

New Insights into the Mechanisms of Ethylbenzene Disproportionation over Medium-Pore Zeolites

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The catalytic performance of ethylbenzene (EB) disproportionation over various medium-pore zeolites (i.e., TNU-9, MCM-22, EU-1, NU-87, ZSM-5, IM-5, ITQ-2, ZSM-22, ZSM-23, ZSM-57, and TNU-10) are compared, and the detailed reaction mechanisms are discussed on the basis of ex situ gas chromatography-mass spectrometry (GC-MS) analyses. It was found that the diphenylethane (DPE) intermediates are formed on the three-dimensional or cage-containing 10-ring zeolites. The overall results of our study suggest that the EB disproportionation over three-dimensional or cage-containing 10-ring zeolites proceeds by a DPE-mediated reaction mechanism, while one-dimensional or two-dimensional but intersecting 10- and 8-ring ones does by a monomolecular ethyl-transfer pathway. The catalytic activity of medium-pore zeolites dominated by DPE-mediated pathway is much higher than that of the materials dominated by monomolecular ethyl-transfer pathway probably due to the lower activation energy.