

Zeolite Nucleation in Na-Rich Hydrogel Systems Yielding Low-Silica Zeolites

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It is clear now that the crystals obtained from hydrogel precursor systems are often formed via much more complex routes than the classical pathways established for the nucleation of inorganic cells in supersaturated solutions. This talk will summarize recent developments in the field with an emphasis on the nucleation process in hydrogel systems.

Special attention is paid to Na-rich aluminosilicate systems yielding zeolites with FAU- and LTA-type framework topology. A parallel study at ambient and conventional (high temperature) conditions is performed. The sluggish crystal growth kinetics at ambient conditions permits to track down the entire sequence of crystallization events from the formation of the initial gel to the complete transformation into a zeolite-type material. Then the investigation is performed at elevated temperature employing the same initial system. The processes taking place at nanometer scale are studied by high resolution transmission electron microscopy complemented by ^{23}Na 3Q-MAS NMR analysis, hyperpolarized ^{129}Xe NMR and other techniques. Thus, more light is shed on the relationship chemical composition - gel structure, the role of each component in the initial system, the temporal and spatial location of proto zeolite nuclei.

The last part of the talk is devoted to the preparation of polycrystalline zeolite structures with hierarchical organization. Examples how the knowledge gain in the fundamental studies could be applied in the fabrication of complex macrostructures will be given.