

Green solvothermal synthesis and characterisation of surface organosilylated hierarchical nanozeolite ZSM-5

ABSTRACT

Micellization of the exterior layer of zeolite precursor seeds with surface passivating organosilane groups is an effective technique to reduce aggregation of growing of crystallites. Simultaneously, this technique produces hierarchically porous material with additional mesopores, to minimise typical diffusional limitations encountered with conventional microporous zeolites. The average particle size and the pore architecture of the zeolite can be altered by changing the synthesis environment of the surface passivation process. In this study, low hazard organic solvents with different hydrophobicities (log P) have been used as an effective matrix for the surface organosilanization and crystallization processes of zeolitic species. A clear interaction of organosilane moieties on the exterior region of hierarchical nanozeolite ZSM-5 clusters is evidenced by solid-state nuclear magnetic resonance (NMR) analysis. In addition, hydrolysis of the organosilane molecules has been followed by mass spectroscopy analysis on the synthesis gel solution, leading to a mechanism proposed for the surface silanization processes of the zeolite nanoparticles using the soft-template surface passivating technique.