

Technology Development for Iron and Cobalt Fischer-Tropsch Catalysts

Quarterly Report

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## Abstract

### CAER

A series of Fe-Al (0-25% Al) and Fe-Si (0-8% Si) catalyst were prepared to study the effect of structural promoters on iron FTS catalysts. BET analysis showed that as the quantity of the promoters is increased, the surface area increased. In addition, as the calcination temperature increases, the surface area decreases. XRD analyses of the catalysts are also reported.

Iron based FTS catalyst promoted with K or Be showed a superior deactivation rate. The K promoted catalyst showed a deactivation rate of 0.59% CO conversion per week after passing an initial conditioning period of 300 hours. The Be promoted catalyst showed a deactivation rate of 0.43% CO conversion per week. FTS activity and selectivity are also reported.

We are continuing the study on the impact or reducibility of cobalt oxides by the use of different supports and by incorporation of different promoters and the order of addition to the supported cobalt catalysts. The reduction of  $\text{Co}_3\text{O}_4$  is a two-step process which passes through an intermediate CoO phase before reduction to the metal. The promotion of the supported Co catalysts with Pt and Ru noble metal promoters had a similar effect on catalyzing both reduction steps. Promotion with Re only aided in catalyzing the second step when a significant interaction of the Co species with the support was present, such as found on the  $\text{Al}_2\text{O}_3$  supported catalysts.

The effect of water on Co FTS catalysts was studied using a Co catalyst. The results obtained for conversion, selectivity and deactivation using this catalyst were compared to the previous data using a Pt promoted Co/ $\text{SiO}_2$  catalyst.

## UC/B

Most of the efforts during this reporting period were focused on the preparation of manuscripts covering the work done the past several months. A new transient experimental setup was developed in order to perform transient isotopic switch experiments. In addition, modifications to the high-pressure reactor unit were done to improve the sample collection procedure for the  $^{13}\text{CO}_2$  addition experiments, which are in progress. Switching experiments were carried out on the Co-FT unit under typical reaction conditions in order to estimate the number of active sites on the catalyst during the reaction. The experimental technique for collecting data and analyzing them was modified in order to take into account active sites only.

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