NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

MSE – FACTS Joint Seminar:

Investigating Disorder in 'Soft' Materials at the Nanoscale using Scanning Electron Diffraction

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Abstract

In recent years the advent of fast and sensitive direct electron detectors, coupled with a huge increase in computing power, has enabled the nanoscale study of 'soft' materials that had previously been considered too beam-sensitive to investigate with the electron microscope. In addition, new 4D-STEM methods have evolved that allow a wealth of crystallographically-rich information to be acquired. Here we use a variant of 4D-STEM called scanning electron diffraction (SED) to investigate the local crystallography and, in particular, the nature of the disorder seen in certain polymers, molecular solids and hybrid organic-inorganic materials. SED uses a focussed but weakly-convergent beam such that when the beam is rastered across a 2D region of interest a 4D data set is acquired consisting of many thousands of 'spot' diffraction patterns. Such patterns can be analysed to provide information, for example, about changes in local orientation, determined through changes in the geometry of the pattern, and the distribution of microstructural defects through changes in the intensity of particular diffracted beams and the subsequent formation of 'virtual' dark field images. This presentation will focus on the development of the SED technique and what new structural information can be obtained from conformationally-disordered polymers, liquid crystalline polymers, twisted organic nanostructures and heterogeneous metal-organic frameworks.

Biography

Prof Paul A. Midgley FRS FIMMM MAE HonFRMS is Professor of Materials Science at the Department of Materials Science and Metallurgy in the University of Cambridge. He has studied a wide variety of materials by electron microscopy and has developed a number of novel electron microscopy techniques, including precession electron diffraction, new micro-analytical methods using energy filtered transmission electron microscopy (EFTEM) and scanning transmission electron microscopy (STEM) and the introduction and development of electron tomography in materials science. More recently he has focussed on multi-dimensional electron microscopy (e.g. 3D-ED and 4D-STEM) to reveal atomic and nanoscale information about highly beam sensitive materials, including polymers, hybrid organic-inorganic materials and pharmaceutical materials. In Cambridge, he was Director of the Electron Microscopy Facility (now known as the Wolfson Microscopy Suite) for ca. 20 years and Head of Department of Materials Science and Metallurgy from 2018 to 2020. Between 2003 and 2010 he was Editor-in-Chief of the journal Ultramicroscopy. In 2004 he was the Federation of European Materials Societies (FEMS) Lecturer and recipient of the Institute of Materials Rosenhain Medal. He was awarded a Royal Academy of Engineering / Leverhulme Trust Senior Research Fellowship in 2005/6. He won the Ernst-Ruska Prize awarded by the German Microscopy Society in 2007. Between 2008 and 2012 he was President of the European Microscopy Society, and between 2012 and 2016 served as its Past-President. He was made a Fellow of the Royal Society in 2014, an Honorary Fellow of the Royal Microscopy Society in 2016, a Fellow of the IOM3 in 2020 and a Member of Academia Europaea in 2021.

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Please register here.
Hosted by: Professor Lam Yeng Ming

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