

CO oxidation mechanism of Pt nanostructures deposited on Tantalum oxide

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CO oxidation reactivity of Pt nanostructures formed on tantalum oxide films was studied at 483 K, and the results were compared with those of the respective bulk crystal. Pt nanostructures were prepared by evaporation of Pt under high vacuum conditions, and their surface structures were analyzed using scanning electron microscopy (SEM) and x-ray photoelectron spectroscopy (XPS). For relatively lower amounts of Pt deposited ($< 2\text{nm}$), separate Pt particles can be observed, whereas at higher Pt coverages, agglomeration of Pt nanoparticles can be observed. For Pt nanostructures on tantalum oxide, in general, the CO oxidation reactivity is constant during the experiments. In contrast, for Pt-bulk (or when the amount of Pt deposited is than 4 nm on tantalum oxide), a gradual increase of the reactivity as a function of reaction time can be found, i.e. the initial CO-oxidation rate is low; however, the reactivity is accelerated with increasing reaction time. The initial reactivity of Pt-nanostructures is much higher than that of the Pt-bulk; however, as the reaction time increases, Pt-bulk may become more reactive. Our result is attributed to the growth of the "hyperactive area" on Pt-bulk as the reaction time increases, which cannot be found for Pt-nanostructures on tantalum oxide.