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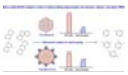
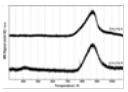
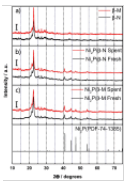
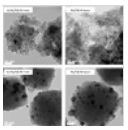
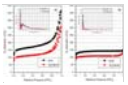


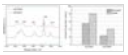
Table 1

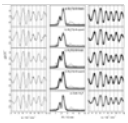












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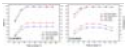

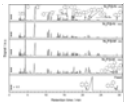

Table 3

Journal of Catalysis

Volume 351, July 2017, Pages 67–78

Morphology effect of β-zeolite supports for Ni_2P catalysts on the hydrocracking of polycyclic aromatic hydrocarbons to benzene, toluene, and xylene

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Received 12 October 2016, Revised 18 February 2017, Accepted 7 March 2017, Available online 4 May 2017

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https://doi.org/10.1016/j.jcat.2017.03.006

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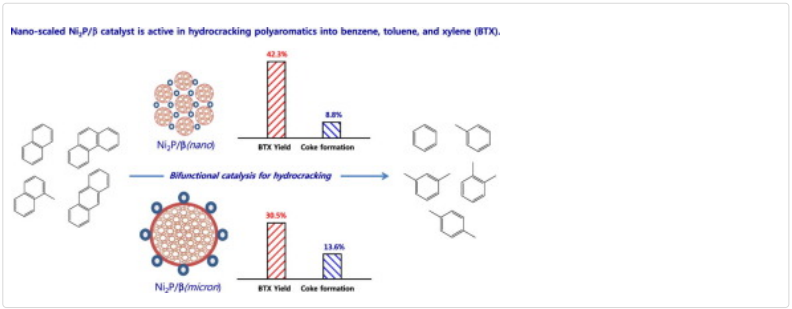
Highlights

- Ni_2P/β catalysts are active in 1-methylnaphthalene (1-MN) hydrocracking (HCK) to produce benzene, toluene, and xylene (BTX).
- Ni_2P/β-N catalyst promotes 1-MN HCK with BTX yield over 42%.
- Interparticulate mesopore system of β-N offers high dispersion of Ni_2P particles.

Abstract

Ni_2P catalysts supported on nano-sized β (β-N) or micrometer-sized β (β-M) zeolites were prepared by temperature-programmed reduction, and their structural and chemical properties were analyzed by N_2 physisorption, transmission electron microscopy, X-ray diffraction, extended X-ray absorption fine structure, NH_3 temperature-programmed desorption, and CO uptake. The catalytic activity was tested at 653 K and 6.0 MPa in a fixed bed reactor for the hydrocracking of 1-methylnaphthalene (1-MN) into benzene, toluene, and xylene (BTX). In the hydrocracking, Ni_2P/β-N showed better activity and stability for hydrocracking of 1-MN than Ni_2P/β-M, with BTX yields of 42.3% and 30.5% for Ni_2P/β-N and Ni_2P/β-M, respectively. In addition, Ni_2P/β-N maintained the stability in terms of catalytic activity and local structure, while Ni_2P/β-M suffered from coke formation, particularly in the presence of heavy aromatics such as phenanthrene in the feed. The characterization results demonstrated that the β-N has abundant intercrystalline mesopores to provide better dispersion for Ni_2P catalysts and accessibility toward acid sites, offering the proximity of the hydrogenation active center and the cracking sites. Kinetic analysis for the hydrocracking of 1-MN over the catalysts revealed that the Ni_2P/β-N catalyst shows superior activity for both hydrogenation and cracking over the Ni_2P/β-M catalyst.

Graphical abstract



Keywords

Ni_2P; β Zeolite; Hydrocracking; Morphology; Naphthalene; BTX; EXAFS

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