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Mesoporous EU-1 zeolite with enhanced accessibility and diffusion for bulky molecular reaction

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Abstract: Mesoporous EU-1 zeolites with adjustable mesoporosity have been prepared by employing silanized silica into the starting synthesis gel, based on the hinder effect of organic moiety to crystal growth. The synthesized mesoporous EU-1 zeolites were characterized by XRD, NMR, SEM/TEM and N_2 adsorption/desorption at 77K, showing the persistence of inherent microporous framework structure of EU-1 zeolite and the existence of additional mesopores within the range of 3-10 nm. The generation of mesoporosities is from the intercrystalline voids of nanocrystal aggregates. The introduction of mesopores in EU-1 zeolite increased the adsorption of mesitylene with the kinetics diameter larger than the micropore size, and made it possible for the diffusion pattern of n-heptane from one-dimensional in microporous EU-1 to three-dimensional in mesoporous EU-1. This result together with the enhanced accessibility of acidic sites of mesoporous EU-1 improved greatly the catalytic activity and product yields of cumene cracking reaction involving bulky molecules.

Keywords: A. microporous materials, A. nanostructures, B. sol-gel chemistry, D. catalytic properties, D. diffusion

1. Introduction

EU-1, discovered by Casci et al. in 1981 and later identified by Briscoe et al., is a zeolite with one-dimensional channel system, EUO framework topology and medium-pore size [1, 2]. Its pore architecture is formed by a monodimensional system of 10-membered ring (10-MR) channels (0.54 × 0.41 nm) running