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)**	
9:00 AM	*BREAKFAST & SIGN-IN*
9:50 AM	**Welcome**
Morning Session (MDCL 1105)	
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)	
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 Schaffer**[1], S. Pfeffer[1], S. Kleindiek[2], Michael Heymann[3], B.D. Engel[1], J. Mahamid[1], S. Albert[1], T. Laugks[1], J.M. Plitzko[1], W. Baumeister[1]
[1]Max Planck Institute of Biochemistry, Dept. of Molecular Structural Biology [2]Kleindiek Nanotechnik GmbH, [3]Max 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 McLaughlin**[1], John Lindsay[2], Christopher Parmenter[3], Jenny Goulden[2]
[1]Oxford Instruments NanoAnalysis, USA, [2]Oxford Instruments NanoAnalysis, UK, [3]University 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 Zhong**[1], M. Grace Burke[1], Philip J. Withers[1], Xun Zhang[1], Xiaorong Zhou[1], Stuart B. Lyon[1], Tim L. Burnett[1], Yanwen Liu[1], Simon R. Gibbon[2]
[1]University of Manchester, [2]AkzoNobel Research & Development
Plasma Focused Ion Beam Serial Section Analytical Tomography of an Organic Paint Coating (Abstract)

11:45 AM **Tomáš Hrnčíř**[1], Miroslav Rudolf[1], Mikuláš Kocman[1], Zsolt Radi[1], Jean-Baptiste Mellier[2], Laurent Alcaraz[2], Anne Delobbe[2]
[1]TESCAN Brno s.r.o., [2]Orsay 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 Kiani**[1], A. P. Knights[1], J.D.B. Bradley[1], S. Norris[2], N. D. Bassim[2]
[1]McMaster University, Dept of Engineering Physics, [2]McMaster 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 Norris[1], N.D. Bassim[1], T. Folland[2], J.D. Caldwell[2]
[1]McMaster University, Dept. of Materials Science and Engineering, [2]Vanderbilt 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. Sanabia**[1], Joel Fridmann[1], Jacques Gierak[2], Sven Bauerdick[3], Ralf Jede[3]
[1]Raith America, Inc., [2]Centre de Nanosciences et de Nanotechnologies, [3]Raith GmbH
A New FIB-SEM Nanofabrication Instrument Concept and its Application in Plasmonics and Nanophotonics (Abstract)

2:45 PM **Alex Krechmer**[1], Chris Pawlowicz[1], Alexander Sorkin[1], Michael W. Phaneuf[2]
[1]TechInsights, [2]FIBICS
Circuit Tracing on integrated Circuit Using FIB Passive Voltage Contrast Effect (Abstract)

3:00 PM *WRAP-UP DAY 2 &* ***Bus to Evening Social***

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

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

9:30 AM **Fouzia Khanom**[1], David Dowsett[2]
[1]Carl Zeiss Microscopy, LLC, [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[1], Nicolas Piche[1], **Mike Marsh**[2]
[1]Object Research Systems, Montreal, Canada, [2]Object Research Systems, Denver, USA
Dragonfly Deep Filters: Deep Learning Image Segmentation (Abstract)

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

10:30 AM *COFFEE BREAK*

11:00 AM **Soeren Eyhusen**[1], Pascal Anger[1], Tobias Volkenandt[2], Fabián Pérez-Willard[2], Michael Rauscher[2]
[1]Carl Zeiss Microscopy LLC, [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)

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

11:45 AM	**Jonathan Schwartz**[1], Yi Jiang[2], Robert Hovden[1] [1]University of Michigan, [2]Argonne National Laboratory, APS *Removing Artifacts from Sample Preparation and Beam Instability in Micrographs with Compressed Sensing (Abstract)*
12:00 PM	**Christopher W. Schankula**[1], Christopher K. Anand[1], Nabil D. Bassim[2] [1]McMaster University, Dept. Computing and Software, [2]McMaster 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) - CCEM live-demo on Zeiss FIB
- ORS Visual (JHE 233A) - 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 (BSB 249) – Software demo, computer lab

ABB: Arthur N. Bourns Building, Building 25

MDCL: Michael DeGroote Center for Leaning and Discovery, Building 52

JHE: John Hodgins Engineering Building, Building 16

BSB: Burke Sciences Building, Building 11