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Ce, Ti modified MCM-48 mesoporous photocatalysts: Effect of the synthesis route on support and metal ion properties

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Abstract

New Ti-MCM-48 and CeTi-MCM-48 photocatalysts were obtained by impregnation of the MCM-48 silica support synthesized by a hydrothermal process with aqueous solution of Ti and Ce precursors. The immobilization of metal cations presented a low effect on the porosity, morphology and structure of MCM-48 mesoporous silica support as was evidenced by N₂ adsorption-desorption, X-ray diffraction, SEM and TEM electron microscopy. EDAX analysis and X-ray photoelectron microscopy (XPS) indicated that titanium cations were present on the mesoporous silica surface only as Ti⁴⁺ species and the effect of ceria on titanium speciation was different, compared to the CeTi-MCM-48 sample, previously obtained by direct synthesis. The photocatalytic properties of mono- and bimetallic catalysts were evaluated in degradation of phenol from water and correlated with the active metallic species concentration, distribution, speciation and their interaction with the support or each other. An advanced oxidation mechanism for phenol degradation by radical species was proposed.

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