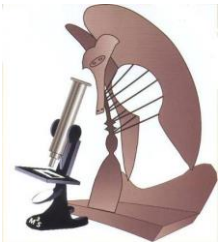
New Announcements from MMMS Corporate Members

Hosted by Baxter Healthcare Corporation



Presented by

Midwest Microscopy and Microanalysis Society (M^3S)

A local affiliate of the Microscopy Society of America and the Microanalysis Society

Friday, November 11th

Baxter Healthcare Headquarters

1 Baxter Parkway, Deerfield IL, 60015

Directions see page 3

RSVP by Tuesday, November 8th to:

https://forms.gle/iWT1QpaR5XyBNcvM6

Cem Akatay, MMMS Secretary mcakatay@gmail.com

Please Note: *. Masks are not required at this time but if you would like to wear one, you are welcome to do so. If you are symptomatic or recently had COVID, please refrain from attending.*

Onsite Registration Fees

Meeting Free for M^3S members, $20.00 for non-members, $5.00 for students
(Fee includes M^3S membership for 2023)
Vendors are welcome to exhibit, please contact Brandon Brandt bbrandt@jeol.com for details.

Program

8:00 – 9:00AM **Registration -** Continental Breakfast will be served

9:00 – 9:10AM **Welcome and Opening Remarks**

9:10 – 9:40AM **Multimodal Correlation of Raman Images and other Microscopy Techniques** Tim Prusnick, Renishaw

This talk discusses the integration and applications of two correlative techniques for Raman imaging, Florescence Lifetime Imaging Microscopy (FLIM) and SEM. Applications specific to biological materials, pharmaceutical drug products, and mineral thin sections will be discussed to highlight the benefits of multimodal correlation analysis with Raman spectroscopy.

9:40 – 10:10AM **nano-FTIR for probing molecule orientation and conformation in thin polymer brush films with nanoscale spatial resolution** Tobias Gokus*, Artem Danilov and Adrian Cernescu 1attocube systems AG, neaspec,

The properties of ultrathin functional surface coatings such as polymer brushes strongly depends on orientation and conformation of their polymer chains. Assessing these properties on nanometer length scales is vital for obtaining further insights into the structure-function relation and consequently for optimizing the polymer brush formation parameters. While analytical techniques such as neutron reflectometry as well as conventional infrared spectroscopy, have been successfully utilized for studying polymer chain conformation and orientation in polymer brush films, respectively, those lack the spatial resolution for probing these properties on the nanoscale.
nano-FTIR is an emerging new optical super resolution microscopy technique that enables IR spectroscopy and chemical mapping down to 10nm spatial resolution. Utilizing a broadband laser sources like a mid-IR supercontinuum laser for AFM tip illumination and interferometric light detection analogous to classical FTIR spectroscopy, nano-FTIR enables near-field spectroscopic measurements with unprecedented spatial resolution and signal quality.
Owing to its orders of magnitude higher detection sensitivity compared to conventional FTIR spectroscopy as well deep subdiffractional spatial resolution of 10-20 nm nano-FTIR has been successfully employed for determining the chemical composition of multiphase thin films and polymer blends. Exploiting the inherent sensitivity of nano-FTIR spectroscopy to molecule orientation, it was also successfully used to analyze the molecule orientation and in polymer fibers and thin biological membranes.
In this presentation, we introduce the working principle of the nano-FTIR technology. Furthermore, we will demonstrate the capability of nano-FTIR for visualizing and distinguishing between nanometer sized phases with different crystallinity as well as for determining the molecule orientation and conformation in a few-nanometer-thin poly(ethylene oxide) polymer brush film.
*tobias.gokus@attocube.com

10:10 – 10:40AM **Break – Visit with Vendor**

10:40 - 11:10AM **New opportunities of atomic-resolution magnetic-field-free electron microscopy for materials science.** Robert F Klie, Ph.D., Department of Physics, University of Illinois Chicago

While the development of aberration-correctors, monochromated electron sources, and advanced detectors has fueled the current revolution in resolution, nearly all high-resolution transmission electron microscopy (TEM) experiments are still performed with the sample being exposed to a high magnetic field, since the objective lens (OL) pole-pieces require a magnetic field of about 3 tesla. Such a magnetic field limits the samples that can be studied, preventing magnetic, magneto-optical, magneto-electric, superconductive or topological materials from being characterized under relevant conditions.
Traditional magnetic imaging methods, where the OL is turned off, limit the spatial resolution to nanometer length-scales and do not allow for atomic-resolution chemical analysis. The new JEOL Z200MF-MONO, to be installed at the University of Illinois Chicago, will have a novel lens design that allows for better than 100 pm spatial resolution at 200 kV with a residual magnetic field of less than 0.3 mT and 40 meV energy resolution with a probe size of 110 nm. I will discuss how atomic-resolution chemical analysis, as well as novel image modes, such as 4D-STEM and differential phase contrast imaging, can be combined with in-situ heating or cooling experiments to study magnetic, superconducting or other electronic phase transitions. https://phys.uic.edu/profiles/klie-robert/

11:10 - 11:40AM **Introduction to TESCAN's TEM - 0ur Latest Innovation** Gary Hawkinson, CEO Tescan USA

More information will be shared about TESCAN's first TEM solution.

11:40AM – 1:00PM **Lunch – Visit with Vendors**

1:00 – 1:15PM **MMMS Business Meeting**

1:15 – 1:45PM **Volume EM and TEM applications in Neuroscience, Respiration, Cancer, and Bioscience** Steven L. Goodman, PhD., Microscopy Innovations LLC

This presentation will provide examples of biomedical and biological scientific discovery from users of the mPrep System for specimen preparation. This will include neuroscience research at the Cleveland Clinic enabled by reliable and efficient serial block face volume electron microscopy (vEM) specimen prep that provides the critical reproducibility to enable artificial intelligence image segmentation and quantification. An example from the University of Wisconsin will present scientific discovery that used TEM, vEM and 3D image analysis, to provide insight into a potential mitochondrial structural basis for why young adults that were born prematurely often have reduced skeletal and cardiac respiratory capacity. An example from Oregon Health & Science University will illustrate how breast cancer research using vEM can be accelerated using rapid and reliable automated specimen prep. Also presented will be a new freeze-substitution specimen prep workflow and protocol that improves contrast and reproducibility to enable multiple scale imaging of botanical and mammalian specimens using correlative vEM, TEM, STEM, and other imaging modalities including light microscopy and x-ray micro/nano computerized tomography.

1:45 – 2:05PM **Break**

2:05 – 2:35PM **Advances in Cryo Electron Microscopy** Natalia de Val, PhD, Sr. Scientist, Sr. Product Specialist, Electron Microscopy

In order to fully understand biological processes, and how they fail in disease, it is vital to obtain structural information for the relevant biological machinery. Notably, it is becoming increasingly apparent that proteins, the key biological players in fundamental biology or disease mechanisms, often adopt multiple conformations or act in complexes with other proteins. These large and/or dynamic systems present a challenge to traditional methods of 3D structural determination as X-Ray crystallography or NMR.

In recent years, single particle analysis (SPA) through cryo-EM has emerged as a mainstream structural biology technique, which can determine the 3D structure of proteins and protein complexes at near-atomic resolution. SPA allows determination of molecular details of purified and isolated proteins at near native conditions, albeit without the spatial and functional context of these proteins within the cell. Cryo Electron Tomography (Cryo-ET) fills this gap by visualizing proteins within their functional cellular environments. This allows for observation of their relationships and interactions with other cellular components and holds great promise for cell biology.

In Cryo-EM, specimens are rapidly frozen (vitrified) so that their biologically relevant native states are preserved. This technique has transformed the field of structural biology, leading to new insight into numerous biological processes.

Senior Scientist with Thermo Fisher Scientific, Natalia de Val, will discuss the latest advances in the SPA and cellular Cryo-ET workflows and will present the latest results in SPA and Tomography. These results will show how the field is changing our understanding of fundamental cell biology.

2:35 – 3:05PM **Applications of Direct Detection, Electron Counting Cameras for Materials Science** Fernando C. Castro, Ph.D. Imaging & In-Situ Applications Scientist Gatan

Direct detection cameras are changing the transmission electron microscopy landscape by delivering outstanding data quality at extremely low electron dose rates. These cameras have supercharged the cryo-EM research community and are increasingly valuable to materials scientists as research interests continually extend to more beam-sensitive materials. This presentation will review the fundamentals of direct detection sensor design, concepts of electron counting, and how these technological advancements enable low dose TEM imaging, diffraction, and *in-situ* experiments. Key results from a range of materials applications will be highlighted, including energy storage materials, 2-D materials, polymers, and other beam sensitive samples. Extending direct detection technology to low-kV TEM analysis, EELS, and EBSD will also be discussed.

3:05 – 3:35PM **3D Imaging and Analytics with X-ray Microscopy: Technology and Research Updates** Will Harris, Ph.D., Carl Zeiss Microscopy, Eshan Ganju, Ph.D., Purdue University

With the proliferation of research demanding 3D morphological analysis (electrochemical devices, biomaterials, additive manufacturing, and lightweight composites, to name a few), lab-based X-ray microscopy (XRM) has evolved out of synchrotron-based designs to fulfill a key position in today's multimodal microscopy lab.

This talk will be presented in two parts. In the first part, a brief introduction to the XRM technology will be presented. This overview will include a broad survey of scientific applications, and several of the enabling recent advances like deep learning X-ray reconstruction. Part two will be presented by Dr. Eshan Ganju of Purdue University. Dr. Ganju will dive into case studies of how XRM is used in their lab (with Prof. Nik Chawla) to enable correlative microscopy and time-dependent 3D microstructural evolution studies. The first example, based on imaging, will focus on the mechanics of time-resolved honeycomb growth as means for bioinspiration. A second example, from the metals area, will focus on a relatively new technique called diffraction contrast tomography (DCT). Here, DCT enabled a crystallographic-based understanding of slip transfer in titanium.

3:35 – 3:45PM **Closing Remarks**

Directions to Baxter Corporate Headquarters: 1 Baxter Parkway, Deerfield Illinois, 60015

From South (O'Hare Airport): I-294 (Tri State Tollway) north to the merge with I-94 (west) towards Milwaukee. North on I-94 to Lake Cook Road exit. Turn left (west) to first light, Saunders Road. Turn right on Saunders to Baxter Parkway. Turn right on Baxter Parkway. Keep to the right. Follow the special event parking signs in the garage. See Deerfield Campus Map and proceed to "Cafeteria, Auditorium, Reception" building on ground level.
From South (Edens): North to the merge with I-94 (west) towards Milwaukee on Edens Spur. Exit on Deerfield Road. Turn left (west), then take left on Saunders Road. Turn left on Baxter Parkway. Keep to the right. Follow the special event parking signs in the garage. See Deerfield Campus Map and proceed to "Cafeteria, Auditorium, Reception" building on ground level.
From North (Milwaukee): From I-94 east, going south towards Chicago exit at Lake Cook Road exit. Turn right (west) to first light, Saunders Road. Turn right on Saunders to Baxter Parkway. Turn right on Baxter Parkway. Keep to the right. Follow the special event parking signs in the garage. See Deerfield Campus Map and proceed to "Cafeteria, Auditorium, Reception" building on ground level