

Single phase χ -Fe₅C₂ nanocatalyst encapsulated in mesoporous silica for Fischer-Tropsch synthesis

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Among various iron carbide phases, χ -Fe₅C₂ is considered to be highly active in Fischer-Tropsch synthesis. Fischer-Tropsch synthesis with conventional iron-based catalysts needs to be preceded by pretreatment steps to form iron carbide phases. In this study, iron carbide was directly synthesized by wet-chemical route, which makes the pretreatment steps unnecessary. Also, χ -Fe₅C₂ nanoparticles were encapsulated in spherical mesoporous. TEM images of core-shell structured χ -Fe₅C₂@SiO₂ catalyst showed that χ -Fe₅C₂ nanoparticles were surrounded by spherical mesoporous SiO₂ without further phase transition and size change. Catalytic performance test was conducted in a fixed bed reactor. The effluent gas from the reactor was analyzed by an online gas chromatography. Fresh and spent catalysts were analyzed by N₂-physisorption, X-ray diffraction, and TEM imaging method.