11th Annual FIB SEM Workshop

Monday, April 30th - Wednesday, May 2nd, 2018

McMaster University
Hamilton, Ontario, Canada

Organizers
Nabil Bassim, McMaster University
Kenneth Livi, Johns Hopkins University
Keana Scott, National Institute of Standards and Technology
Samantha Stambula, McMaster University

Sponsors
# FIB SEM 2018 Agenda - Day 1

**Monday, April 30th, 2018**  
**Michael DeGroote Center for Learning and Discovery (MDCL)**

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<tr>
<td>9:00 AM</td>
<td><strong>BREAKFAST &amp; SIGN-IN</strong></td>
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<td>9:50 AM</td>
<td>Welcome</td>
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**Morning Session (MDCL 1105)**

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| 10:00 AM - 10:40 AM | Introduction to FIB SEM: Hardware basics, microscope structure, beam-sample interactions  
Lucille Giannuzzi |
| 10:50 AM - 11:30 AM | Pushing the limits of FIB SEM hardware & software: Beam control, nanofabrication  
Mike Phaneuf |
| 11:30 AM - 11:45 PM | **COFFEE BREAK**                                       |
| 11:45 AM - 12:25 PM | FIB SEM tomography: Tomography basics, tomography with alternative sources  
Mike Phaneuf |
| 12:25 PM - 1:30 PM | **LUNCH**                                               |

**Afternoon Session (MDCL 1105)**

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| 1:30 PM - 2:10 PM | TEM/APT sample preparation: in situ & ex situ methods  
Lucille Giannuzzi |
| 2:20 PM - 3:00 PM | Working with organic materials: Biological and polymer samples, cryo FIB, tomography with spectroscopy  
Keana Scott |
| 3:00 PM - 3:15 PM | **COFFEE BREAK**                                       |
| 3:15 PM - 3:45 PM | Chip circuit edit  
Steve Herschbein |
| 3:55 PM - 4:30 PM | Data handling: 3D data sets and spectrum image data sets, image processing options  
Keana Scott |
| 4:30 PM        | WRAP-UP DAY 1                                           |
| 5:00 PM        | Reception (University Club, Great Hall)                 |
FIB SEM 2018 Agenda - Day 2

Tuesday, May 1st, 2018
Michael DeGroote Center for Learning and Discovery (MDCL)

7:30 AM  BREAKFAST & SIGN-IN

Morning Session (MDCL 1105)

8:45 AM  CCEM & CMC
           Welcome

9:00 AM  (Invited) Miroslava Schaffer¹, S. Pfeffer¹, S. Kleindiek², Michael Heymann³, B.D. Engel¹, J. Mahamid¹, S. Albert¹, T. Laugks¹, J.M. Plitzko¹, W. Baumeister¹
           ¹Max Planck Institute of Biochemistry, Dept. of Molecular Structural Biology ²Kleindiek Nanotechnik GmbH, ³Max Planck Institute of Biochemistry, Dept. of Cellular and Molecular Biophysics
           **Cryo-FIB sample preparation for biological application: Challenges and solutions (Abstract)**

9:30 AM  Brandon Van Leer, Ron Kelley, Lee Casalena
           Thermo Fisher Scientific
           **Protective deposition optimization for high quality cross-sections and S/TEM samples in the plasma FIB (Abstract)**

9:45 AM  Isabelle Martin, Y. Chen, K.P. Rice, T.J. Prosa
           CAMECA Instruments, Inc.
           **New Approaches in Atom Probe Sample Preparation: STEM Imaging and Plasma FIB Milling (Abstract)**

10:00 AM Fernando Camino, Ming Lu, Myung-Geun Han
           Brookhaven National Laboratory
           **Electrical Biasing Transmission Electron Microscope Sample Holder Compatible with Focused Ion Beam Sample Cleaning (Abstract)**

10:15 AM Lucille Giannuzzi
           EXpressLO, LLC
           **Advances in ex situ Lift Out and Micromanipulation Applications, Instrumentation, and Methods (Abstract)**

10:30 AM  COFFEE BREAK

11:00 AM  Richard McLaughlin¹, John Lindsay², Christopher Parmenter³, Jenny Goulden²
           ¹Oxford Instruments NanoAnalysis, USA, ²Oxford Instruments NanoAnalysis, UK, ³University of Nottingham
           **A Universal Workflow for In-Situ FIBSEM Cryo Lift-Out (Abstract)**

11:15 AM  Wen-An Chiou, Jiancun Rao, Sz-Chian Liou
           University of Maryland, College Park
           **Sample Preparation of Hydrated Materials for Cryo-FIB/SEM (Abstract)**

11:30 AM  Xiangli Zhong¹, M. Grace Burke¹, Philip J. Withers¹, Xun Zhang¹, Xiaorong Zhou¹, Stuart B. Lyon¹, Tim L. Burnett¹, Yanwen Liu¹, Simon R. Gibbon²
           ¹University of Manchester, ²AkzoNobel Research & Development
           **Plasma Focused Ion Beam Serial Section Analytical Tomography of an Organic Paint Coating (Abstract)**

11:45 AM  Tomáš Hrnčíř¹, Miroslav Rudolf¹, Mikuláš Kocman¹, Zsolt Radi¹, Jean-Baptiste Mellier², Laurent Alcaraz², Anne Delobbe²
           ¹TESCAN Brno s.r.o., ²Orsay Physics S.A.
           **Improving the Orage Ga-FIB: Towards Easier FIB-SEM Control (Abstract)**
Tuesday, May 1st, 2018 (Continued)
Michael DeGroote Center for Learning and Discovery (MDCL)

Lunch & Poster Session (MDCL Lobby)

12:00 PM Khadijeh Miarabbas Kiani1, A. P. Knights1, J.D.B. Bradley1, S. Norris2, N. D. Bassim2
1McMaster University, Dept of Engineering Physics, 2McMaster University, Dept. of Materials Science and Engineering

Improved Fiber-Chip Coupling in Waveguides by Focused Ion Beam Modification (Abstract)

Bradley T. De Gregorio, Todd H. Brintlinger, Rhonda M. Stroud
U.S. Naval Research Laboratory

Identification and Extraction of Interstellar Dust Impact Craters in Spacecraft Aluminum Foils (Abstract)

Samuel Norris1, N.D. Bassim1, T. Folland2, J.D. Caldwell2
1McMaster University, Dept. of Materials Science and Engineering, 2Vanderbilt University, Dept. of Mechanical Engineering

Focused Ion Beam Fabrication of a Chiral Infrared Polarizer (Abstract)

Yasamin Sartipi, Weiwei Zhang, Samuel Norris, Hesham El-Sherif, Aidan Ross, Nabil Bassim, Christopher Anand
McMaster University

Scanning electron microscope 3D surface reconstruction via optimization (Abstract)

Bruker GmbH, Berlin, Germany

3D Advanced Material Characterization by Combined 3D EBSD/EDS analysis with Esprit QUBE (Abstract)

Weiwei Zhang, Lis Melo, Adam Hitchcock, Nabil Bassim
McMaster University

Untangling the electron beam damage from specimen damage in the FIB-SEM system (Abstract)

Afternoon Session (MDCL 1105)

1:30 PM Andrew J. Smith, K. Schock, Stephan Kleindiek
Kleindiek Nanotechnik

ACS - Anti Curtaining Stage for Smooth Cross Sections on Difficult Materials (Abstract)

1:45 PM Jian Li
CanmetMATERIALS

Tips on FIB Milling of Engineering Materials (Abstract)

2:00 PM Jamil Clarke
Hitachi High Technologies America

A Multi-Step Approach for Material Characterization by a Triple-Beam FIB-SEM System NX5000 - TEM - Dopant Profiling - SSRM (Abstract)

2:15 PM Elias Garratt
Michigan State University

Focused beam sputtering as probe to nanostructure formation dynamics (Abstract)

2:30 PM Jason E. Sanabia1, Joel Fridmann1, Jacques Gierak2, Sven Bauerdiick3, Ralf Jede3
1Raith America, Inc., 2Centre de Nanosciences et de Nanotechnologies, 3Raith GmbH

A New FIB-SEM Nanofabrication Instrument Concept and its Application in Plasmonics and Nanophotonics (Abstract)

2:45 PM Alex Krechmer1, Chris Pawlowicz1, Alexander Sorkin1, Michael W. Phaneuf2
1Techinsights, 2FIBICS

Circuit Tracing on integrated Circuit Using FIB Passive Voltage Contrast Effect (Abstract)

3:00 PM WRAP-UP DAY 2 & Bus to Evening Social (pick-up in front of Ivor Wynne Centre)
FIB SEM 2018 Agenda - Day 3

Wednesday, May 2nd, 2018
Michael DeGroote Center for Learning and Discovery (MDCL)

7:30 AM BREAKFAST

Morning Session (MDCL 1105)

8:45 AM  CCEM  Welcome & Update

9:00 AM  (Invited) Alex Belianinov\textsuperscript{1,2}, Anton V. Ievlev\textsuperscript{1,2}, Jacek Jakowski\textsuperscript{1,3}, Bobby G. Sumpter\textsuperscript{1,3}, Alison Pawlicki\textsuperscript{4}, Jeff Fowler\textsuperscript{5}, Raymond R. Unocic\textsuperscript{1,2}, Olga S. Ovchinnikova\textsuperscript{1,2}
\textsuperscript{1}Center for Nanophase Materials Sciences, ORNL, \textsuperscript{2}The Institute for Functional Imaging of Materials, ORNL, \textsuperscript{3}Computer Science and Mathematics Division, ORNL, \textsuperscript{4}Dept. of Materials Science and Engineering, University of Tennessee, \textsuperscript{5}Syngenta Crop Protection
Helium Ion Microscopy and Patterning in Liquids (Abstract)

9:15 AM  Dean J. Miller\textsuperscript{1}, Dave Zapotok\textsuperscript{1}, Paul Anzalone\textsuperscript{1}, Tomáš Šamořil\textsuperscript{2}, Lukáš Hladík\textsuperscript{2}, Hana Tesařová\textsuperscript{2}, Koffi Pierre Claver Yao\textsuperscript{3}, Victor A. Maroni\textsuperscript{3}, Daniel P. Abraham\textsuperscript{3}
\textsuperscript{1}TESCAN USA, \textsuperscript{2}TESCAN Orsay Holding, \textsuperscript{3}Argonne National Laboratory
Exploring Li distribution in Li-ion batteries with FIB-SEM and TOF-SIMS (Abstract)

9:30 AM  Fouzia Khanom\textsuperscript{1}, David Dowsett\textsuperscript{2}
\textsuperscript{1}Carl Zeiss Microscopy, LLC, \textsuperscript{2}Luxembourg Ion Optical Nano-Systems
Study of lateral resolution on standard BAM L-200 sample from Zeiss ORION NanoFab equipped with SIMS (Abstract)

9:45 AM  Julie C. Savage, Cynthia Lecours, Marie-Eve Tremblay
Axe Neurosciences, Universite Laval
Imaging Brain Tissues in 3 dimensions with FIB-SEM (Abstract)

10:00 AM  Ruslana Makovetsky\textsuperscript{1}, Nicolas Piche\textsuperscript{1}, Mike Marsh\textsuperscript{2}
\textsuperscript{1}Object Research Systems, Montreal, Canada, \textsuperscript{2}Object Research Systems, Denver, USA
Dragonfly Deep Filters: Deep Learning Image Segmentation (Abstract)

10:15 AM  Alexander S. Hall\textsuperscript{1}, Matthia A. Karreman\textsuperscript{2,3}, Yannick Schwab\textsuperscript{2}
\textsuperscript{1}Thermo Fisher Scientific, \textsuperscript{2}European Molecular Biology Laboratory, \textsuperscript{3}Deutsches Krebsforschungszentrum
Correlative Microscopy: A Solution for Multi-Scale Sample Analysis (Abstract)

10:30 AM  COFFEE BREAK

11:00 AM  Soeren Eyhusen\textsuperscript{1}, Pascal Anger\textsuperscript{1}, Tobias Volkenandt\textsuperscript{2}, Fabián Pérez-Willard\textsuperscript{2}, Michael Rauscher\textsuperscript{2}
\textsuperscript{1}Carl Zeiss Microscopy LLC, \textsuperscript{2}Carl Zeiss Microscopy GmbH
The Solution to High-Resolution Analytic FIB-SEM Tomography (Abstract)

11:15 AM  (Invited) Joshua Taillon
National Institute of Standards and Technology
Applications of Compressive Sensing for EDS Analysis (Abstract)

11:30 AM  Jan Henrik Fitschen
Technische Universität Kaiserlautern
Removal of Curtaining Effects by a Variational Model from Mathematical Image Processing (Abstract)
11:45 AM  Jonathan Schwartz¹, Yi Jiang², Robert Hovden¹
¹University of Michigan, ²Argonne National Laboratory, APS
Removing Artifacts from Sample Preparation and Beam Instability in Micrographs with Compressed Sensing (Abstract)

12:00 PM  Christopher W. Schankula¹, Christopher K. Anand¹, Nabil D. Bassim²
¹McMaster University, Dept. Computing and Software, ²McMaster University, Dept. of Materials Science and Engineering
Plasma Focused Ion Beam Curtaining Artifact Correction by Fourier-Based Linear Optimization Model (Abstract)

Lunch (MDCL Lobby)
12:15 PM  LUNCH

Afternoon Demos (MDCL, CCEM, BSB, JHE)
1:30 PM  Demo
2:30 PM  Demo
3:15 PM  COFFEE BREAK @ CCEM/ABB B161
4:00 PM  Demo
4:45 PM  ADJOURN

2018 FIB SEM Workshop - Day 3 Demo Options

- EXpressLO (ABB/CCEM) - ex situ lift-out system, CCEM live-demo
- FIBICS/Zeiss (MDCL 1009) - Live-stream classroom
- Hitachi (MDCL 1008) - Instrumentation presentation, classroom
- Kleindiek (ABB/CCEM) - In-situ TEM sample lift-out made easy, demo on Zeiss FIB
- ORS Visual (TBD) - Software demo, computer lab
- Raith America (MDCL 1016) - Instrumentation presentation, vendor booth
- Tescan (MDCL 1010) - Live-stream Plasma FIB strategies for cross-sections, classroom
- Thermo Fisher (ABB/CCEM) - Plasma FIB, CCEM live-demo
- Thermo Fisher (JHE A114) - Software demo, computer lab

ABB: Arthur N. Bourns Building, Building 25
MDCL: Michael DeGroote Center for Learning and Discovery, Building 52
JHE: John Hodgins Engineering Building, Building 16
BSB: Burke Sciences Building, Building 11