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Building concept inspired by raspberries: From microporous zeolite nanocrystals to hierarchically porous assemblies

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MICROPOROUS AND MESOPOROUS MATERIALS

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Abstract

Hierarchically porous zeolites offer great potential in catalytic and sorptive processes due to the enhanced mass transport properties by the increased diffusivity of the molecules from the bulk phase to the final active sites or sorption sites, respectively. In this contribution we present a simple, 3-step bottom-up preparation route yielding binder-free spherical zeolite material exhibiting a hierarchical pore system. This process consists of zeolite synthesis, aggregation and recrystallization. In this contribution, the process is demonstrated on silicalite-1 (MFI-type zeolite) as a model system. The aggregation process was realized by special spray drying of a complete reaction mixture containing pre-synthesized nanocrystals. The spray drying process results in spherical aggregates which contain amorphous silica species originating from the unconverted part of the zeolite synthesis mixture and which are acting as an intermediate binder. Steam-assisted crystallization was then applied to convert these amorphous species into crystalline zeolite enabling the overall process to utilize 100% of the initial silicon from the zeolite synthesis mixture. (C) 2016 Elsevier Inc. All rights reserved.

Keywords

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