Development of a Compact Fischer Tropsch Reactor

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Fischer Tropsch (FT) synthesis is a polymerization process where a CH_X species is added to a growing aliphatic chain. There are several models of the catalytic chain propagation rate and the termination of the chain growth (e.g. Anderson – Schulz – Flory model). The exact methodology for the surface catalyzed formation and termination of the hydrocarbon chain is still a matter for study. Most FT facilities built today (e.g. the Oryx gas-to-liquids plant built in Qatar) are very large, expensive facilities that entail large capital expenditures and associated risk.

Ceramatec has been developing an alternative approach under funding from the Office of Naval Research and the State of Wyoming. The reactor design is a compact fixed bed reactor with integral cooling and unique components to insure the conduct of heat from the catalyst bed to maintain even heat through the bed. The basis of the reactor design was the reaction cooling duty requirement calculated using the process modeling tool VMGSim. The compact design will enable the transportation of the reactor and the use with any source of synthesis gas (e.g. coal gasification, biomass gasification, co-electrolysis of CO_2 and steam, etc).

This paper will discuss the modeling effort and the resultant patented design for the compact FT reactor. The presentation will also discuss the results obtained from the laboratory prototype of this reactor using a FeCuK catalyst and a Co based catalyst that were manufactured at Ceramatec. The initial results obtained from a larger scale unit (i.e. ~ 4 bpd with high activity Co catalyst) in place at Western Research Institute in Laramie, Wyoming will also be discussed.

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