

Techno-economic analysis of low-temperature Fischer-Tropsch processes with different catalysts

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Fischer-Tropsch (FT) synthesis converts syngas to hydrocarbons of different carbon chain lengths, and thus can be used to produce various products such as linear alpha olefin, naphtha, wax and diesel. FT synthesis can be broadly classified into two categories based on the reaction temperature: high-temperature FT (HI FT), and low-temperature FT (LI FT). A major difference between HI FT and LI FT lies in the product portfolio, and LI FT is typically used to produce C<sub>5</sub>+ hydrocarbons such as wax and diesel. In the LI FT process, various catalysts can be used, such as Co, Ru/Al<sub>3</sub>, Co/Re/N/Al<sub>2</sub>O<sub>3</sub>, Fe/Cu/K, which feature different product compositions and overall conversion. Such feature can significantly affect the design of separation processes, as the optimal process configuration and its optimal operating conditions can vary with the catalyst used. Thus, a comprehensive techno-economic analysis needs to be performed to provide a guideline for the selection of LI FT catalyst. In this study, separation processes are designed for several representative catalysts, and they are compared in terms of economics and production rates of different products.