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**Neutron and synchrotron X-ray scattering studies of advanced energy materials**

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**D**iffraction of penetrating radiation – neutrons and synchrotron X-rays – offers unique opportunities for the study of advanced energy materials under a wide range of complex conditions associated with thermo-mechanical loading, imposed electrochemical and environmental conditions, etc. In this lecture I shall provide an overview of recent studies involving neutron diffraction, Wide Angle X-ray Scattering (WAXS) and Small Angle X-ray Scattering (SAXS) of materials ranging from advanced metallic alloys of nickel, titanium, aluminium and magnesium, to ceramics, including zirconia and silica, to cathode materials for lithium ion batteries. Important aspect of such studies concerns the integration between the complex sample environment and the X-ray instrument (beamline) data collection. The insights obtained from these investigations will be presented, and further outlook for in situ and operando studies will be assessed.

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