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Optimization of preparation and process conditions for production of light olefins via FTS on the Fe-Co catalysts

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Catalysts have many applications in various industries, so their production is very important. Among catalysts, various types of iron and cobalt base catalysts with different catalyst support are widely used in Fischer–Tropsch synthesis. The Fischer–Tropsch process is designed and implemented based on the two main methods of fixed bed and slurry [1, 2].

In this project, the basis of the work is based on the fixed bed method of Fischer–Tropsch synthesis, during which iron-cobalt catalysts have been prepared by three methods of solid phase, hydrothermal and wetness impregnation synthesis. Catalyst synthesis was performed in all three methods with 5 different ratios of iron to cobalt. The syntheses have been done by observing all the relevant points and details. A total of 15 catalysts were synthesized and evaluated under the reaction condition in order to produce light olefins by the Fischer–Tropsch method. The physical and chemical properties of the catalysts were investigated by SEM, BET, XRD and ICP/MS. Reactor test conditions were performed at a pressure of 1 atmosphere and temperatures of 270, 300, 330, 360 and 390°C with a GHSV of 3300 hr-1 and a ratio of H2 to CO equal to 2. Catalysts synthesized by wetness impregnation method with the iron to cobalt ratio of 0.25 to 0.75 had the best performance. For the production of these catalysts, gamma alumina was used as the catalyst support and iron and cobalt nitrate salts were used as iron and cobalt precursor respectively. The best CO conversion is about 46% and the best selectivity is about 28% based on ethylene selectivity. It is noteworthy that other olefins, including propylene, have been produced with ethylene.

***Keywords**:* Fischer-Tropsch Synthesis, Light Olefin, Solid Phase Synthesis

References

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