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Authors: Deniz Uykun Mangaloğlu, Murat Baranak, Özlem Ataç, Hüsnü Atakül



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Effect of the Promoter Presence in Catalysts on the Compositions of Fischer-Tropsch Synthesis Products

Deniz Uykun Mangaloğlu^a, Murat Baranak^b, Özlem Ataç^c, Hüsnü Atakül^a

^a Faculty of Chemical and Metallurgical Engineering, Istanbul Technical University, 34469 Istanbul, Turkey

^b Free Researcher Industrial District, 26110 Eskişehir, Turkey

^c TUBITAK Marmara Research Center, Energy Institute, 41470 Gebze, Kocaeli, Turkey

Highlights

- Bi-functional Fe/ZSM-5 catalysts with and without promoters were synthesized and tested for The FTS performance.
- Using K, Cu and Mn single and multiple promoted catalysts were prepared.
- All catalysts displayed activity in the FTS and presence of promoters generally resulted in a decrease in both the CO and H₂ conversions to some degree.
- Promoters considerably enhanced the C₅-C₁₈ (gasoline & diesel) and suppressed the C₁-C₄ range hydrocarbons production.

Abstract

The effects of alkali promoters namely potassium, copper, and manganese, on the performance of the bi-functional iron–low acidity ZSM-5 catalysts in the Fischer-Tropsch (FT) synthesis were studied. ZSM-5 with very high silica alumina ratio (SAR) of 280 was used to take advantage of its shape selectivity and suppressing the effect of alkali migration on zeolite cation exchange sites. One bi-functional iron base catalyst (FeZ), three single promoted (KFeZ, CuFeZ, MnFeZ) and four multiple promoted (CuKFeZ, CuMnFeZ, KMnFeZ, CuKMnFeZ) catalysts were synthesized by the incipient to wetness impregnation method. They were characterized by XRD, BET, TPR, TEM and TPD analyses methods and tested for their FT synthesis activities.

Promoters had considerable impacts on the compositions and the hydrocarbon distributions of the FT synthesis products. Addition of promoters resulted in an increase of up to 8.5 – 56% and 20 – 743% in the synthesis of gasoline and diesel range hydrocarbons, respectively. Consequently, the production of the total liquid fuel (gasoline + diesel) also increased from 48% (base catalyst) to 64-79% (promoted catalysts). The highest gasoline range hydrocarbon

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