

Shape Selectivity and Pore-mouth Catalysis in Ethanol to Hydrocarbons Process: Control by Postsynthetic Experiments

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Abstract

Beside MOBIL processes or catalytic cracking, conversion of ethanol to hydrocarbons (ETH) is an example of the well-known family of hydrocarbon pool processes. From the large variety of hydrocarbon products formed over the porous zeolite ZSM-5 questions arise not only on the preferred types of conversion reactions but also on their major location on the zeolite crystal during progressing catalyst coking.

From mechanistic consideration of dehydration and following build-up and cracking reactions the overall selectivity towards higher build-up products correlates with the accessibility of the pore system. (i) Pore cleaning in combination with dealumination increases the accessibility of the zeolite pores and supplies a good transport of bulkier products out of the pore channels. (ii) Artificial pore blocking by silicate impregnation and subsequent pore cleaning initially reduces product forming tendencies to higher hydrocarbons in gas phase. Additionally, liquid phase xylenes reveal an opening or closing of the pores by slightly preferred formation of sterically overdemanding m/o-xylene or matching p-xylene compared to the pore dimensions. In conclusion, tuned shape selectivity and final isomerization at the pore exit or pore mouth seems obvious. (see figure)

