Ultra-stable Gold Nanocatalysts

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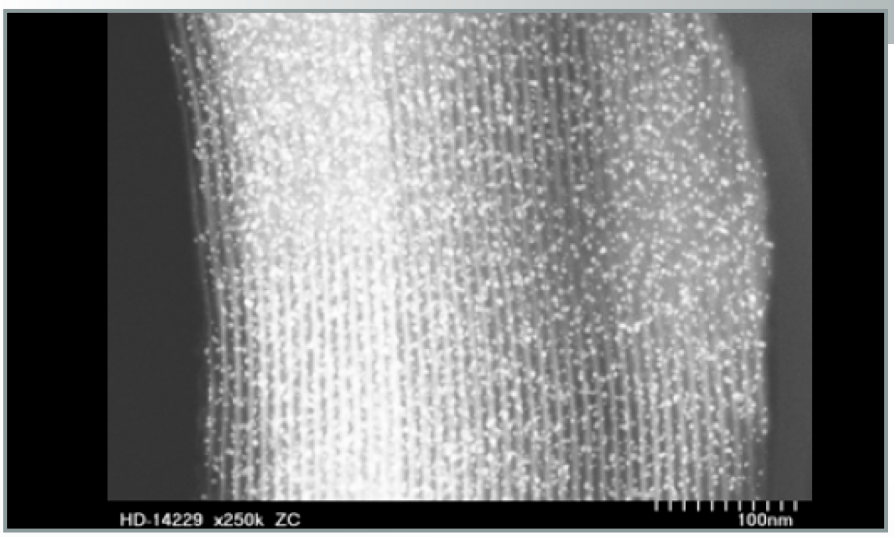

Technology Summary

Gold is inert in large quantities but exhibits surprisingly high catalytic activity when dispersed as small nanoparticles on selected metal oxides. ORNL researchers successfully deposited and stabilized gold nanoparticles on surfaces of rare earth materials, creating ultra-stable gold nanocatalysts that exhibit unprecedented efficiency in industrial oxidation processes. The bottleneck for commercialization of gold catalysts has been problems with critical stability.

The stability of the gold nanocatalysts yielded from this invention exceeds that of the gold reference nanocatalyst supplied by the World Gold Council. As a result, the nanocatalysts are an excellent fit for industry settings requiring reactions with improved catalytic efficiency. These nanocatalysts may be deposited on semiconductive metal oxides and alkaline earth metal hydroxides.

In one version of this invention, gold nanocatalysts are synthesized by depositing gold nanoparticles on rare earth phosphate nanoparticles. Another version of the invention employs a stabilizing support with two chemically distinct layers to form a multilayer support. This technique provides a gold nanocatalyst with enhanced stability at high temperature in oxygen-containing environments.

Advantages

- Improved stability under high-temperature treatments
- Oxidation ability of gold nanoparticles on semiconductive metal oxides

Potential Applications

- Industrial processes
- Catalyzing hydrocarbons in methanol synthesis
- Reducing nitric oxide by hydrogen, propane, or carbon monoxide
- Propylene epoxidation, PROX reaction, fuel cell applications, and hydrogenation of unsaturated hydrocarbons

Patent

Sheng Dai and Wenfu Yan, *Surface-Stabilized Gold Nanocatalysts,* U.S. Patent 7,629,291, issued December 8, 2009.

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