The use of heterogeneous catalysis is well established in chemical synthesis, energy, and environmental engineering applications. Supported Pt nanoclusters have been extensively reported to act as catalysts in a wide number of chemical reactions.

In this study, the performance of Pt/ZrO2 nanocatalyst is investigated for the decomposition of methanol, ethanol, 2-propanol, and 2-butanol. The potential of each alcohol for the production of H2 and other relevant products in the presence of a catalyst is studied. All the alcohols studied show some decomposition activity below 200°C which increased with increasing temperature. In all cases, high selectivity towards H2 formation is observed. With the exception of methanol, all alcohol conversion reactions lead to catalyst deactivation at high temperatures (T >250°C for 2-propanol and 2-butanol, T >325°C for ethanol) due to carbon poisoning. However, long-term catalyst deactivation can be avoided by optimizing reaction conditions such as operating temperature.

In addition, the performance Pt/γ-Al2O3 is evaluated in the oxidation of 2-propanol. Pt nanoclusters of similar size (~1 nm diameter) but different structure display distinctively different catalytic properties. All the systems studied achieve high conversion (~ 90%) below 100°C. However, flatter particles display a lower reaction onset temperature, demonstrating superior catalytic performance. Acetone, CO2, and water are generated as products indicating that both partial and complete oxidation are taking place.

A number of techniques including AFM, XPS, TEM-HAADF, XAFS as well as packed-bed reactor experiments were used for sample characterization and evaluation of catalytic performance.

Major: Environmental Engineering

Educational Career:
Bachelor’s of Environmental Engineering, BS, 2008, University of Central Florida

Committee in Charge:
Beatriz Roldan Cuenya, Chair, Physics/Civil, Environmental, and Construction Engineering
C. David Cooper, Civil, Environmental, and Construction Engineering
Debra Reinhart, Civil, Environmental, and Construction Engineering

Approved for distribution by Beatriz Roldan Cuenya, Committee Chair, on March 18, 2010.

The public is welcome to attend.