

Effect of Si/Al Ratio on SSZ-13 Crystallization and Its Methanol-To-Olefins Catalytic Properties

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Abstract : SSZ-13 materials with different Si/Al ratio were prepared by varying the composition of aluminosilicate precursor solutions upon hydrothermal treatment at 150 °C. The Si/Al ratio of the initial system was systematically changed from 12.5 to infinity in order to study the limits of Al composition in precursor solutions for constructing CHA structure. The intermediates and final products were investigated by complementary techniques such as XRD, HRTEM, FESEM, and chemical analysis. NH₃-TPD was used to study the Brønsted acidity of SSZ-13 samples with different Si/Al ratios. The effect of the Si/Al ratio on the precursor species, ultimate crystal size, morphology and yield was investigated. The results revealed that Al species determine the nucleation rate and the number of nuclei, which is tied to the morphology and yield of SSZ-13. The size of SSZ-13 increased and the yield decreased as the Si/Al ratio was improved. Varying Si/Al ratio of the initial system is a facile, commercially viable method of tailoring SSZ-13 crystal size and morphology. Furthermore, SSZ-13 materials with different Si/Al ratio were tested as catalysts for the methanol to olefins (MTO) reaction at 350 °C. SSZ-13 with the Si/Al ratio of 35 shows the best MTO catalytic performance.

Keywords : crystallization, MTO, Si/Al ratio, SSZ-13

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