UNRAVELING THE INNER WORKINGS OF ENERGY-RELATED MATERIALS USING IN-SITU X-RAY ABSORPTION TECHNIQUES

Faisal M. Alamgir
School of Materials Science and Engineering
Georgia Institute of Technology

Due to the tunability of synchrotron X-rays species-specific information can be obtained using X-ray Absorption Spectroscopy (XAS) from nearly every known constituent element of energy-related materials. Using the near-edge or the extended fine structure in an XAS spectrum, the chemical state and the local atomic structure from a material can be obtained from a single experiment. In addition, the high brightness, high coherence and short pulse trains allow synchrotron light to be used for species-specific, in-situ studies at high temporal and energy resolutions. We will look at examples of in-situ (and ex-situ) XAS measurements in the area of energy storage (Li-ion battery intercalation reactions), energy conversion (surface reactions on fuel-cell catalysts) and energy harvesting (catalytic H_2 production from ethanol). Using a survey of the current state of in-situ synchrotron X-ray measurements of materials for energy storage, conversion and harvesting, a vision of the future research that will result from the advent of the next generation of synchrotrons, such as the NSLS II, will be presented.