44th Annual Fall Symposium and Business Meeting

Gordon College · 255 Grapevine Road · Wenham, MA 01984 · 978.927.2300
(http://www.gordon.edu)

Thursday, December 2, 2010

12:30 pm - **Registration**—Presidential Dining Room (Lane Student Center)

1:00 pm - **Welcome**: Warren MoberlyChan

1:10 pm **Microstructure modification of two-phase Titanium alloys by hydrogen treatment.**
Speaker: **Yong Zhang, Massachusetts Institute of Technology, MA**

1:50 pm **Recent developments in Analytical TEM.**
Speaker: **Neil Rowlands, Oxford Instruments, Concord, MA**

2:30 pm Coffee Break

3:00 pm **A semiconductor platform for High Resolution *in situ* Electron Microscopy**
Speaker: **Steven Mick, Protochips, Raleigh, NC**

3:40 pm **Receptor dynamics and interactions revealed by quantitative single-molecule imaging: The case of CD36**
Speaker: **Khuloud Jaqaman, Harvard Medical School, MA**

4:20 pm **Atmospheric Scanning Electron Microscopy: a new correlative microscopy tool.**
Speaker: **Donna Guarrera, JEOL USA, Peabody, MA**

5:10 pm NESM Annual Business Meeting
I. Elections
II. President's and Treasurer's Reports
III. Report on Woods Hole
IV. Introduction of New Officers

6:30-7:30 Dinner, with dinner music provided by Gordon College music majors!

7:30 pm After Dinner Talk**:** **High Resolution TEM & STEM in nanoscience applications.**
Speaker: **David Bell, Harvard University, MA**

8:30 pm **Closing Remarks:** by ?? new NESM President

Microstructure Modification of Two-Phase Titanium Alloys by Hydrogen Heat Treatment

Yong Zhang
Center for Materials Science & Engineering,
Massachusetts Institute of Technology, Cambridge, MA 02139

Abstract

Hydrogen treatment is a thermal hydrogenation and dehydrogenation process. Hydrogen can be easily charged into or discharged from Ti alloys with an isothermal aging process. Actually, hydrogen is taken as a temporary alloying element for modifying microstructure and thus improving mechanical properties of Ti alloys. In this presentation, the hydrogenation behaviors of typical ($\alpha + \beta$) titanium alloys have been systematically investigated using gas charging method. The microstructure evolution with hydrogen treatment (hydrogenation-solution treatment-dehydrogenation) in typical ($\alpha + \beta$) two phase Titanium alloys, has been studied with OM, TEM, HRTEM, and SEM. Mechanical property tests are used to evaluate the efficiency of hydrogen treatment. Microstructure modification has been successfully achieved during the hydrogen heat treatment of ($\alpha + \beta$) Ti alloys, leading to the improvement of mechanical properties, especially ductility.

Biography

Yong Zhang is working for the EM facility in the Center for Materials Science & Engineering at MIT. Before he came to MIT, he worked in the department of Physics & Astronomy at the University of Delaware, running the electron microscopy facility. He got advanced degrees of Materials Science & Engineering and Electrical Engineering from China and US universities. He has accumulated more than 15 years work experience in the operation of electron microscopy as well as EM maintenance and user training. He is specialty in the application of transmission electron microscopy and sample preparation. He has done intensive studies on the nanostructured magnetic materials and engineering structural alloys. His research results were published in prestigious journals including Nature, Journal of American Chemical Society, Applied Physics Letter, Physics Review, etc.

Recent developments in Analytical Transmission Microscopy

Neil Rowlands
Oxford Instruments, Concord, MA

Abstract

Recent developments in Transmission Electron Microscopy have changed the nature of analysis in the TEM. Everything from sample preparation techniques to the use of aberration corrected field emission TEMs have made it possible to use EDS and EELS to perform chemical analysis down to the atomic level. Not only is it possible to analyze much smaller areas but beam currents commonly experienced in probe corrected TEM mean that these analyses can be performed in much shorter times than were previously possible. Consequently, not only are the analyses faster but spatial resolution is enhanced not only for imaging but also for chemical analysis. Examples of such analyses will be shown during the presentation.

Biography

Dr. Rowland received his PhD. Cardiff UK in 1977. He was a professor at McGill University from 1978 until 1986, at which time he became a Product Manager at JEOL USA while retaining Adjunct Professor position at McGill. He worked at The Massachusetts Institute of Technology in the Center for Materials Science and Engineering as a Research Manager from 1993 until 1996. He has been with Oxford Instruments since March 2000 and is presently their EDS Product Manager

A Semiconductor Platform for High Resolution *in situ* Electron Microscopy

Stephen Mick
Protochips, Inc, Raleigh, NC

Abstract

Using semiconductor technology, Protochips has developed a platform for high resolution in situ electron microscopy. This platform combines semiconductor specimen supports with electron microscope holders to enable new approaches to in situ studies. Compared to conventional approaches for in situ work, a semiconductor approach allows for thermal & electrical stimulus to be directly applied to the specimen and provides millisecond heating rates from ambient to 1000 deg.C. By extending this technology it is possible to contain the environment directly around the specimen allowing for real-time observation of a specimen in gaseous or hydrated environments at high resolution. In this talk, numerous applications and results will be presented.

Biography

Dr. Mick received the B.S.E.E from The University of Houston in 1995, the M.S.E.E. from North Carolina State University in 1998, and the Ph.D. in Electrical Engineering from North Carolina State University in 2004. Dr. Mick is a Co-Founder of Protochips, Inc. He is responsible for business development and is actively building out the sales and distribution channel for the company's products. Stephen is also responsible for corporate branding, partnership development, and managing the company's rapidly growing manufacturing and sales staff. With his founding partners, Stephen is closely involved in product roadmap development, IP portfolio and corporate strategic planning. Dr. Mick has over 30 technical publications and has two U.S. patents granted with eight patents pending in fields ranging from semiconductor circuits & packaging to instrumentation for electron microscopes.

Receptor dynamics and interactions revealed by quantitative single-molecule imaging: The case of CD36

Khuloud Jaqaman
Harvard Medical School, MA

Abstract

The mechanisms that govern receptor coalescence into functional clusters – often a critical step in their stimulation by ligand – are poorly understood. We used live-cell single-molecule image, single particle tracking and multi-scale motion analysis to investigate the dynamics of CD36, a clustering-responsive receptor that mediates oxidized LDL uptake by macrophages. We found that even unliganded CD36 existed as metastable oligomers whose motion in the membrane was spatially structured by the cortical cytoskeleton. A subpopulation of receptors diffused within linear confinement regions that simultaneously increased freedom of movement along one direction and effective receptor density via confinement in the opposite direction. This optimal diffusion dimensionality enhanced the probability of collisions between receptors and favored their association into oligomers; disruption of the cytoskeleton reduced oligomer formation and suppressed CD36-mediated signaling and oxidized LDL internalization. These observations demonstrate a role for the cytoskeleton in controlling signal transduction by structuring receptor diffusion within membrane regions that increase their collision frequency.

Biography

Khuloud Jaqaman received her B.Sc. in Physics from Birzeit University in the West Bank in 1998 and her Ph. D. in Computational Chemistry from Indiana University Bloomington in 2004. For her postdoctoral training she joined the lab of Prof. Gaudenz Danuser at the Scripps Research Institute in order to work at the interface between mathematical modeling and experimental cell biology. In 2009 she became an Instructor in the Department of Systems Biology at Harvard Medical School. Her current research is focused on developing quantitative single molecule imaging approaches to establish how cell signaling is defined by the spatiotemporal organization and dynamics of receptor interactions in the plasma membrane.

Atmospheric Scanning Electron Microscopy: A New Correlative Microscopy Tool

Donna Guarrera
JEOL USA, Inc., Peabody, MA

Co-authors: Hidetoshi Nishiyama, JEOL Ltd., Mitsuo Suga, JEOL Ltd.

Abstract

A new correlative microscopy instrument (ClairScope) has been developed which consists of a scanning electron microscope (SEM) coupled with a wide field optical microscope. The key to the design of this instrument is to allow concurrent imaging of a sample at atmospheric pressure and temperature, by both an optical microscope and SEM.

Traditional SEM techniques, even ESEM technology, require the sample to be subjected to some level of vacuum. With the ClairScope, the sample holder incorporates a thin film window that allows for penetration of the electron beam for imaging of materials (liquids, solids, gels…) at atmosphere. The sample holder is compatible with cell culture and flexible in design for modification. This instrument supports an open system well suited for dynamic experiments. The instrument will be described in more detail as well as several applications from cell biology to materials science.

Biography

Prior to joining JEOL in 2002, Donna Guarrera spent over 15 years as an Analytical and Research Chemist in industry with extensive experience in R&D, product development and manufacturing across a broad range of industries. Donna is currently the Assistant Director of the Scanning Microscopy Division at JEOL USA and is here to give us a brief introduction of a new instrument that integrates an SEM with a wide field optical microscope.

High Resolution TEM & STEM in Nanoscience Applications.

David C. Bell
Center for Nanoscale Systems, Harvard University, MA

Abstract

Aberration Corrected Transmission Electron Microscopy (Cs TEM) has shown many benefits; perhaps the greatest improvement in imaging performance has been in the lower voltage range (80-120 KeV). With modern Cs corrected TEM's able to obtain Angstrom level resolution at 80 KeV, this opens up the ability to investigate a wide range of materials problems. In the development process to produce an electron source with all the benefits of both cold and thermal emitters, the incorporation of a monochromator on a thermal source is one of the mechanisms of choice to minimize the energy spread.

The advantages of low voltage TEM imaging have been known for many years with reduced sample damage and typically improved contrast. These instruments will allow us insight in materials classes previously excluded from high-resolution analysis due to their beam-sensitivity. This will include light element materials, which can now be investigated at an unprecedented contrast and spatial resolution. Tunable Cs correction, monochromator and in-column energy filtering combined on one instrument platform provide a foundation for the future with a high resolution transmission electron microscope with advanced resolution and contrast capabilities.

Biography

Dr. Bell's research focuses on the application and development of advanced microscopy techniques to study the structure of materials at very high spatial resolution. The core area of research is based on transmission electron microscopy methods but we also use scanning probe techniques and other characterization techniques to provide information on how the structure of materials affects the properties these materials exhibit. Through collaborations with several researchers specialized in the synthesis methods, he applies these techniques to study a broad range of nanoscale materials. These materials are the building blocks of nanoscience and nanotechnology. Dr. Bell is a Lecturer in Applied Physics at SEAS since 2003 and is a teaching professor at the Harvard Extension School. Dr. Bell is an expert in the field of elemental analysis using electron microscopy (TEM and STEM) and has co-authored a book on this subject. Dr. Bell has been one of the pioneers of Helium Ion Microscopy and has published several papers on the fundamentals and novel applications of this microscope to materials science and biology. Dr. Bell is a Fellow of the Royal Microscopical Society, U.K.