Shape-Controlled Platinum Nanoparticles: Comparison with Single-Crystalline Study for Ethylene/Benzene Hydrogenation

이현주*
연세대학교 화학공학과
(azhyun@yonsei.ac.kr*)

Single crystalline platinum surface have been shown to exhibit distinctive catalytic activity and selectivity for different surface structures. Nanoparticles (NP) with the different surface property which result from morphology control can lead to better activity and selectivity for catalytic reaction. Catalytically active platinum NP have been synthesized by using tetradecyltrimethylammonium bromide(C14TAB) as a surface stabilizing agent. Cubes, cuboctahedra, and porous NP were synthesized by manipulating reduction kinetics. The C14TAB-capped NP showed a superior catalytic activity (7.1 times) to the NP synthesized by polymeric capping agent (polyvinylpyrrolidone) and silver for ethylene hydrogenation. The effect of the shapes of NP was estimated for benzene hydrogenation. Single crystalline (100) surface produces only cyclohexane as products while (111) surface produce cyclohexane and cyclohexene. The same trend was observed for NP. However, these nanoparticles showed better TOF (3.5 times), lower activation energy, and better selectivity to cyclohexene (2.6 times).