

Effects of Hierarchical Zeolites on Aromatization of Acetylene

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Novel zeolite catalysts were employed to investigate the catalytic performance of aromatization from acetylene [1,2]. It is of essence that zeolite should have additional mesopores as well as micropores originally formed during conventional synthesis. The newly incorporated mesoporous structure has been known to significantly reduce diffusional resistance during reaction.

Among the synthesis methods for hierarchical zeolites, the classical ones are physical and chemical treatments such as dealumination [3] and desilication [4], but they may cause instability of structure and decreasing of surface area of zeolites.

In this work, a highly ordered 3-D hierarchical zeolite with high surface area (MCM-36) and a novel hierarchical zeolite (HCZ-1) induced by a surfactant were prepared for aromatization of acetylene.

The two different types of zeolites were characterized by physisorption and TEM imaging analyses. Fig. 1 (a) shows physisorption results of original MCM-22 and hierarchical MCM-36 derived from MCM-22 by exfoliation and pillaring. The isotherm and pore size distribution results (inset) indicated the existence of mesopores and the structure were highly ordered. The ordered structure of MCM-36 was more clearly and easily identified by TEM image (Fig. 1 (b)). Regarding HCZ-1, the existence of mesopores was identified by physisorption results (Fig. 1 (c)). Fig. 1 (d) shows different morphologies of original ZSM-5 and hierarchical HCZ-1 from ZSM-5 seeds.

Fig. 2 shows the catalytic activities of H-MCM-22 having only micropores and

hierarchical H-MCM-36 at 700 °C. Due to the mesoporosity of H-MCM-36 zeolite, the initial deactivation rate was slowed. It should be noted that selectivity of BTX (Benzene, Toluene and Xylene) were significantly increased. The mesoporosity of H-MCM-36 seemed to improve the accessibility of reactants to the acid sites and to suppress unnecessary side reactions by increasing the diffusion rate of product. These additionally incorporated mesopores seemed to help improve the BTX selectivity and slow the initial deactivation rate.

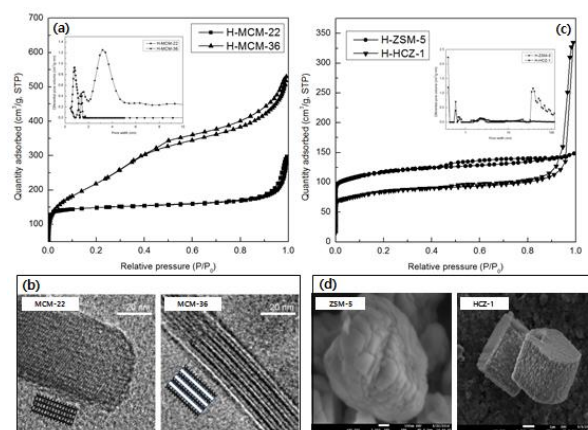


Fig. 1 Physisorption results (a), TEM images (b) of MCM-22 (left) and MCM-36 (right), physisorption results (c), SEM images (d) of ZSM-5 (left) and HCZ-1 (right)

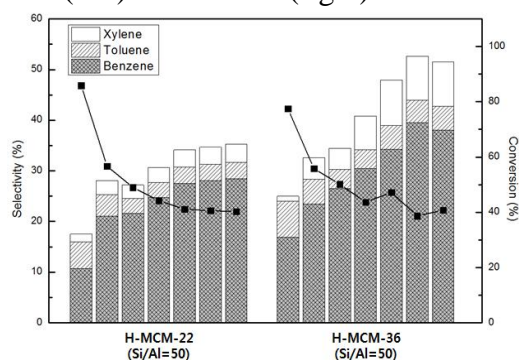


Fig. 2 Catalytic performances of H-MCM-22 and H-MCM-36 for the aromatization of acetylene

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