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Reaction pathways of n-pentane cracking on the fresh and regenerated Sr, Zr and La-loaded ZSM-5 zeolites

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Abstract

In order to reveal the influences of metal-incorporation and regeneration of ZSM-5 zeolites on naphtha catalytic cracking, the fresh and regenerated Sr, Zr and La-loaded ZSM-5 zeolites have been prepared and evaluated using n-pentane catalytic cracking as a model reaction. It was found that the metal-incorporated ZSM-5 zeolites promoted hydride transfer reactions, and the Zr-incorporation helped to promote and maintain the catalytic activity while reduced alkenes selectivity; the regenerated ZSM-5 zeolites promoted C-H bond breaking that increased alkenes selectivity and n-pentane conversion but accelerated catalyst deactivation. The regenerated metal-incorporated ZSM-5 zeolites combined the feature roles of metal-incorporation and regeneration in modulating reaction pathways, and seemed a promising way to balance the activity, stability and alkenes selectivity, facilitating the optimal production for light olefins. Within the research scope, the regenerated Zr-loaded ZSM-5 zeolites reached an optimal production (0.97 g) for light olefins in n-pentane catalytic cracking at 550 ºC with a weight hourly space velocity of 3.7 h^{-1} in 3 h, which was 24 % higher than that of the parent HZSM-5 (0.78 g).