

Characterization of Alumina-Supported Pt-Ru Catalyst and Its Activities for Ethylene Hydrogenation and *n*-Butane Hydrogenolysis

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ABSTRACT

Gamma-alumina supported bimetallic Pt-Ru catalyst (Pt-Ru/ γ -Al₂O₃) was prepared by impregnation of Pt₃Ru₆(CO)₂₁(μ_3 -H)(μ -H)₃ cluster in CH₂Cl₂ solution on γ -Al₂O₃ and decarbonylated in helium at 300°C. Changes of the cluster before and after decarbonylation, monitored by infrared (IR) spectroscopy indicated that Pt₃Ru₆(CO)₂₁(μ_3 -H)(μ -H)₃ adsorbed strongly to surface of γ -Al₂O₃ and could not be extracted from support by CH₂Cl₂ solvent. In addition, Pt-Ru/ γ -Al₂O₃ was characterized by extended X-ray absorption fine structure (EXAFS) spectroscopy which confirmed that Pt and Ru were still intact after decarbonylation. Some changes in the cluster bonding were likely caused by cluster-support interaction. The catalyst was active for ethylene hydrogenation and *n*-butane hydrogenolysis. The temperature dependence of both reactions gave apparent activation energy of 8.4 ± 0.1 and 30.9 ± 0.1 kcal/mol, respectively.

KEYWORDS

Bimetallic catalyst, Pt-Ru, alumina, ethylene hydrogenation, *n*-butane hydrogenolysis