Reactivity of Pt, Rh and Pt-Rh Nanoparticles on TiO_2(110)

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Abstract

Growth of bimetallic Pt-Rh nanoparticles and catalytic properties of Pt, Rh and Pt-Rh nanoparticles supported on TiO_2(110) surface were studied with STM, low energy ion scattering (LEIS), X-ray photoelectron spectroscopy (XPS), and temperature programmed desorption (TPD) techniques. CO and NO were used as probe molecules for chemical studies. An STM study of Pt deposited on Rh/TiO_2(110) showed that Pt grows on both TiO_2 and Rh nanoparticles. A LEIS study of Rh growth on 2ML of Pt performed at room temperature and low temperature indicates that Rh likely diffuses into Pt nanoparticles, leading to formation of bimetallic nanoparticles. Pt and Rh nanoparticles decompose NO to form N_2. However, in addition to N_2, N_2O was produced on Pt-Rh bimetallic nanoparticles. Much more CO_2 was produced on Pt-Rh bimetallic nanoparticles in the reaction of NO with CO, compared to pure metal nanoparticles. Oxygen desorption was not detected during TPD experiments. This study shows that the reactivity of bimetallic nanoparticles is different from that of pure metals.