

FILM STUDY GROUP

SUBJECT INDEX

T.O.M. REEL NO. 1

Prepared by

THE ATLANTIC REFINING COMPANY

(See T.O.M. Reel No. 143 for report on T.O.M. Reel No. 1 prepared by The Atlantic Refining Company. Comments on T.O.M. Reel No. 1 prepared by Standard Oil Development Company follow this Subject Index.)

Atlantic Ref. Co  
F.S.G.

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Comments on Reel #1

L. L. Newman
REC'D.....
MAR 29 1946
TIC L.F. & L. S-C.

Item 3 - pages 20-35

This article of 16 pages gives an idea of what can be obtained from high pressure hydrogenation, particularly from products of liquefaction of coal. There are many polycyclic aromatics contained in this material but because of the small quantities in which they are present and the very complicated nature of the hydrocarbon mixture, it is difficult to isolate the individual hydrocarbons from the mixture. Information on this item should be of value in connection with the mechanism of hydrogenation.

Item 4 - page 36

Working up the C<sub>2</sub> to C<sub>11</sub> saturated hydrocarbons by the I.G. Farben processes in their hydrogenation plants. This is a very complete diagrammatic table showing the processes and routing of products, and indicates that they were able, by some of these processes, to make octane numbers as high as 96 or even isooctane of 100 octane number. This is a worth-while chart to reproduce.

Item 5 - pages 37-44

It is a sump phase preheater at the Lutzkendorf plant. There is quite a discussion of the preheater, the way it's built and the temperatures at which it operated. As they had it set up it failed; therefore to overcome the difficulty, they put in much larger pumps to circulate the gases and by this device they were able to overcome their difficulties with the preheater as originally set up. This report consists of five pages and is accompanied by charts showing heat balances and the temperatures of the flue gases used in connection with control of the process; pressure drops through the preheater are a feature of the report.

Item 10 - pages 53-59

Item 10 Curves and analyses of the hydrogenation unit at Lutzkendorf. This is accompanied by very fine curves and shows analyses of gases taken at various points in the plant. The report is dated November 20, 1940.

Item 12 - pages 73-87

Cracking of high molecular weight paraffins from Fischer process to give olefins which are suitable for polymerization to make lube oils. This item is of interest in connection with the preparation of synthetic lube oils which the Germans report to have given satisfactory performance.

Item 14 - pages 89-91

This item covers calculations in 1941 at Lutzkendorf. It gives data on the solubility of inert gases in high hydrogenation total products which is of value in hydrogenation work.

Item 17 - pages 99-104

This item gives information on the influence of the carbon dioxide content in the synthesis gas on the Fischer gasoline yield when using the cobalt-thorium-magnesium catalyst.

Item 22 - pages 110-111

This item covers cost calculations at Lutzkendorf for the production of 100 cubic meters per hour of hydrogen from water gas. Although the German cost figures cannot be translated into American costs reliably, the costs at different German plants should give an indication of relative costs for different processes that may be involved. It is only from this angle that references of this type are included in the comments.

Item 27 - page 118

This item includes a letter which discusses the cracking of methane in the presence of oxygen to produce acetylene. It mentions that Shell has patents on this process.

Item 29 - page 120

There is some further information in this item on the production of acetylene from methane.

Item 33 - page 127

This item gives some information on the scrubbing of acetylene gas produced by cracking of methane in the presence of oxygen. The use of butyrolactone (which, according to other reels, was made by the Germans by oxidation of 1,4-butane Diol) is reported in this item as being quite effective for removal of acetylene gas from dilute solutions.

Items 34-39, inclusive - pages 128-135

These items include several letters on the production of acetylene by the cracking of methane in the presence of oxygen. It appears from these letters that the Germans question the practicability of the process because of the difficulties that may be involved in the concentration of acetylene produced in this manner. However, one of the letters in this group shows more optimism on this subject.

Items 40-43 inclusive - pages 136-141

These items deal with an experimental plant for the concentration of acetylene.

Items 61-63 inclusive - pages 168-172

Gives information on the Fischer-Tropsch synthesis plant at Oppau which includes operating costs, some technical data and some information on the cleaning up of synthesis gas by activated carbon.

Item 64 - pages 173-175

This is a letter which mentions the use of an iron catalyst in the

Fischer-Tropsch synthesis operating at 25 atmosphere pressure with an oil recirculation process giving the production of the plant at 5,000 tons per year and a product distribution table.

Item 65 - pages 176-189

A 12-page report on development work on the Fischer synthesis. It includes a hot gas recycle process, a liquid phase process and the Synol process.

Item 66 - pages 190-192

This is a three-page report which deals with the Fischer synthesis using an iron catalyst.

Items 68-69 - pages 196-209

These items deal with a discussion of results obtained on the use of iron catalysts in the Fischer synthesis in a hot gas recycling process. It includes information on the purification of the feed stock.

Item 76 - pages 220-236

This is a 1940 article on the removal of CO from water gas by its conversion to methane. It gives considerable detail on the composition of the catalyst used.

Item 77 - page 237

This is a short tabulation showing the distribution of sulfur in a Winkler-type gas generator used in synthesis.

Item 78 - pages 238-239

This is a two-page article on the determination of acetylene in gases from a synthesis plant.

Item 81 - pages 242-255

This is a report on an alkylate plant for removal of CO<sub>2</sub> and/or hydrogen sulfide. Part of this item deals with corrosion problems in such a plant which should be of interest to the oil industry.

Item 82 - pages 256-280

This item discusses operating problems in several synthesis plants. It gives in considerable detail some of the difficulties they had from an operating and engineering point of view and the means they used for overcoming them.

Item 83 - pages 281-318

This item covers a discussion of operating and technical problems in the operation of the Lutzkendorf Fischer plant. There are a number of

figures which show the equipment and changes in equipment by the proposals of this report. There is also a flow diagram of the plant at the Schwalfeldt Winterschall works. This report should be of interest to anyone working on the Fischer Tropsch synthesis.

Items 101-104 - pages 336-339

These items deal with the high pressure hydrogenation plant at Lutzkendorf. A part of this deals with hydrogenation requirements and also power requirements.

Item 194 - pages 440-455

This item deals with the starting up of the hydrogen plant at Lutzkendorf in 1940. It includes not only the production of hydrogen, but also methane. It contains charts showing the analysis of the gas produced, the design of the plant, etc.

Item 200 - page 470

This item deals with the results of work on the BS catalyst for methanization of water gas. It includes the properties of the catalyst and its behavior under certain conditions.

Item 201 - page 471

This item deals with the testing of the methanization catalyst from the Lutzkendorf plant. It shows the activity of the nickel catalyst used and gives analysis of the gases.

Item 202 - page 472

This is a 1940 memorandum on the methanization unit at Lutzkendorf.

Item 74 - pages 488-489

This is a pictorial diagram of the Fischer-Tropsch plant at Lutzkendorf and also of a lubricating oil plant and hydrogenation plant at Lutzkendorf.

Part 4 - Gas Purification - pages 493-503

This consists of two reports, the first of which covers tests in 1942 of a synthesis gas procedure. It includes several tables giving the analysis of the circulating and producer gases and also of the synthesized gases. The second report, dated 1943, deals with the final purification of the gas during the manufacture of synthetic motor fuel.

Item 3B - pages 504-601

Most of this item deals with problems on the operation of the alkacid plant at Lutzkendorf which was used for purification of the synthesis gas to the Fischer process. This item includes a 1940 report covering tests for the conversion of organic sulfur into  $H_2S$  by the incomplete conversion under pressure of CO-containing gases. This report consists of six pages with curves and two attachments which show the effect on catalyst life and the effect of the degree of the conversion of  $CO_2$  to CO and also gives data on

the solubility of carbon dioxide, sulfur dioxide and H<sub>2</sub>S in a number of organic liquids. These solubility data should be of interest to the oil industry.

Item 207 - page 604

This is a flow diagram of a process for making isooctane which involves the dehydrogenation of isobutane with chlorine with the subsequent dimerization of the isobutylene, followed by hydrogenation of the isobutylene.

Items 208-214 inclusive - pages 605-611

These items deal with a flow diagram and a discussion of a process to produce isooctane involving the chlorination of isobutane under conditions under which part of the isobutane is chlorinated in the presence of light to form isobutyl chloride and the latter reacted with the inert isobutane to form isooctane.

Pages 784-787

An amendment to an original patent application which deals with the preparation of dichlorbutane-butylene mixtures, and another application on "Process for the Preparation of Alkacid-Dichlorhydrocarbons."

Pages 788-820

Correspondence on the subject of the butane-butadiene plant at the Hydebreck works, which includes a flow diagram of the plant layout and material requirements. One flow diagram is on the cracking of dichlorbutane to butadiene and another flow diagram on the chlorination of butane to produce dichlorbutane.

Pages 829-831

A table and discussion which give a comparison of the plant costs in energy and material required for the following processes for producing butadiene:

- (a) From ethyl alcohol
- (b) By chlorination and dechlorination of butane
- (c) From acetylene.

It is of interest that they claim 90% yield on the chlorination process.

Pages 836-856

There is a discussion of a four-step process for making butadiene involving:

- (a) dehydrogenation of butane
- (b) conversion of the resulting butene to monochlorbutane by the addition of HCl
- (c) chlorination of the monochlorbutane to dichlorbutane, and
- (d) dehydrochlorination of the dichlorbutane to produce butadiene

Flow sheets and cost estimates on a 20,000 ton per year plant for such a process are included.

Pages 862-866

There are two flow diagrams on the purification of butadiene, followed by charts showing equipment and flow diagrams for the liquid phase and vapor phase polymerization of butadiene to synthetic rubber.

Pages 880-889

Information is given of work in 1942 on the chlorination in the presence of light, of butane and isobutane to produce the corresponding monochloride derivatives and the split of these monochlorides to the corresponding olefins.

Pages 890-893

There are given two proposed processes for making triptane

- (1) by a Grignard reaction
- (2) by the reaction of isobutyl chloride with propylene. No details, however, are given on the conditions or yields for these processes.

Part 6 - DHD Process - pages 895-904

This section deals with the German work in 1942 on the preparation of the following catalysts:

- (1) Catalyst for DHD plant consisting of activated clay containing 5-10% molybdic acid.
- (2) Hydrogenation catalyst #7846 consisting of 75% clay and 25% tungsten and nickel sulfide.

Part 7 - Oxo Process - Pages 912-919

This section deals with a report on the conversion of C<sub>10</sub>-C<sub>20</sub> olefins from the Fischer process into alcohols by the Oxo process. It is worth while reading for those interested in the Oxo process.

Pages 921-936

This section gives a brief report on the polymerization of ethylene to make synthetic lubricating oils using aluminum chloride as the catalyst. Some information is given on the purification of ethylene. There is also a brief mention of the use of haemoglobin for the analysis of CO.

Pages 924-932

There are some data on experiments carried out on propane dewaxing which may be of interest to those working in this field.