MONASH University

DEPARTMENT OF MATERIALS ENGINEERING

Seminar

ELECTRON TOMOGRAPHY IN MATERIALS SCIENCE - UNRAVELLING THREE DIMENSIONAL STRUCTURE AT THE NANOSCALE

Dr. Matthew Weyland
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Monash Centre for Electron Microscopy

Tuesday 27th May 2008, 4:00 p.m. – 5:00 p.m.
Science Lecture Theatre S10

With materials science increasingly relying on design and control of microstructure at the nanoscale, microstructural characterisation is becoming increasingly challenging. While transmission electron microscopy (TEM) is one of the most powerful techniques for unravelling these kinds of structure, its transmission nature can be a serious limitation. This is because the properties of modern materials are often controlled by morphological features both smaller than the thickness of a TEM specimen (~100 nm) and complex in three dimensions (3D). One way around this limitation is electron tomography; where a three dimensional reconstruction of the specimen is achieved from a tilt series of electron micrographs. In recent years a number of researchers have pioneered the application of electron tomography, which was originally developed for the visualisation of cellular and macromolecular biological structure, in the physical sciences. Perhaps the most exciting aspect of this research is that it has lead to the application of large number of alternative imaging techniques to problems spanning a broad range of materials. These include the use of high angle annular dark field (HAADF) scanning transmission electron microscopy (STEM) for systems showing strong atomic number (Z) variations, core-loss energy filtered TEM (EFTEM) for visualisation chemical partitioning and low-loss EFTEM which can reveal 3D differences in bonding. The new instrumentation being installed at the Monash Centre for Electron Microscopy (MCEM) is equipped to apply existing tomography techniques to almost any materials system. It will also be used to expand the application of tomography, into 4D imaging and to atomic resolution in three dimensions.

Dr. Weyland is a Senior Research Fellow at the Department of Materials Engineering and a staff member at the Monash Centre for Electron Microscopy. He received his BSc from Brunel University, London in 1998. His postgraduate studies were carried out at Girton College, University of Cambridge with Dr. Paul Midgley in the Department of Materials Science and Metallurgy. He defended his Ph.D thesis, titled “Two and Three Dimensional Nanoscale Analysis: New Techniques and Applications” in 2001. This thesis pioneered the application of three dimensional electron microscopy to nanoscale materials systems. In 2002 Matthew was awarded a prestigious "Royal Commission for the Exhibition of 1851" fellowship, also held at Cambridge. In 2004, he took a postdoctoral position at the School of Applied and Engineering Physics, Cornell University, NY to work with Prof. David Muller. In late 2006 he moved to Monash University to take up a permanent position at MCEM, a new central research facility which will soon be the most well equipped electron microscopy laboratory in Australia. He joined the Department of Materials Engineering in 2007. His current research interests include the investigation of the resolution limits to electron tomography, characterization of functional nano-materials and the investigation of new imaging modes in the electron microscope.

Visitors are most welcome: Please note the parking arrangements. There is a designated Visitors Car Park (N1) clearly ground-marked by white paint and tickets, at a cost of $3/day, are available from a dispensing machine. (‘Blue’ permit designated areas are for Monash members only.). It is also possible to park at other designated Visitors Car Parks (E1, S1 and S2) on the Clayton Campus, but tickets are $1.4/hour.

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