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Hierarchical BEA and MOR zeolites as catalysts for N₂O and NO elimination

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ABSTRACT

In the work, we present the results of a study of the morphology, structural, adsorption and acid characteristics of the surface of the starting and indium-oxide-modified hierarchical BEA and MOR zeolites as well as their activity in the combined reduction of nitrous oxide and nitric oxide by propylene, including under conditions of the SCR reaction (in excess oxygen) and in the presence of water vapor.

Hierarchical materials containing crystalline BEA and MOR nanoparticles with different morphologies were obtained using polycationic surfactants differing in structure. The materials studied differ in their adsorption characteristics from usual 3D zeolites, in particular, by having well-developed external surface and higher accessibility to the active sites.

Comparison of our data on the activity of indium-containing H-BEA and H-MOR zeolites in the reactions studied suggests promise for the use of hierarchical BEA zeolite catalysts, which display considerable activity in the combined conversion of NO and N₂O also in the presence of moisture. Conversions of 73% and 69% of N₂O and NO, respectively (65%-64% in the presence of water vapor), are achieved on the most active 5% In₂O₃/H-BEA catalyst in the combined reduction of N₂O and NO by propylene at 550 °C due to a greater concentration of accessible surface Brønsted acid sites, which are the activation centers both for hydrocarbon reductant and for N₂O.

Keywords: Hierarchical zeolites, Acidity, In₂O₃/H-BEA, In₂O₃/H-MOR, N₂O, NO, SCR reaction

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