

Synthesis and Applications of Pentasil Zeolites

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Pentasil zeolites, with their medium-to-large pore architectures and well-defined framework topology, remain central to heterogeneous catalysis and adsorption technologies. However, their performance is not solely dictated by crystallographic structure, but also by more subtle features such as crystal morphology, mass-transport pathways, aluminum distribution, acidity gradients, and defect chemistry. These parameters critically influence both catalytic behavior and adsorption properties, including molecular diffusion, selectivity, and uptake capacity.

This presentation highlights recent advances in synthesis of pentasil zeolites across multiple length scales. By employing organic and inorganic modifiers as active structure-directing elements, it becomes possible to tailor crystal size, porosity, and accessibility, thereby transforming conventional diffusion-limited materials into optimized systems for both catalysis and adsorption processes. In addition, the role of defects is reconsidered, with silanol groups shown to actively participate not only in catalytic reactions but also in adsorption and host - guest interactions.

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