Catalytic Applicabilities of Mesoporous Materials Synthesized by Zeolite-Structure-Directing Surfactants

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A new synthetic strategy has been developed for the synthesis of zeolitic material that are composed of ultrathin crystals less than 5 nm thick, using surfactants functionalized with zeolite structure-directing (SD) groups. For example, $C_{22}H_{45}$-$N^+(CH_3)_2$-C_6H_{12}-$N^+(CH_3)_2$-C_6H_{13} can be used to obtain ultrathin MFI zeolite nanosheets with a single-unit-cell-thickness (2.0 nm) along *b*-axis. Depending on the synthesis conditions, the nanosheets can be assembled to irregular aggregation or regular stacking into a multilamellar structure. Surfactants with other-SD head groups can be used to obtain a mesoporous material composed of nanosponge-like disordered BEA zeolite network (~3 nm thick) or an MTW zeolite exhibiting nanoneedle morphologies. The surfactant head groups are the zeolite SDAs while the assembly of the tails leads to the generation of mesoporosity or mesoscale morphologies. The synthesis strategy using zeolite SD surfactants may be applied to other zeolites with mesoporosity. The resultant zeolites show possibilities as high-performance catalysts in reactions for the production of renewable energy and for the development of green chemical processes.