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Preparation of Highly Active Co/SiO₂ Fischer-Tropsch Synthesis Catalyst with Chelating Agents: Effect of Chelating Agents on Structure of Co Species during Preparation Steps

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The present study investigated the structure of Co species formed during the preparation of Co/SiO₂ Fischer-Tropsch synthesis (FTS) catalysts with an aqueous Co nitrate solution modified with chelating agents (NTA and CyDTA), to clarify the origin of the promotion effects. Diffuse reflectance FTIR measurements showed that both NTA and CyDTA complexes formed in the impregnating solution are preserved on the SiO₂ surface. These complexes were interacted with OH groups on SiO₂ surface. During the subsequent drying step, some of the NTA-Co²⁺ complex were decomposed, whereas the CyDTA-Co²⁺ complex was completely preserved. Both types of complex are combusted during the calcination step at *ca.* 100 K higher temperature compared with Co nitrate. Furthermore, the combustion temperature was higher for the CyDTA-Co²⁺ complex than the NTA-Co²⁺ complex. After the calcination step, Co₃O₄ and α -Co₂SiO₄-like structures with smaller cluster sizes were observed by Co K-edge EXAFS when modified with NTA and CyDTA, respectively. The FTS activity of the NTA-modified catalyst strongly depends on the calcination temperature. Higher FTS activities were obtained only when the catalyst was calcined above the combustion temperature of the NTA complex. Therefore, the interactions between the chelating agents, Co²⁺ and the SiO₂ surface during the preparation

steps is the crucial factor for the promotion effect of NTA. Modification with NTA results in moderate interactions with Co^{2+} and the SiO_2 surface, leading to the higher FTS activity.

Keywords: [Fischer-Tropsch synthesis](#), [Cobalt catalyst](#), [Chelating agent](#), [Cobalt silicate](#)

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