Title:	Pd Nanoclusters Supported on MgO(100): Effects of Cluster Size on Chemisorption Properties
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Description:	Low-temperature methane combustion for applications in electric generator turbines is catalyzed by Pd nanoparticles to minimize NOx pollution. The reaction depends on the dissociation of methane molecules on the Pd surface. Nanoscale Pd particles contain coordinatively unsaturated Pd atoms which may facilitate the dissociation of CH4, thereby making this process more facile. Little is known about how metal particle size affects dissociation of small hydrocarbons, in spite of its obvious importance in a variety of catalytic processes. We propose to study particle size effects on the adsorption and dissociation of methane, ethane, and propane on model catalysts consisting of size-controlled Pd nanoclusters supported on MgO(100). The reactions will be studied by molecular beams and temperature programmed desorption at low temperatures, a regime little explored for such well-defined model catalysts. MgO(100) thin films will be grown on a Mo(100) substrate. Pd will be vapor deposited at low temperatures and annealed to control the size of the Pd nanoparticles. The organic molecules will be deposited with a cold molecular beam to prevent direct dissociation upon impact, or at higher energies to open up direct dissociation. Complementary non-contact atomic force microscopy (NC-AFM) measurements will yield information about the morphology and number density of the Pd nanoclusters as a function of deposition temperature and coverage, under the same conditions as the TPD experiments conducted at PNNL. Together these measurements will allow a greater understanding of the catalytic activity of this important combustion catalyst, and particle size effects in hydrocarbon catalysis in general.