

Support Reducibility Impacts Reaction Pathways

We have recently uncovered how the support impacts the activation of oxygen for oxidation reactions. This discovery was based on the oxidation of carbon monoxide catalyzed by gold (Au) nanoparticles dispersed both on a reducible and on a non-reducible phosphate support. Three competing pathways were discovered which depend upon the pre-treatment history and the type of support. By simultaneously monitoring surface species (by infrared spectroscopy) and gas phase species (by mass spectrometry) during transient gas switches, the types of carbon monoxide adsorption sites, the nature of available reactive oxygen, and the oxidation reaction pathways could be determined. It was found that active oxygen is derived from the reaction with 1) hydroxyl groups on the surface of the phosphate, 2) from structural oxygen composing the reducible phosphate or 3) from the direct reaction between carbon monoxide and oxygen adsorbed onto the Au particle or its periphery. The first two pathways aid in accelerating or maintaining the catalytic process when water is around or if there is a temporary oxygen deficiency, while latter pathway is prevalent when the support becomes dehydrated or the support loses oxygen beyond a certain amount. *The results demonstrate the kind of versatility that can be built into a catalytic system if the fundamental details of the catalytic process are well understood.*

Meijun Li, Zili Wu and Steven H. Overbury “CO oxidation on phosphate-supported Au catalysts: Effect of support reducibility on surface reactions” *Journal of Catalysis*, **2011**, 278, 133-142.

