

Synthesis of [Zn,Al]HZSM-5 catalysts for enhanced ethane dehydroaromatization performance

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Advances in shale gas and natural gas extraction technology have led to an increase in production of ethane, the second largest component of natural gas, and a decrease in price. The process of producing high value-added substances such as olefins and aromatic compounds from ethane is attracting attention.

In this study, Zn/HZSM-5, in which Zn species were introduced into the framework of zeolite through isomorphous substitution, was synthesized at various Zn/(Zn+Al) ratios. The results of XRD suggest that Zn species were introduced into the framework of the zeolite in all prepared catalysts. Through UV-vis DRS, it was confirmed that macrocrystalline zinc oxide was not present in all catalysts, and ZnO nanoclusters were formed when the amount of Zn species exceeded the framework introduction limit. The introduced Zn species acted as active species for ethane dehydroaromatization, greatly increasing the catalytic activity compared to HZSM-5. As the amount of Zn species increased, the ethane conversion increased and BTX yield showed a volcano curve with the maximum when the Zn/(Zn+Al) ratio was 0.3.