

Pt₃Ru₆ Clusters Supported on γ -Al₂O₃: Synthesis from Pt₃Ru₆(CO)₂₁(μ ₃-H)(μ -H)₃, Structural Characterization, and Catalysis of Ethylene Hydrogenation and *n*-Butane Hydrogenolysis

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The supported clusters Pt–Ru/ γ -Al₂O₃ were prepared by adsorption of the bimetallic precursor Pt₃Ru₆(CO)₂₁(μ ₃-H)(μ -H)₃ from CH₂Cl₂ solution onto γ -Al₂O₃ followed by decarbonylation in He at 300 °C. The resultant supported clusters were characterized by infrared (IR) and extended X-ray absorption fine structure (EXAFS) spectroscopies and as catalysts for ethylene hydrogenation and *n*-butane hydrogenolysis. After adsorption, the ν_{CO} peaks characterizing the precursor shifted to lower wavenumbers, and some of the hydroxyl bands of the support disappeared or changed, indicating that the CO ligands of the precursor interacted with support hydroxyl groups. The EXAFS results show that the metal core of the precursor remained essentially unchanged upon adsorption, but there were distortions of the metal core indicated by changes in the metal–metal distances. After decarbonylation of the supported clusters, the EXAFS data indicated that Pt and Ru atoms interacted with support oxygen atoms and that about half of the Pt–Ru bonds were maintained, with the composition of the metal frame remaining almost unchanged. The decarbonylated supported bimetallic clusters reported here are the first having essentially the same metal core composition as that of a precursor metal carbonyl, and they appear to be the best-defined supported bimetallic clusters. The material was found to be an active catalyst for ethylene hydrogenation and *n*-butane hydrogenolysis under conditions mild enough to prevent substantial cluster disruption.