Synthesis and characterization of silica MCM-48 as carrier of size-confined nanocrystalline metal oxides particles inside the pore system

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Abstract

The interpenetrating 3-dimensional channel system of silica MCM-48 has been selected for the deposition of Cu/Zn/O mixed metal oxide particles. With the wet impregnation technique aqueous solutions of metal acetates have been used to load the calcined form of the mesoporous silica. Successive impregnation yielded metal contents of ca. 9 wt.%. Calcination of the composite transformed the acetates to the metal oxides. X-ray powder diffraction and solid-state MAS NMR showed the uptake of the metal salt inside the pore system. N_2-adsorption, X-ray diffraction and TEM confirmed the mesoporous structure. XPS measurements and EXAFS analysis (Cu K- and Zn K-edges) confirmed the metal uptake. Whereas nano-disperse CuO particles have been obtained ZnO shows no regular structure and seems to have reacted with the silicate channel surface by coating the channel wall.