

Sustainable Energy Research using Neutrons: Recent Neutron Scattering Research at OPAL

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Creating a global energy system that is both environmentally and economically sustainable is unquestionably one of the largest challenges facing the scientific and engineering communities. Alternative energy sources, new materials, and gas sequestration technologies have risen as a result of the combined needs for energy and environmental sustainability, with the focus moving increasingly away from more traditional combustion of fossil fuels. Neutron scattering is essential to the study of sustainable energy materials. In particular, hydrogen (often as a proton) and lithium, are ideally suited to neutron scattering techniques of analysis that access information on structure and dynamics across a variety of length and timescales that are appropriately matched to these materials.

The Australian reactor source OPAL has recently commissioned a suite of neutron instruments, including two powder neutron diffractometers, which researchers at the Bragg Institute have used to understand sustainable energy materials. Much of this research involves *in-situ* experiments and often complex sample environments, particularly on the new high-intensity powder diffractometer which features a large area detector allowing rapid data acquisition. Some recent examples of this research will be presented, including hydrogen storage in porous materials, structural studies during charge-discharge cycling of whole batteries, and the *in-situ* formation of methane clathrates.