

Near-Surface Atomic and Electronic Structural Effects in Layer-By-Layer Derived Core-Shell Catalysts

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A review of our recent work on layer-by-layer near-surface effects of atomic and electronic structure on catalytically relevant properties will be presented. We use surface-limited redox replacement (SLRR) for layer-by-layer growth of platinum group metals (PGM), and measure the evolution of electronic and atomic structure using synchrotron-based X-ray Photoelectron Spectroscopy (XPS) and X-ray absorption spectroscopy. XPS using a tunable energy synchrotron X-ray source allows us to profile the transitions in the electronic structure from the surface down to the adlayer/support interface and beyond. In addition to depth profile studies of these layered metal architectures, the effects of thermally and electrochemically activated near-surface alloying in the PGM systems will be presented here. We observe undulations of near-surface electronic structure brought on by the low-dimensionality of the PGM adlayer as well as the adlayer-support interactions, effects that can explain the resulting surface electrochemistry in these systems.

