

The Effect of Catalytic Reactor Bed Dilution on Product Distribution for Fischer-Tropsch Synthesis over Ru/Co/Al₂O₃ Catalyst

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Recently there has been a revival of interest in eco-friendly fuels and alternative route for oil production. The Gas to Liquid (GTL) process is one of the promising technologies for the production of clean energies. In the GTL process, Fischer-Tropsch Synthesis (FTS) reaction is a catalytic process that converts synthesis gas (CO + H₂) into hydrocarbon products.

The FTS reaction should be developed in the direction of producing the long chain carbon with liquid phase for the application to liquid fuels market, which can reduce the treatment energy for upgrading process. The product selectivity can be control by the variation of catalyst types, the composition of feed ratio (H₂/CO), reactor types and operation conditions [1].

E. Iglesia et al. proposed that in FTS reaction, the probability of product chain growth increase as reactor bed residence time increases, leading to an olefin transport rate which helps the secondary hydrogenation reaction by enhancing the α -olefin re-adsorption in the reactor bed [2, 3].

R.J. Berger et al. reported that the different bed configuration of the reactor had an effect on axial and radial dispersion of reactants, leading to different conversion in the catalytic reactions [4].

As shown in the above studies, the dilution of catalytic reactor bed affects the performance

of FTS reaction in terms of product distribution of hydrocarbons.

Thus, the objective of this study is to investigate the effect of variation of catalytic reactor bed loaded by dilution charging method to study the product distribution over Ru/Co/Al₂O₃ FTS catalyst.

The FTS reaction were carried out in a fixed-bed reactor system for 100 h time on stream with 20 bar, H₂/CO = 2, and 230-240 °C. The catalytic reactor bed packing with FTS catalyst and inert material (γ -Al₂O₃) at different split layer numbers.

It was found that the CO conversion and C₅+ selectivity increased as the number of bed layers increased. The increase in catalytic bed layer led to the increase in both the re-adsorption of reactive α -olefin on catalyst pellet and the residence time of reactor bed.

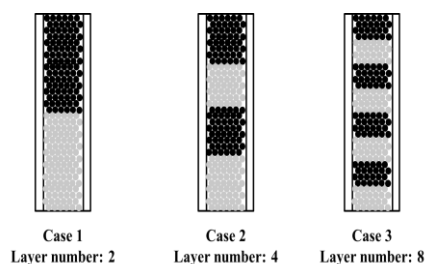


Fig.1. Catalyst charging method with different bed configuration.

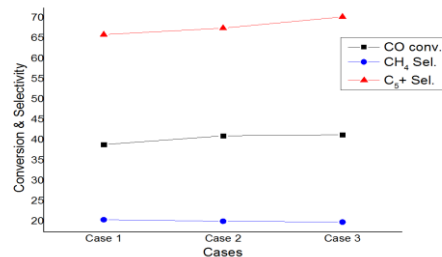


Fig. 2. Average conversion and selectivity over different catalyst charging methods.

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