The Texas Company

T O M REEL 55

Item 94

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Assignment: 628

Hydrocarbon synthesis from carbon monoxide and hydrogen.

Research workers: Breywisch, Geiseler

Status on December 1, 1943

1) Semi-technical tests: (Breywisch)

The Synol experimental plants Me 458 and Me 776 were shut down during the report period. In Me 458, the 2½ m^3 plate reactor which as a semi-technical furnace with the recycling of gas was almost completed will be set in operation when operators and technicians will be available to do so. The product on hand was worked up. The recovery of alcohols in the boric acid apparatus shall be continued in intervals. The reduction apparatus shall be used for the reduction of catalysts of the SH 200 installation. In addition, the apparatus or also the catalyst W.K. 17 (1.5 m^3) which is still on hand shall be used for the hydrogenation of Sebacic acid dinitrile.

Me 776

The reactor equipped with gas recycle (21/3) was shut off after an operating period of 7 months. While former duration tests without the recycling of gas could only be run 4-5 months

at the most, without having the catalyst changed, whereby the reaction temperature rose 10-15 deg. over a period of time, the operating temperature and the yields remained constant in this test in spite of the somewhat higher rate (1:150 against 1:120-130 in former corresponding tests). It can be concluded from this test that the catalyst will probably last more than one year in the recycle method. (The test had to be stopped due to a leaky heating jacket.)

By means of the gas recycle test 20/6 it should be determined to what extent CO_2 formation depends on the reaction speed of the synthesis gas. With increasing conversion the energy consumption of the blower, the heat consumption of the preheater and the cooling water requirements of the cooler increase. Besides greater aggregates are necessary. This results in a longer life for the catalyst, in better quality of products and the gas can be further used without washing, since more H_2O and less CO_2 are formed. First, the conversion amounts of 1:1000 and 1:3400 at constant conversion (1:120) were compared. The correspondingly calculated average steam partial pressure in the reactor was 0.5 nd 0.15 atms. In the first case 41%, and in the second case 22% of the synthesis gas were converted to CO_2. If it is assumed that the gas can be consumed to an inert gas level of 50%, 81% in the first case and 86.5% of the $CO + H_2$ in the second case could be used with 10% CH_4 formation. This test was discontinued.

Liquid Phase Reactor with gas recycle (see former report) was finished. A blank test without catalyst showed that the production of foam and product mist in spite of the relatively high gas rate (1:3500) stayed within reasonable limits. Tests that

can be evaluated have not yet been started as the catalysts reduced in the dust phase do not possess as yet the necessary activity.

Different catalysts for the hydrogenation of adipic acid dinitril have been prepared.

2) Hydrogenation of CO with Mixed Catalysts under normal pressure: (Geiseler)

Investigation was to be made as to how the Fischer synthesis works when under otherwise similar conditions a part of the cobalt catalyst is replaced by pure iron catalyst.

A 3 L. furnace was therefore equipped with a mixed catalyst consisting of equal volume parts WK 17 0.3-0.5 mm and R.Ch 1-4 mm and was operated under conditions which correspond to the Ruhrchemie method (without pressure, synthesis temperature 180-200 deg., fresh gas charge 1:150). The synthesis temperature was first kept at 180 deg. and then brought up to 190 deg. very carefully. At this temperature the conversion is about 1:25. The balance results show that at 190 deg. only the cobalt catalyst works exclusively. The high olefin content (see Table 1) is due alone to the R.Ch catalyst and not to the W.K. 17 (olefin synthesis with high CC partial pressure and high space velocity). Although W.K. 17 does not affect the synthesis itself, its converting property is very noticeable since the proportion of H_2O : CO_2 is here 60:40.

TABLE 1

Fraction	Weight %	Weight % Olefin	Weight % Alcohol
-200 deg.	31.3	68.3	3.3
-230 deg.	3.1	44.5	6.1
-350 deg.	41.7	46.5	5.8
-400 deg.	12.0	64.8	2.6
3400 deg.	10.9		