Minnesota Microscopy Society

*Local affiliate of the **Microscopy Society of America***
*and the **Microanalysis Society***

Newsletter *April 2013*

Date: Friday, May 3, 2013

Location: Science Museum of Minnesota
120 W. Kellogg Blvd., St. Paul
Discovery Hall

Parking: Science Museum or River Centre parking ramps

Schedule

7:30 – 8:15 AM	Registration, Continental Breakfast, Vendor Displays
8:15 – 8:30 AM	Welcome
8:30 – 9:30 AM	**R. Lee Penn, Associate Prof of Chemistry, University of Minn.** *In Situ Characterization of Nanoparticle Aggregation*
9:30 – 10:30 AM	**Wei Zhang, Assistant Prof, Institute for Molecular Virology, U of M** *TEM imaging and 3D reconstruction*
10:30 – 11:00 AM	Break and Vendor Displays
11:00 – 12:00 PM	**Lynne Osterman, Managing Director, NanoVox, and Steve Campbell, Prof, Electrical and Computer Engineering, U of M** *The Current State of Nanotechnology*
12:00 – 1:30 PM	Lunch and Vendor Displays
1:30 – 1:45 PM	Business Meeting
1:45 – 2:45 PM	**Mark Cavaleri, Lead Research Specialist, 3M** *The Use of Analytical Centrifugation in the Development of Process Control Test Methods*
2:45 – 3:45 PM	**Brittany Nelson-Cheeseman, Assistant Prof, School of Engineering, University of St. Thomas** *Giant Oxygen Response to Electrostatic Inversion Symmetry Breaking Uncovered by 3-D Electron Density Mapping*

Spring Symposium
continued

Registration

The cost of the meeting will be $65 for MMS members via PayPal at the link below, $75 for nonmembers, and $20 for students/K-12 teachers. The fee includes the meeting, buffet lunch, breakfast, coffee breaks and a free pass to the Museum exhibits.

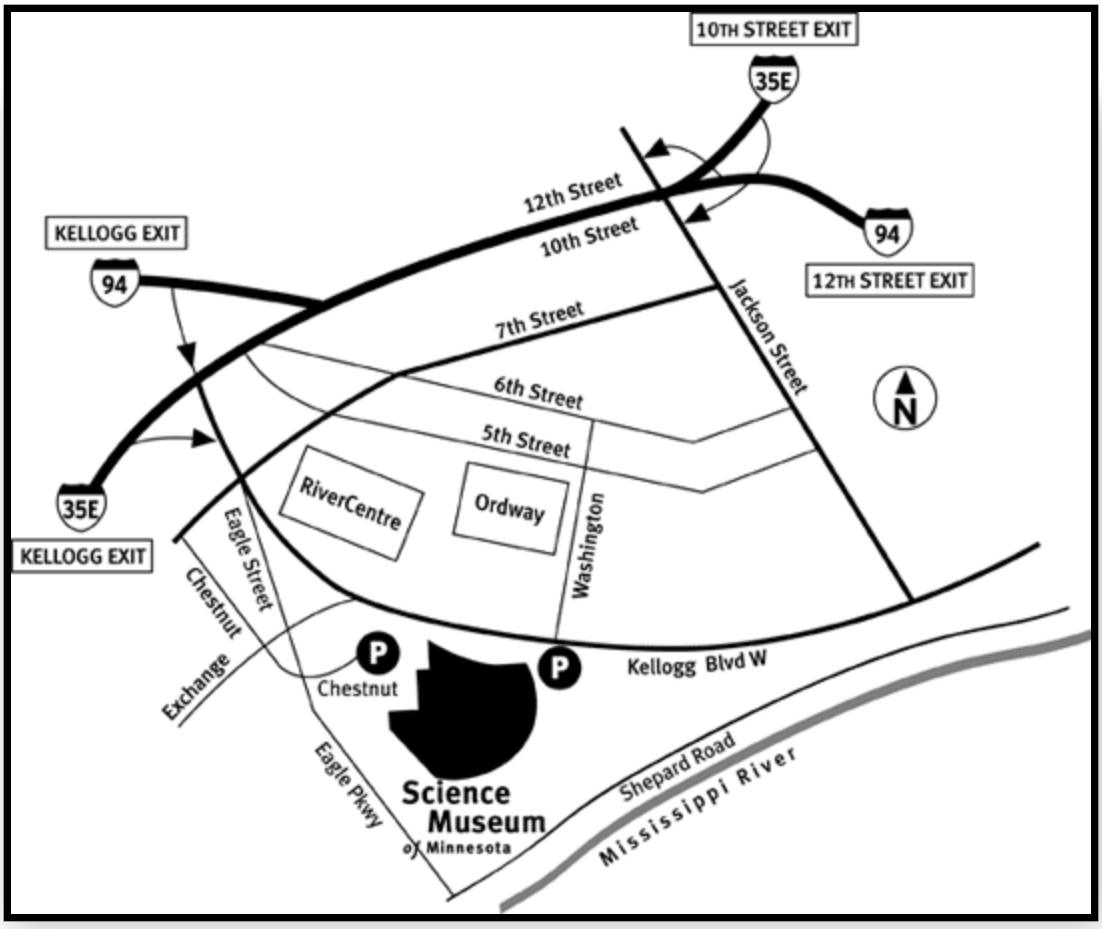
Reservations must be made no later than April 26th.

Register online at **http://www.mnmicroscopy.org/calendar.html.** Or call Bede Willenbring at 651-236-5470 – include your name, company, phone number and email address.

Directions

The Science Museum's parking ramp can be accessed from either Kellogg Blvd or Chestnut St. Enter museum by taking parking ramp elevator to the Lobby level. The River Centre ramp is an alternative to the Science Museum ramp.

The meeting will be held in Discovery Hall. If entering the museum from Kellogg Boulevard, go through the Lobby, angle left just after the box office and continue to the stairs/elevators. The Discovery Hall is one floor down.



Spring Symposium 2013 - Speakers

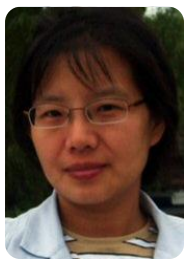
In Situ Characterization of Nanoparticle Aggregation

R. Lee Penn, Associate Professor of Chemistry, McKnight Presidential Fellow, University of Minnesota

Abstract

A major research focus in the Penn group is pairing careful solid-state characterization with quantitative kinetics of reaction, nanoparticle growth, and phase transformations. Particle surfaces play important roles in natural and engineered environmental systems, and aggregation state can dramatically change accessible surface area. In addition, aggregation state is dynamic, and rates are sensitive to the dynamics of aggregation. Transitions between different states of aggregation (*e.g.*, ranging from single-phase fractal aggregates to mesocrystals composed of oriented primary nanocrystals to heterogeneous aggregates of two or more phases) can be directly linked to evolving kinetics of redox reactions and phase transformation. Results from characterization using cryogenic transmission electron microscopy will be presented.

TEM imaging and 3D reconstruction



Wei Zhang, Research Assistant Professor, Institute of Molecular Virology; Characterization Facility, University of Minnesota

Biography

As a graduate student in Purdue University, Wei Zhang worked on virus structures using cryo-transmission electron microscopy and 3D reconstruction methods. Her current research involves studies of virus membrane fusion properties using single particle reconstruction and tomography methods. Her future research goal includes study retrovirus structures and development of correlative electron microscopy using both fluorescence microscopy and TEM.

Abstract

Interpretation of cryo-transmission electron microscopy images of biological samples is challenging due to electron radiation damages to the specimen, low contrast between the macromolecules and the frozen buffer, and complexity of the projection images recorded in a TEM. This talk will discuss the principle and methods of TEM image processing and analysis, including 2D image averaging, single particle 3D reconstruction and electron tomography. These methods help to elucidate the structural information of macromolecular complexes.

Spring Symposium 2013 - Speakers

ROUNDTABLE *with Lynne Osterman from NanoVox & Stephen Campbell from the University of Minnesota – The Current State of Nanotechnology*

Lynne Osterman, Executive Director of the NanoVox Project;
Steve Campbell, Professor, Electrical and Computer Engineering, Univ of Minnesota

Biographies

Lynne Osterman is the Managing Director for NanoVox, a five-state regional, not-for-profit mechanism to find and link technology, products, expertise and resources, leveraging nanoscale science and nanotechnology to accelerate commercialization through increased collaboration. Lynne refers to herself as a "recovering legislator," having served in the MN House of Representatives from 2002-2004. She has since served as a lobbyist for a Minneapolis law firm, opened a Twin-Cities legislative-advocacy office for a Pittsburgh-based firm and has had her own company for approximately four years. Prior to, during and since serving in the House, Lynne has maintained focus on projects intended to strengthen local/state and regional economies, particularly via enhanced manufacturing and science and technology advocacy and promotion. The NanoVox project grew out of a former Minnesota-centric trade association, MN Nano, moving into a broad-based, inclusive asset-mapping business model vs. a "pay-to-play" membership model. While not a researcher herself, Lynne spends a lot of time visiting with both academic and industrial folks in the R&D community, traversing Minnesota, Wisconsin, Iowa and both the Dakotas.

Stephen A. Campbell received a B.A. in physics from St. Thomas University and an M.S. and Ph.D. in physics from Northwestern University in Evanston, Illinois in 1977 and 1981, respectively. After a brief stint at Unisys where he worked on CMOS, he joined the University of Minnesota in Minneapolis, Minnesota in 1986. He is on the faculty of the Department of Electrical and Computer Engineering and directs the Nanofabrication Center, one of the NNIN nodes. He has about 200 refereed publications. His textbook, *Fabrication Engineering at the Micro- and Nanoscale* (New York: Oxford University Press, 1996, 2001, 2006, 2013), has been used in more than 80 U.S. schools as well as institutions in Europe and Asia. It has been translated into several languages. His work in the area of silicon process technology ultimately led to fundamental changes in the way that CMOS transistors are manufactured. More recently, Professor Campbell has worked on carbon-based nano-electromechanical devices (NEMS), silicon quantum dots, and thin film solar cells. Professor Campbell is a fellow of the IEEE, holds the Sanford P. and Lenore Edgerton Bordeau Chair in Electrical and Computer Engineering and is a Distinguished Professor in the University's College of Science and Engineering.

cont'd…

Spring Symposium 2013 - Speakers

ROUNDTABLE *with Osterman & Campbell cont'd…*

Abstract

General overview of current nanotech applications in a variety of industry sectors; an introduction to varied examples of research underway or ongoing at the the University of Minnesota leveraging the equipment and facilities available to academic as well as private-sector researchers, students and graduate students; an introduction to "NanoVox," a regional asset-mapping and collaboration initiative intended for interdisciplinary utilization of technology, products, expertise and resources across Minnesota, Wisconsin, Iowa and the Dakotas.

The Use of Analytical Centrifugation in the Development of Process Control Test Methods

Mark Cavaleri, Lead Research Specialist, 3M Corporate Research Analytical Laboratory

Abstract

It is often necessary to know the state of the particle size distribution (psd) during manufacturing in order to properly control the process and insure the quality of the end product. Most near line psd measurements are carried out under conditions that are significantly different than the process. These differences typically include re-dispersing the particles in lower viscosity carriers and greatly reducing the particle concentration. This raises the question – 'Are the measurements representative of the particles in the manufacturing process?' This presentation will focus on using analytical centrifugation as a primary tool for developing and verifying appropriate measurement methods for the characterization of particle systems that accurately characterize the particles during the manufacturing process.

Spring Symposium 2013 - Speakers

Giant Oxygen Response to Electrostatic Inversion Symmetry Breaking Uncovered by 3-D Electron Density Mapping

Brittany Nelson-Cheeseman, Assistant Professor, School of Engineering, University of St. Thomas

Biography

Brittany Nelson-Cheeseman is an Assistant Professor in the School of Engineering at the University of St. Thomas. She received her PhD in Materials Science and Engineering (MSE) with a designated emphasis in Nanoscale Science and Engineering from the UC-Berkeley in 2009, and her BS in MSE from the UW-Madison in 2003. Her work focuses on creating and investigating novel nanoscale complex oxide materials for energy applications, which she does by using epitaxial thin film growth techniques and synchrotron x-ray characterization techniques. As a postdoctoral researcher at Argonne National Lab, she utilized oxide molecular beam epitaxy (MBE) in the Center for Nanoscale Materials to craft new materials using the single atomic layer control of MBE.

Abstract

Many of the attractive properties of oxide materials (such as high temperature superconductivity, colossal magnetoresistance, and multiferroicity) are essentially dictated by the transition metal crystal field, which is created by the coordinating oxygen ligands. Here, I will present a novel method to tune the positions of these oxygens--and, thus, the crystal field--in oxide thin films via electrostatic inversion symmetry breaking. Using the atomic monolayer control of molecular beam epitaxy, we order the dopant cations in various patterns within chemically-equivalent single-crystalline nickelate films. We then map out the 3-dimensional electron density of these thin films from one unit cell layer to another using synchrotron surface x-ray diffraction and coherent bragg rod analysis (COBRA). This complete atomic structure information allows us to directly investigate the chemical cation order and the resulting atomic displacements for each ordering pattern. For a particular ordering pattern that breaks electrostatic inversion symmetry, we find giant oxygen bond length changes as large as +0.70 A (+35%) and -0.65 A (-33%). The ability to modify the oxygen bond lengths by this magnitude, while still maintaining the overall chemical equivalency of the material, could have far-reaching implications for re-envisioning the electronic, magnetic and orbital properties of well-known oxide materials.

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