Shape Effect of Pt Nanocrystals on Electrocatalytic Reaction

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Shape-controlled platinum nanocrystals have different surface atomic structure. For example, cubic nanoparticles have only (100) surfaces while octahedral or tetrahedral nanoparticles are fully bound by (111) surfaces. Cuboctahedral nanoparticles have both (100) and (111) surfaces. Here, we synthesized cubic, cuboctahedra, and porous Pt nanoparticles and investigate the effect of shape on selectivity for electrocatalytic reaction. As a model reaction, we used electrocatalytic hydrogenation of 2-cyclohexenone. Surface-capping agents of the nanoparticles were removed by an electrochemical activation procedure, and consequently each type of nanoparticle showed the characteristic H adsorption/desorption peaks consistent with the corresponding single crystalline surface. 2-cyclohexenone was electrocatalytically hydrogenated to cyclohexanone and cyclohexanol, and the selectivity showed dependence on the shape of the nanocrystals, probably resulting from the distinct surface atomic structure.