Conditions for Practical Operation

Synthesis at high temperatures increases the yield of gasoline and light hydrocarbon gases. It would be desirable to learn how to control the relative production of gasoline and these gases in order to make the process as versatile as possible. During periods of small demand for heating gas, production of gasoline could then be increased at the expense of gas, and vice versa. Further work on catalyst and operating variables may result in a more flexible process.

The oil-circulation process has been shown to operate satisfactorily up to 270° C. Above that temperature deposition of carbon and oxidation of the catalyst were accelerated, and the active surface of lathe turnings was lost in a relatively short time. These problems, and the effects of additives, catalyst pretreatment, and partial pressures of water vapor and carbon dioxide on rate of oxidation and carbon deposition need further study. To perform experiments of this nature a small reactor, designed to permit high recycle rates of end gas, would be advantageous.

The oil-slurry process requires only about one-tenth as much catalyst as the oil-circulation process. The main problems with the slurry system have been agglomeration and settling of finely divided catalyst; at times, the catalyst adheres to the walls of the reactor. With nitrided iron catalyst agglomeration did not occur during several months of experimentation, probably because of the presence of alcohols in the oil. Favorable results have been obtained also by addition of high-boiling alcohols to a slurry containing reduced iron catalyst. The factors affecting agglomeration are being studied further.

A recently completed pilot plant will be employed to investigate the hot-gas-recycle process, operated at relatively high temperature, with the newly developed lathe-turning catalysts. With this form of catalyst the pressure drop through the catalyst bed was reduced to only about two percent of that through a bed of 6- to 20-mesh granules. The rate of carbon deposition, reported to be high in fluidized-bed Fischer-Tropsch reactors, must be determined. However, the true catalyst temperature in hot-gas-recycle operation is expected to be considerably lower than in fluidized beds at the same nominal temperature, and thus less deposition of carbon should be expected.

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