

Innovation in materials characterisation: UK-Japan studies on energy-related materials using large-scale facilities

The ability to generate and store energy is one of the key challenges facing humanity. Understanding the behaviour of energy materials on the atomic scale is vital in optimising their properties to provide the energy we need in an economically and environmentally sound way. EPSRC, the Japan Society for the Promotion of Science (JSPS) and STFC's ISIS Neutron and Muon Source have co-organised a symposium on the study of energy-related materials using large facilities such as ISIS and the Diamond Light Source.

The Symposium was held near STFC's Rutherford Appleton Laboratory, home of ISIS and Diamond, on 22 Feb 2018, and attracted around 90 researchers. The meeting aimed to encourage collaboration between UK and Japanese scientists working in the energy materials area. It also aimed to highlight how facility-based techniques such as x-ray and neutron scattering can provide key information for the development of new materials to help tackle energy production and storage challenges.

Talks at the meeting were wide-ranging, including the role of neutron and x-ray diffraction in the understanding of chemical and electrochemical energy storage systems; development of polymer electrolyte fuel cells for zero emission vehicles, where water absorption on fuel cell cathode catalyst surface has been studied using x-ray methods; neutron studies of cathode material phases using a cell for studying battery discharge in-situ; and measurement of intrinsic diffusion coefficients for ion mobility in Li-ion battery materials using muons. X-ray techniques for imaging of automobile exhaust and fuel cell catalysts were highlighted, and the contribution of neutron diffraction to studies of thermoelectric materials – which enable the conversion of waste heat to useful energy – described. The use of hydrogenases – which play central roles in the metabolism of micro-organisms – for fuel cell catalysts was discussed.

Dr Philip King, Co-Chair of the meeting and a Division Head at the ISIS Neutron and Muon Source said, 'This meeting has demonstrated the richness of the energy materials field for collaborative work between the UK and Japan, and the benefits of using facility-based techniques for energy materials research.'

Professor Nobuo Ueno, Director of JSPS London, added: “It was convincing that many of the participants at this symposium were impressed by the scientific possibilities of synchrotron radiation and Muon beam in analyses of energy-related materials as explained by the presenters on both the Japan and UK side. I understood also from these presentations that these materials have been waiting to be studied more with these beams of important characteristics; namely energy-tunable, polarization-controllable and pulsed photons beams and 100-% spin-polarized Muon beams. Therefore I believe that new collaborations between Japan and the UK can strengthen these challenging research areas. “



Symposium Participants