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研究论文

$Au/CeO_2/SiO_2$ 催化CO 低温氧化反应过程中CeO_2 的作用

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摘要 采用具有分等级孔道结构的 SiO_2 (HMS) 为载体, 通过润湿浸渍引入少量 CeO_2, 经焙烧得到 CeO_2/HMS 复合载体, 然后采用沉积沉淀法负载上 Au 纳米粒子, 得到 Au/CeO_2/HMS 三元复合催化剂. 通过 X 射线衍射、程序升温还原和原位红外光谱等手段表征了催化剂的结构. 结果表明, CeO_2 的存在可控制 Au 颗粒的沉积并稳定载体上的纳米 Au 颗粒. Au/CeO_2/HMS 上 CO 低温氧化反应完全转化温度为 60 °C. 高度分散的 Au0 可以活化 CO, CeO_2 颗粒则可以提供反应需要的氧. 稳定性测试结果显示, 反应 48 h 催化剂活性维持不变.

关键词: 二氧化硅 一氧化碳氧化 金 二氧化铈 稳定性

Abstract: Hierarchical composite nanostructure composed of Au, CeO_2, and SiO_2 was fabricated by sequentially depositing ceria nanoparticles through impregnation and calcination, and then gold nanoparticles through a deposition-precipitation method on hierarchical monolithic silica (HMS) with multi-length scale pore structure. The Au/CeO_2/HMS composite nanostructure was characterized by X-ray diffraction, temperature-programmed reduction, and diffuse reflectance infrared Fourier transform spectroscopy. The results indicate that the presence of ceria had a significant effect on targeted deposition and stabilization of small metallic gold nanoparticles on the support. The temperature for complete conversion of CO to CO_2 over Au/CeO_2/HMS is ca. 60 °C at a space velocity of 80000 ml/(g • h). The highly dispersed metallic gold nanoparticles can activate CO and the small ceria nanoparticles supply oxygen in the reaction. The catalytic activity remains considerably stable during 48 h stability testing. The interaction between gold and ceria contributed greatly to CO oxidation and the presence of silica improved the stability of the gold catalyst.

Keywords: silica, carbon monoxide oxidation, gold, ceria, stability

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