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CO oxidation reactivity of Pt nanostructures on Titanium oxide

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We studied CO oxidation reactivity for Pt deposited on native TiO_2 formed on Ti foil. The Pt catalysts were prepared by evaporation of Pt on a flat titanium oxide film, and their surface structures were characterized by scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy (XPS). For lower amounts of Pt deposited (<2nm), separate Pt nanoparticle could be observed. With increasing amount of Pt, agglomeration of Pt nanoparticles into more complicated nanostructures was found. When about 5nm of Pt was deposited, the TiO_2 surface was almost completely covered by Pt. Additional deposition of Pt on these complete Pt-layers resulted in formation of small nanoparticles (~ 5nm) on top of them. CO oxidation reactivity normalized with respect to the amount of Pt deposited initially decreased with increasing Pt coverage, mainly due to the decrease of the surface to volume ratio; however, the reactivity increased as the amount of Pt deposited exceeds 5 nm, which correlated with the unique structural properties of Pt-adlayers observed using SEM. The results are compared with the Pt nanostructures deposited on TiO_2 thin films prepared by chemical vapor deposition (CVD).