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A durable nanocatalyst of potassium-doped iron-carbide/alumina for significant production of linear alpha olefins via Fischer-Tropsch synthesis

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ABSTRACT

Improvement of activity, selectivity, and stability of the catalyst used in Fischer-Tropsch synthesis (FTS) to produce targeted hydrocarbon products has been a major challenge. In this work, the potassium-doped iron-carbide/alumina (K-Fe_5C_2/Al_2O_3), as a durable nanocatalyst containing small iron-carbide particles (~ 10 nm), was applied to high-temperature Fischer-Tropsch synthesis (HT-FTS) to optimize the production of linear alpha olefins. The catalyst, suitable under high space velocity reaction conditions (14–36 N L g_{cat}^{-1} h^{-1}) based on the well-dispersed potassium as an efficient base promoter on the active iron-carbide surface, shows very high CO conversion (up to ~90%) with extremely high activity (1.41 $mmol_{CO}$ g_{Fe}^{-1} s^{-1}) and selectivity for C_5–C_{13} linear alpha olefins.