

In Situ Anomalous Small-angle X-ray Scattering Studies of Platinum Nanoparticle Fuel Cell Electrocatalyst Degradation

Debbie J. Myers

Argonne National Laboratory, Chemical Sciences and Engineering Division, Argonne, IL 60439

One of the phenomena responsible for performance degradation of polymer electrolyte fuel cells is loss of electrochemically active surface area of the platinum-based electrocatalysts. We are studying the key mechanistic steps in the degradation of Pt and Pt alloy nanoparticle electrocatalysts in an aqueous environment and in the fuel cell environment using *in situ* anomalous small-angle x-ray scattering (ASAXS) and x-ray absorption spectroscopy (XAFS). These techniques allow correlation of the loss of electrochemically-active surface area with particle growth (ASAXS) processes and with Pt loss (XAFS edge step analysis) and to relate these two loss processes to the extent of Pt oxidation as a function of cell operating conditions. Studies of the mechanisms of loss provide the foundation for the design of more durable electrocatalysts and definition of the operating conditions that maximize the performance lifetime of these materials.