491d Synthesis and Characterization of Mesoporous Zsm-12 by Using Carbon Particles

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The generation of mesoporosity in 1-dimensional zeolite ZSM-12 was explored by using carbon black as template during synthesis. After the carbon particles were burned off, intracrystalline mesopore networks were formed. Mesoporous ZSM-12s with nominal Si/Al ratios of 40, 60, 75, 100 in the gel, were successfully synthesized. For relatively high C/Si and H_2O/Si ratios, there is higher chance to generate mesoporosity. Mesopore volumes around 0.15-0.19 cm^3/g and mesopores distributed in the range of 10-50 nm were determined by nitrogen physisorption. The STPD and FT-IR results revealed that these mesoporous ZSM-12s have the same number of acid sites as regularly synthesized ZSM-12s for comparable Si/Al ratios. For the synthesis gel containing the same nominal Si/Al ratios, the Si/Al ratios of the generated zeolites were almost the same in both the mesoporous and conventional ZSM-12 products, which indicated that the carbon black involved in the synthesis did not affect the crystallization efficiency of aluminum during the nucleation. The conversion of n-tridecane and 1,3-dimethylcyclyhexane were chosen as test reactions. The mesoporous ZSM-12s are found to exhibit higher activity compared to conventional ones especially under high WHSV. The enhanced activity is attributed to the introduction of the mesopores in the zeolite crystals, which decreases the intracrystalline mass transfer limitations. Moreover, the mesoporous samples promoted the production of longer and more branched products than the case of the traditional samples since the former ones favor to a higher extent the outwards diffusion of the products. It can be concluded that this is a general method for formation of mesoporosity for zeolites materials, which leads to superior intracrystalline mass transfer properties.