

Cobalt carbide catalysts for Fischer–Tropsch Synthesis: Formation, Activation, and Regeneration

곽근재*, 하경수, 이윤조, 전기원
한국화학연구원
(gkwak@kRICT.re.kr*)

The low-temperature rapid transition of cobalt carbide to metal cobalt species in a H₂ environment was studied using in situ analyses during hydrogenation of cobalt carbide. Cobalt carbide was readily prepared by treatment of cobalt metal species in pure CO. The analysis results give direct evidence for the formation of the cobalt metal hexagonal close packed (hcp) phase and light hydrocarbons (methane, ethane, and propane), and clearly demonstrate that hydrogenation was completed at 220 °C in excess H₂ within 2 h. As a result of the transition, before slurry phase Fischer–Tropsch (FTS), an activated metal cobalt catalyst was easily obtained in situ by H₂ bubbling at 220 °C, in the slurry phase. Moreover, the cobalt metal hcp phase derived from cobalt carbide exhibited significantly improved catalytic performance in FTS compared with the cobalt metal face-centered cubic phase obtained by cobalt oxide catalyst reduction. These results not only broaden and deepen fundamental understanding of the hydrogenation of cobalt carbide but also provide a potential facile activation route for cobalt catalysts for FTS