Highly selective iron-based Fischer–Tropsch catalysts activated by CO_2-containing syngas

Dong Hyun Chun [a], Ji Chan Park [a], Seok Yong Hong [a], Jung Tae Lim [b], Chul Sung Kim [b], Ho-Tae Lee [a], Jung-Il Yang [a], SungJun Hong [a], Heon Jung [a,*]

[a] Clean Fuel Laboratory, Korea Institute of Energy Research, 152 Gajeong-Ro, Yuseong-Gu, Daejeon 305-343, Republic of Korea
[b] Department of Nano and Electronic Physics, Kookmin University, 77 Jeongneung-Ro, Seongbuk-Gu, Seoul 136-702, Republic of Korea

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ABSTRACT

Fischer–Tropsch synthesis (FTS) was carried out over precipitated iron-based catalysts activated by syngas (H_2 + CO) with different amounts of CO_2 (0%, 20%, 33%, and 50%). The activation using CO_2-containing syngas significantly suppressed the production of undesired products, CH_4 and C_2–C_4 hydrocarbons, but facilitated the production of valuable products, C_{5+} hydrocarbons. In particular, in the case of C_{19+} hydrocarbons, the target products of low-temperature FTS ($\leqslant$280 °C), both selectivity and productivity showed a great increase with an increased inlet CO_2 content during activation. We attribute the advantageous performance of the catalysts activated by CO_2-containing syngas to the improvement in the effective performance of active iron carbides, possibly induced by an increased ratio of ε′-carbide ($Fe_{2.2}C$) to χ-carbide ($Fe_{2.5}C$) and a decreased fraction of inactive bulk carbons.