ST-P004

Catalytic Activity of Au/TiO_2 and Pt/TiO_2 Nanocatalysts Synthesized by Arc Plasma Deposition

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Syntheses of oxide supported metal catalysts by wet-chemical routes have been well known for their use in heterogeneous catalysis. However, uniform deposition of metal nanoparticles with controlled size and shape on the support with high reproducibility is still a challenge for catalyst preparation. Among various synthesis methods, arc plasma deposition (APD) of metal nanoparticles or thin films on oxide supports has received great interest recently, due to its high reproducibility and large-scale production, and used for their application in catalysis. In this work, Au and Pt nanoparticles with size of 1-2 nm have been deposited on titania powder by APD. The size of metal nanoparticles was controlled by number of shots of metal deposition and APD conditions. These catalytic materials were characterized by x-ray diffraction (XRD), inductively coupled plasma (ICP-AES), CO-chemisorption and transmission electron microscopy (TEM). Catalytic activity of the materials was measured by CO oxidation using oxygen, as a model reaction, in a micro-flow reactor at atmospheric pressure. We found that Au/TiO_2 is reactive, showing 100% conversion at 110°C, while Pt/TiO_2 shows 100% conversion at 200°C. High activity of metal nanoparticles suggests that APD can be used for large scale synthesis of active nanocatalysts. We will discuss the effect of the structure and metal-oxide interactions of the catalysts on catalytic activity.

Keywords: CO oxidation, Flow reactor, Arc plasma deposition, Nanocatalyst