Preparation and characterization of mesoporous TiO2-CeO2 nanopowders respond to visible wavelength

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Source: JOURNAL OF SOLID STATE CHEMISTRY **Volume:** 178 **Issue:** 1 **Pages:** 128-134 **DOI:** 10.1016/j.jssc.2004.10.028 **Published:** JAN 2005

Abstract: Mesoporous TiO2-CeO2 nanopowders responding to visible wavelength were synthesized by using a surfactant assisted sol-gel technique. They were obtained using metal alkoxide precursors modified with acetylacetone (ACA) and laurylamine hydrochloride (LAHC) as surfactant. The samples were characterized by XRD, nitrogen adsorption isotherm, SEM, TEM, and selected area electron diffraction (SAED), respectively. The 95 mol% TiO2-5 mol% CeO2 system yielded single anatase phase, however, further addition of the CeO2 formed cubic CeO2 structure while anatase TiO2 decreased. Additions of 5 and 10 mol% CeO2 increased the surface area, but those of 25, 50, and 75 mol% CeO2 did not affect it very much. By using this mixed metal oxides system, TiO2 can be modified to respond to the visible wavelength. The mixed metal oxides had catalytic activity (evaluating the formation rate of 13) about 2-3 times higher than pure CeO2, while nanosize anatase type TiO2, materials had no catalytic activity under visible light. The catalytic activity was almost proportional to the specific surface area. The formation rate of 13 was much improved by changing the calcination temperature and calcination period. Highest catalytic activity in this study was obtained for the 50 mol% TiO2-50 mol% CeO2 nanopowders calcined at 250degreesC for 24h.

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