

# Monash Centre for Electron Microscopy Seminar



## Prospects for High Resolution Analytical Transmission Electron Microscopy of Beam Sensitive Materials



**Tuesday 28 August, 2018**



**11.30am**



**Lecture Theatre S2  
16 Rainforest Walk  
Monash Clayton Campus**



**Professor Rik  
Brydson**

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and Process  
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of Leeds**

### Abstract

High resolution analytical transmission electron microscopy (TEM) of materials systems such as organic crystalline materials, hybrid organic-inorganic materials, hydrated inorganic materials and nanoparticle dispersions in liquids or polymers allows, in principle, information on structure and chemistry to be extracted at the single particle level. This information complements that obtained using many other lower resolution or averaging techniques such as X-ray diffraction, (Polarised) Light Microscopy or Infra-red or Raman spectroscopies.

However, a major issue preventing high resolution analysis of beam sensitive materials by TEM is electron beam induced damage which can lead to both structural and chemical change. Hence, prior to any investigation, a detailed study of both the critical fluence (aka "dose") and fluence rates is required in order to identify the safe limits for analysis by electron diffraction, imaging and also spectroscopy.

We review a number of strategies for analysis including low dose phase contrast TEM and scanning TEM (STEM), as well as the preparation using plunge freezing and cryo-FIB and the study of rapidly frozen thin sections using cryo-TEM and cryo-STEM. We demonstrate the ability to identify different crystalline polymorphs, structural defects in the bulk and at surfaces of crystals using atomic resolution TEM/STEM, and compositions and chemistries of particles and their interaction with liquid media via adsorbed layers via energy dispersive X-ray analysis and (high energy resolution) electron energy loss spectroscopy. We also discuss the future prospects for the analysis of such materials and their study in complex processed or natural products.

### About the Presenter

Professor Rik Brydson (Leeds) oversees the Materials Characterisation Research group at Leeds and coordinates the interdisciplinary Electron Microscopy (LEMAS) Centre which houses extensive (environmental) SEM, TEM and FIB instrumentation and is an EPSRC Nanoscience Research Equipment Facility (LENNF) funded 2008-2016. He was co-director for the Centre for Molecular Nanoscience and Crystallisation in Chemistry at Leeds. He has 30 years research experience of electron microscopy and surface analysis from a large number of different classes of materials. He leads the SuperSTEM aberration corrected microscopy consortium at Daresbury Laboratories in Cheshire, is currently a member of Executive Board of the European Microscopy Society, a member of Council of the Royal Microscopical Society, a former Chair and also Secretary of the EMAG group of the Institute of Physics.

In recent years his research interests have focused on applying high spatial resolution characterisation methods (particularly TEM and EELS) to the nanochemical analysis of softer, more radiation sensitive.

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