

Restructuring X Zeolite from Microporous to Mesoporous Materials by Controlled Decationization

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It was known that decationization of highly aluminous zeolites ($\text{Si}/\text{Al} < 1.3$) results in a complete loss of zeolite crystallinity. Although such structural transformation has been known for several decades, the pore structures of the amorphous phases have not been investigated to our best knowledge. The reason might be attributed to the lack of scientific interests in such ill-defined amorphous materials and to the hasty conclusion that atomically 'collapsed' phase would be nonporous. In this work, controlled decationization of NaX zeolite could produce hierarchically micro-/mesoporous aluminosilicates with systematically variable micro- and mesoporosity. The remarkable advantage of this process is that mesopores can be evenly generated over the entire domain of zeolite crystals, while conventional dealumination methods lead to heterogeneous structural destruction of zeolite crystallites. The present decationization method provides an extremely economic and simple templateless synthesis route to produce hierarchically micro-/mesoporous aluminosilicates, which are promising as heterogeneous catalysts and adsorbents for large molecular species.