Room-temperature CO oxidation over highly ordered mesoporous RuO_2 catalyst

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Highly ordered mesoporous ruthenium dioxide (meso-RuO_2) has been successfully synthesized by controlling the surface hydrophobicity of mesoporous silica template (KIT-6) via a nano-replication method. The meso-RuO_2 material, thus obtained, exhibits a well-defined mesostructure and high surface area (131 m^2 g^{-1}). The physicochemical properties of the meso-RuO_2 material are characterized by electron microscopy, X-ray diffraction, N_2 adsorption-desorption, temperature programmed techniques, and X-ray photoelectron spectroscopy. Pretreatment of the meso-RuO_2 catalyst under different gas environments (O_2, H_2 and CO) strongly affects the catalytic activity towards CO oxidation. The meso-RuO_2, pretreated by O_2 flowing at 200 °C, exhibited excellent catalytic activity for CO oxidation, 100% CO conversion with long-term stability at room temperature, whereas the meso-RuO_2 catalysts with pretreatment under other conditions are not very active at room temperature. It is found that the surface oxygen species, generated on the meso-RuO_2 during O_2 pretreatment at 200 °C, provide CO oxidation activity at room temperature.