CO carburization effect on catalytic performance of iron-based catalyst in FTS using CO and CO_2 hydrogenation

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The effect of CO carburization on catalytic performance of iron supported mesoporous silica in Ficher-Tropsch Synthesis (FTS) using CO and CO_2 hydrogenation was investigated. Mesoporous silica (MS) support was synthesized by precipitation method. The 20%Fe/MS catalyst was prepared by incipient wetness impregnation. N_2 adsorption-desorption, H_2-TPR, TPH, TEM and FTIR were applied to characterize the support and/or the catalysts. The activation pre-treatment of prepared catalyst by reducing agent using CO and H_2 gases was performed before the catalytic behavior in FTS was tested using CO and CO_2 hydrogenation at 220°C and 1 bar. Results reveal that 20%Fe/MS catalyst activated by CO is more active in FTS to produce C_{5+} than the catalyst activated by H_2. Moreover, the performance of the catalyst activated by CO in FTS using CO_2 hydrogenation shows lower methane with higher C_{5+} selectivity than that in CO hydrogenation. The difference in product distributions of CO and CO_2 hydrogenation over carburized iron carbide catalyst is ascribed by the different reaction pathways. The effective performance in CO_2 hydrogenation over active iron carbide catalyst is possibly attributed to the reverse water gas shifts (RWGS) following by FT reaction.

Keywords: CO hydrogenation; CO_2 hydrogenation; Iron-based catalyst; Fischer-Tropsch synthesis; Carburization