Effect of Particle Morphology on the Ripening of Supported Pt Nanoparticles

To improve the understanding of sintering in diesel and lean-burn engine exhaust after-treatment catalysts, we examined oxygen-induced sintering in a model catalyst consisting of Pt nanoparticles supported on a planar, amorphous Al2O3 substrate. After aging at increasing temperatures, a transmission electron microscopy analysis reveals that a highly monodispersed ensemble of nanoparticles transformed into an ensemble with bimodal and subsequently Lifshitz–Slyozov–Wagner particle size distribution. Moreover, scanning transmission electron microscopy and atomic force microscopy analyses suggest that the Pt nanoparticle had size-dependent morphologies after sintering in the oxidizing environment. The evolution of the particle sizes is described by a simple kinetic model for ripening, and the size-dependent particle morphology is proposed as an explanation for the observed bimodal particle size distribution shape.

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