An investigation into the physically mixed Fe-ZSM-5 catalysts for the selective production of liquid-range hydrocarbons from syngas and its correlation with acidic reactions

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Syngas (CO + H_2) can be converted into clean fuels and chemicals by a widely known process called Fischer–Tropsch synthesis (FTS: nCO + $\{2n(+1)\}H_2 \rightarrow C_nH_{2n(+2)} + nH_2O$). However, traditional FTS is restricted by ASF model (gasoline, jet fuel, diesel: 48%, 41%, 40%). Hence, bifunctional catalysts (active metal and acidic ZSM-5) were used; but, the correlation between the ZSM-5 acidic properties and the C_{5+} distribution has not been clearly established. In this study, the precipitated Fe-based catalysts were physically mixed with various mass fractions (5.88 wt%, 11,11 wt%, 20 wt%) of ZSM-5 (Si/Al: 15, 25, 140), followed by activation, then reaction at 275 °C and 1.5 MPa for 114 h. For each mass fraction with different Si/Al ratios, the differences of those hydrocarbon ranges (C_1, C_{2-4}, C_{5+}) negligible; however, the selectivity of C_{5-20}, C_{21+} showed great differences depending on the Si/Al ratios. This implies that Si/Al ratio (acidic site) greatly affected the selectivity of C_{5-20}, C_{21+} due to hydrocracking reaction. Other acidic reactions were also being investigated.