Degradation of Pt and Pt alloy nanoparticle catalysts monitored in situ by X-rays

Peter Strasser

The Electrochemical Energy, Catalysis, and Materials Science Laboratory
Department of Chemistry, Chemical Engineering Division, Technical University Berlin, Germany
pstrasser@tu-berlin.de

Electrified supported Pt and Pt alloy nanoparticle ensembles undergo irreversible changes in composition, shape and size depending on the nature of the catalyst material, the support, the electrode potential and the chemical environment(*1-7*). The structural and compositional changes form the atomic-scale basis of irreversible changes in macroscopic variables, such as active surface area or average catalyst composition, which are generally associated with the stability of electrocatalysts(*5, 8*). While a number of basic degradation mechanisms have been hypothesized (*3*) reliable experimental methods to monitor and unambiguously distinguish different degradation processes are still missing.

Here, we report on new experiments using X-ray scattering techniques to study size and compositional dynamics of mono- and bimetallic particle ensembles in catalyst layers and full single MEAs. In particular we have performed a comparative in situ SAXS study of Pt coarsening on different carbon supports and Anomalous SAXS experiments during the formation of core shell catalysts.

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