

Abstract

Mesoporous oxides attract a great deal of interest in many fields, including energy, catalysis and separation, because of their tunable structural properties such as surface area, pore volume and size, and nanocrystalline walls. Here we report thermally stable, crystalline, thermally controlled monomodal pore size mesoporous materials. Generation of such materials involves the use of inverse micelles, elimination of solvent effects, minimizing the effect of [water](#) content and controlling the condensation of inorganic frameworks by NO_x decomposition. Nanosize particles are formed in inverse micelles and are randomly packed to a mesoporous structure. The mesopores are created by interconnected intraparticle voids and can be tuned from 1.2 to 25 nm by controlling the nanoparticle size. Such phenomena allow the preparation of multiple phases of the same metal oxide and syntheses of materials having compositions throughout much of the periodic table, with different structures and thermal stabilities as high as 800 °C.