Rational Design of Nanoporous Materials via Templating Strategies

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The cooperative assembly between organic surfactants and inorganic species is a versatile route to ordered nanoporous materials with various structures and compositions. The nanopore diameters can be uniformly tailored, typically, in the range of 2 ~ 15 nm, which attracts much attention for advanced applications. In particular, the silica-based nanoporous materials afford possibilities to fabricate other nanostructured materials having various pore structures, and compositions such as carbon, metal oxides and organic polymers. Furthermore, it is possible to synthesize zeolites possessing high macroporosity (>50 nm in diameter) and mesoporosity (2~50 nm) in addition to their intrinsic crystalline microporous (< 2 nm) textures, by the use of multifunctional surfactants that direct porous structures in the multiple length scales. The hierarchically structured zeolites are suitable as an acid catalyst for the conversion of large molecules. Notably, the hierarchical zeolites exhibit a remarkable resistance to the catalytic deactivation as compared with ordinary zeolites. Here, we discuss on the synthesis, characterization and catalytic properties.