289aa Comparison of Nanostructured Au-Ceo2 and Au-Feox Catalysts for the Wgs and Co Oxidation Reactions

Weiling Deng, Colin Carpenter, Howard Saltsburg, and Maria Flytzani-Stephanopoulos

Nanostructured gold-cerium oxide and gold-iron oxide are active for both the low-temperature water-gas shift (WGS) reaction and preferential CO oxidation used to remove CO from H2-rich feed gas streams for fuel cell applications. Recent work in this laboratory has shown that the active sites of gold-ceria WGS catalysts are associated with Au-O-Ce phases and gold metal particles do not participate in the reaction [1,2]. However, gold nanoparticles in gold-iron oxide appear to be important for the CO oxidation.

Cyclic hydrogen temperature-programmed reduction with intermittent reoxidation showed that the surface structures of gold-ceria and gold-iron oxide catalysts are reversible. Considerable reoxidation by oxygen or H2O can occur even at ambient conditions for gold-ceria.

Gold nanoparticles weakly bound to ceria or iron oxide can be removed by sodium cyanide at pH>12. Only oxidized gold is present in the leached catalysts as confirmed by XPS and UV-Vis. Low-content gold on iron oxide exhibit a much lower reaction rate of CO oxidation than the parent catalyst and the apparent activation energy is different for the leached and parent catalysts. However, in WGS reactions, both leached and parent gold-iron oxides and gold-ceria have similar activation energies.

In this presentation, we will compare the structural effects and kinetics of the WGS reaction over gold-cerium oxide and gold-iron oxide for WGS reaction and CO oxidation. Several surface and bulk analytical techniques were used to characterize the samples.

References

1. Q. Fu, H. Saltsburg and M. Flytzani-Stephanopoulos, Science, 301 (2003) 935.

2. W. Deng, J. De Jesus, H. Saltsburg, M. Flytzani-Stephanopoulos, Appl.Catal. A, in press.