Secret Lives of Nanoscale Catalysts during Reactions

Feng Tao

Department of Chemistry, University of California- Berkeley

Chemistry and Materials Science Divisions, Lawrence Berkeley National Lab

Abstract

The surface structure and chemistry of nanoscale catalysts during reactions under high-pressure conditions were explored with new high-pressure surface analytical techniques including high-pressure XPS (HP-XPS) and high-pressure STM (HP-STM). During CO oxidation over Rh nanoparticles, an active catalytic phase, RhO_x, formed and was identified with HP-XPS. Additionally, our studies show that core-shell Rh-Pd bimetallic nanoparticles restructure under alternating oxidizing and catalytic/reducing conditions. The ability to restructure nanoparticles under different ambient conditions suggests a strategy for the development of new catalysts. Furthermore, platinum stepped crystal surfaces Pt(557) and Pt(332) can reversibly form nanoclusters under high pressure and low pressure conditions, suggesting the creation of highly active catalytic sites in such environments.