MOLECULAR SIEVE EFFECT IN THE HYDRATION OF OLEFINS ON ZEOLITES

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The reactivity of olefins in reactions proceeding by a carbonium ion mechanims varies in the series: ethylene < propylene < isobutylene. This series is observed for sulfuric acid and phosphoric acid hydration [1]. A similar activity series was found in our previous work on the hydration of olefins on type-Y zeolites [2]. Thus, the optimum temperature on various hydrogen and cation forms of zeolite Y is 330-370°C for ethylene, 260-280°C for propylene, and 200-250°C for isobutylene. The maximum conversion of olefins to alcohols at these temperatures and 2500 h^{-1} olefin space velocity is 3%, 4%, and 11%, respectively. Olefin reactivity for synthetic mordenites varies in the series: ethylene < propylene $\leqslant$ isobutylene [2].

A study of the hydration of these alkenes on high-silicon zeolite ZHM displayed an unusual reactivity order: ethylene = propylene > isobutylene. The optimum temperature for the hydration of ethylene and propylene is 250-280°C, and the molar yields of ethanol and 2-propanol were 5-6%. The molar yield of tert-butyl alcohol in the hydration of isobutylene at 150-200°C did not exceed 1%. Carbonization of the catalyst and the formation of isobutylene oligomers increased at higher temperature; the yield of tert-butyl alcohol did not increase. These results may be explained by a molecular sieve effect for olefin hydration and not by sample deactivation and side reactions since even a partially carbonized catalyst did not display reduced activity in olefin hydration.

LITERATURE CITED

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