

Atomically Dispersed Pt on Au Nano-octahedra with High Catalytic Activity on Formic Acid Oxidation

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Platinum was epitaxially deposited on gold octahedral nanoparticles using an electrochemical method. The coverage of platinum on the gold surface was finely controlled from fully covered multiple overlayers (5 monolayers; denoted as ML) to atomically dispersed sub-monolayer (0.05 ML). Catalytic activity for formic acid oxidation greatly increased by two orders of magnitude with decreasing coverage. This high activity resulted from the control toward direct pathway producing no surface-poisoning species (CO), helped by ensemble effect of isolated Pt atoms and bifunctional effect of neighboring Pt-Au sites. The distribution of atomically dispersed platinum was further confirmed by no activity for methanol oxidation, which necessitates platinum ensemble. This result exemplifies that a rational design of catalyst nanostructure can lead to contrasting activities for the same catalyst; unprecedented activity for formic acid oxidation vs. no activity for methanol oxidation.