

Top-down HCl treatment to prepare highly active Ga species in Ga/ZSM-5 for propane aromatization

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Bifunctional zeolite-based catalysts often require high degree of interaction between the active metal and zeolite. Here, we propose a ‘top-down’ synthesis method for the preparation of Ga/ZSM-5, where a substantial amount of Ga is initially loaded and partially removed afterwards by acid treatment with HCl solution of different concentrations. Characterization results reveal that among the various Ga species originally created, the HCl treatment selectively eliminates the redundant Ga species on the zeolite surface, while causing minimal impact on the zeolite structure. The post-treated sample, left with Ga species located in the zeolite pores and strongly interacting with the zeolite, was successfully applied in propane aromatization; the sample treated with 0.2 M HCl showed an initial benzene, toluene, and xylene yield of 43.7 %, which was nearly 1.5 times higher than that of the Ga-impregnated sample prepared without such procedure, containing an identical Ga loading.