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Effect of Micropore Size on Catalyst Deactivation in Vapor Phase Beckmann Rearrangement over Zeolites

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The vapor phase Beckmann rearrangement of cyclohexanone oxime (CHO) was carried out over TS-1 with an MFI pore structure and SSZ-31 and SSZ-24 with pore sizes larger than that of MFI to elucidate the effect of the pore size on catalyst deactivation. The deactivation constant over SSZ-24 was the highest among the zeolites used in the study. Furthermore, when the ratio between the molecular size of ε-caprolactam (CL) and the pore size of zeolite was unity, the deactivation constant was maximum over the zeolites at similar acidity. These results indicate that since CL produced on the active sites cannot diffuse from the micropores, the CL reacts to form coke or its precursor over a long residence time. The pore size of the zeolite is the main controlling factor of catalyst deactivation during the Beckmann rearrangement.

Keywords: Beckmann rearrangement, Cyclohexanone oxime, Zeolite, Caprolactam selectivity, Catalyst deactivation, Pore size effect

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