doped Ba(FeAs)2: Thin Films for Josephson Junctions</td>
<td>Leila Kasaei, Hussein Hijazi, Mengjun Li, Ryan Thorpe, Hongbin Yang, Philip E. Batson, Ken Chen, Torgny Gustafsson, Xiaoxiao Xi and Leonard C. Feldman, Rutgers University, United States; 2Temple University, United States</td>
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<td><strong>2:30 PM MT05.04.04</strong></td>
<td>Nanoscale Devices Fabricated by Focused Ion Beam Irradiation of YBa2Cu3O7 Thin Films</td>
<td>Max Karner, University Tübingen, Germany</td>
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<td><strong>2:45 PM MT05.04.05</strong></td>
<td>Nanocluster Formation In Situ via Microbeam-Focused MeV Ion Implantation</td>
<td>John D. Demaree and Daryush Ilia, CCDC Army Research Laboratory, United States; 2FSU, United States</td>
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<td><strong>3:00 PM BREAK</strong></td>
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<td><strong>SESSION MT05.05: FIB In Situ Stages and Nanotomography</strong></td>
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<td>*<em>3:30 PM <em>MT05.05.01</em></em></td>
<td>Expanding the FIB/SEM Toolkit—Taking a Look at Various In Situ Sample Processing and Characterization Possibilities</td>
<td>Andrew J. Smith, Andreas Rummel, Klaus Schock, Matthias Kemmler and Stephan Kleindiek, Kleindiek Nanotechnik, Germany</td>
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<td>*<em>4:00 PM <em>MT05.05.02</em></em></td>
<td>Advances in FIB Nanotomography—Towards 1 nm3 Voxels</td>
<td>Michael W. Phaneuf, Alexandre Laquerre and Ken G. Lagarec, Fibics Incorporated, Canada</td>
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<td><strong>4:30 PM MT05.05.03</strong></td>
<td>In-Situ Correlative Analysis of Ion-Beam Treated Nanostructures by Combination of AFM and FIB</td>
<td>Christian H. Schwalb, Stefan Hummel, Robert Winkler, Jürgen Sattelkow, Tim Frank, Gregor Hlawacek, Peter Hosemann, Georg E. Fentner and Harald Plank, 2GETec Microscopy, Austria; 3Technical University Graz, Austria; 4Helmholtz-Zentrum Dresden-Rossendorf, Germany, 5University of California, Berkeley, United States; 6EPFL, Switzerland</td>
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<td><strong>4:45 PM MT05.05.04</strong></td>
<td>Focused Ion Beam Processing for Practical 3D Analysis of Hard and Soft Biomaterials</td>
<td>Meltem Sezen and Busra Tugba Camic, Sabanci University, Turkey</td>
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<td><strong>SESSION MT05.06: Theory and Simulations</strong></td>
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<td>Wednesday Morning, December 4, 2019</td>
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<td>*<em>9:00 AM <em>MT05.06.01</em></em></td>
<td>Free-Standing and Supported Two-Dimensional Materials under Ion Irradiation</td>
<td>Arkady Krasheninnikov, Helmholtz-Zentrum Dresden-Rossendorf, Germany</td>
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9:30 AM MT05.06.02
First-Principles Study of Charge Equilibration and Electronic Stopping in Self-Irradiated Silicon Cheng-Wei Lee and Andre Schlafle; University of Illinois at Urbana-Champaign, United States

9:45 AM MT05.06.03
Interrogation of the Nano-Beam and Nano-Target Effects in Ion Radiation Using IM3D Yang Yang1,2, Yong Gang Li3, Michael P. Short1 and Ju Li1,2; 1Massachusetts Institute of Technology, United States; 2Lawrence Berkeley National Laboratory, United States; 3Institute of Solid State Physics, Chinese Academy of Sciences, China

10:00 AM AM BREAK

SESSION MT05.07: FIB-SIMS I
Session Chairs: Alex Belianinov and Silke Christiansen
Wednesday Morning, December 4, 2019
Hynes, Level 2, Room 204

10:30 AM *MT05.07.01
FIB-SIMS—Recent Advances in Secondary Ion Mass Spectrometry for Analytical Dual Beam Focussed Ion Beam Instruments Lex Piltch, Agnieszka Priebe and Johann Michler; Empa–Swiss Federal Laboratories for Materials Science and Technology, Switzerland

11:00 AM *MT05.07.02
NanoFab-SIMS—A Promising Tool for the Characterization of Nanofeatures Christelle Guillermier, Brett Lewis and Fouzia Khanom; Carl Zeiss SMT, Inc., United States

11:30 AM MT05.07.03
Enhancing Sensitivity with NeFIB-SIMS—A Material and Parameter Study Brett Lewis, Fouzia Khanom and Christelle Guillermier; Carl Zeiss SMT Inc, United States

11:45 AM MT05.07.04
High-Resolution Cs+ Ion Beam for FIB and SIMS Applications Brenton Knuffman, Andrew D. Schwarzkopf and Adam V. Steele; Zerok Nanotech Corporation, United States

SESSION MT05.08: FIB-SIMS II
Session Chairs: Silke Christiansen and Shane Cybart
Wednesday Afternoon, December 4, 2019
Hynes, Level 2, Room 204

1:30 PM *MT05.08.01
Analytical Capabilities on FIB Instruments Using SIMS—Applications, Current Developments and Prospects Tom Wirtz, Jean-Nicolas Audinot, Jelena Lovric, Alexander Ost and Olivier De Castro; Luxembourg Institute of Science and Technology, Luxembourg

2:00 PM MT05.08.02
Development of an In Situ Cryo High Resolution Instrument for Multimodal Analysis in Nano-Toxicology Olivier De Castro1, Jelena Lovric1, Rachid Barraha1, Olivier Bouton1, Eduardo Serralt2, Nico Klinger2, Gregor Hlawacek2, Peter Gnauck3, Serge Duarte Pinto4, Falk Lucas5 and Tom Wirtz1; 1Luxembourg Institute of Science and Technology, Luxembourg; 2Helmholtz-Zentrum Dresden-Rossendorf, Germany; 3Carl Zeiss Microscopy GmbH, Germany; 4Photonis Netherlands B.V., Netherlands; 5ETH Zürich, Switzerland

2:15 PM MT05.08.03
Unveiling Photoinduced Ion Dynamics in Hybrid Organic-Inorganic Perovskites Using Time-Resolved Time-of-Flight Secondary Ion Mass Spectrometry Yongtao Liu1,2, Anton V. Ievlev1, Liam Collins1, Nikolay Borodinov1, Alex Belianinov1, Matthias Lorentz2, Stephen Jesse1, Kai Xiao2, Mahshid Almadi2, Bin Hu3, Sergei Kalinin3 and Olga S. Ovchinnikova1; 1Oak Ridge National Laboratory, United States; 2The University of Tennessee, Knoxville, United States

SESSION MT05.09: Biological Applications of FIB
Session Chairs: Alex Belianinov and Silke Christiansen
Thursday Morning, December 5, 2019
Hynes, Level 2, Room 204

9:00 AM *MT05.09.01
Cryo-FIB Sample Preparation Methods for Tissue and Cells in Structure Biology Studies at Molecular Resolution Miroslava Schaffer1, Stephan Kleinindeck1, Benjamin D. Engel1, Stefan Pfeiffer1, Michael Heymann1, Tim Laugks1, Julia Mahamid1, Andrew I. Smith1, Juergen M. Plitzko1 and Wolfgang Baumeister1; 1Max Planck Institute of Biochemistry, Germany; 2Kleindiek Nanotechnik GmbH, Germany

9:30 AM *MT05.09.02
Multimodal Analysis of Calcified Biological Materials Lasse M. Kling; Helmholtz-Zentrum Berlin für Materialien und Energie, Germany

10:00 AM BREAK

SESSION MT05.10: FIB Nano-Fabrication by Deposition and Self-Fold Processes
Session Chairs: Frances Allen and Alex Belianinov
Thursday Morning, December 5, 2019
Hynes, Level 2, Room 204

10:30 AM *MT05.10.01
3D Nanoprinting Using Electron and Ion Beams Jason D. Fowlkes1, Eva Mutunga2, Robert Winkler3, Jurgen Sattelkow3, Grace Pakeltis2, Philip Rack3, Alex Belianinov3, Olga S. Ovchinnikova1 and Harald Plank1; 1Oak Ridge National Laboratory, United States; 2The University of Tennessee, Knoxville, United States; 3The University of Zürich, Switzerland

11:00 AM *MT05.10.02
Direct-Writing Nanofabrication of Complex 3D Superconducting Nanostructures Rosa Córdoba1,2, Alfonso Barra2, Dominique Mailly4 and Jose M. De Teresa3,1; 1Molecular Science Institute (ICMol), Spain; 2Aragon Material Science Institute (ICMA), Spain; 3University of Zaragoza, INA, LMA, Spain; 4University Paris Saclay, Univ Paris Sud, CNRS, Ctr Nanosci & Nanotechnol, France

11:30 AM MT05.10.03
Ultra-Fast Growth of Metal Layers and Nanowires by Focused Ion Beam Induced Deposition under Cryogenic Conditions Jose M. De Teresa1,2, Rosa Córdoba1,2, Pablo Orús1,2, Stefan Strohauer1 and Teobaldo Torres1,2; 1University of Zaragoza, Spain; 2CSIC-University of Zaragoza, Spain

11:45 AM MT05.10.04
Atomistic Insights into Self-Fold Process of Nanostructures Induced by Focused Ion Beam Cheng-Lun Wu and Chun-Wei Pao; Academia Sinica, Taiwan