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Analysis of Reaction Pathways for n-Pentane Cracking over Zeolites to Produce Light Olefins

Xu Hou, Yuan Qiu, Xiangwen Zhang, Guozhu Liu*

Key Laboratory of Green Chemical Technology of Ministry of Education, School of Chemical Engineering and Technology, Collaborative Innovation Center of Chemical Science and Engineering, Tianjin University, Tianjin 300072, PR China

Abstract

Reaction pathways including monomolecular protolytic cracking, hydride transfer, β -scission, and certain side reactions of n-pentane cracking over zeolites have been systematically investigated. Monomolecular protolytic cracking routes were mainly initiated by attack of acid sites on C-H or C₂-C₃ bonds. Operating conditions or zeolite pore caliber can tailor not only the first scission, but also the balance among carbenium ions related routes, e.g. hydride transfer, deprotonation, side reactions, etc. Increasing reaction temperature or zeolite pore caliber promoted the cleavage of C-H bond, and large pore caliber and high conversion were beneficial to the hydride transfer and side reactions. Compared to HZSM-35 and H-Beta, HZSM-5 zeolite with middle pore caliber exhibited the highest selectivity to light olefins, and Ag-incorporation can further promoted selectivity to light olefins at a little cost of P/E (propylene to ethylene) ratio. Promotion of Ag-incorporation on light olefins formation was probably due to the active sites generated by silver species acting as dehydrogenation sites, and enhancing the cleavage of C-H bond.

Keywords

n-pentane cracking, zeolites, reaction pathways, light olefins, metal-incorporation

*Corresponding author. Tel/Fax: +86 22 27892340. E-mail: gliu@tju.edu.cn

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