

INTRODUCTION

The Fischer-Tropsch synthesis may be defined as a hydrogenation of carbon monoxide producing higher hydrocarbons and oxygenated organic molecules that have predominantly straight carbon chains, at least in the range C₄ to C₇. This definition eliminates related processes, such as the higher alcohol and iso syntheses.

The Fischer-Tropsch synthesis is a composite of many reactions producing a variety of molecules of different types and carbon numbers. The catalyst and its environment during synthesis are no less complicated, for the pores are at least partly filled with high-molecular-weight hydrocarbons that are liquid at synthesis temperatures. In addition, carbides, oxides, elemental carbon, and carbonyls are formed to varying degrees, resulting not only in changes in the phases present but also in the physical structure of the catalyst.

This paper considers several physicochemical aspects of the synthesis. It is based in part on three recent reviews.⁴⁻⁶ For more details on studies of the Fischer-Tropsch synthesis by

the Bureau of Mines, the reader is referred to various references,⁷⁻¹³ as well as to papers cited in the text.

⁴ Anderson, R. B. [Contribution for Ullmann's Encyclopedia of Technical Chemistry]; Ullmann's Encyclopädie der technischen Chemie, Urban & Schwarzenberg, Berlin, vol. 9, 1957, pp. 684-748.

⁵ Anderson, R. B., Hofer, L. J. E., and Storch, H. H., A Short Review of the Mechanism of the Fischer-Tropsch Synthesis: Chem.-Ing.-Tech., vol. 30, 1958 pp. 560-566.

⁶ Anderson, R. B., Physical Chemistry of the Fischer-Tropsch Synthesis on Iron Catalysts: Ipatieff Prize Address presented at 123d Meeting, American Chemical Society, Mar. 15-19, 1953, Los Angeles, Calif.; preprinted in General Papers Presented Before the Division of Petroleum Chemistry of the American Chemical Society, No. 29, pp. 69-81.

⁷ Storch, H. H., Anderson, R. B., Hofer, L. J. E., Hawk, C. O., Anderson, H. C., and Golumbic, N., Synthetic Liquid Fuels From Hydrogenation of Carbon Monoxide, Part 1: Bureau of Mines Tech. Paper 709, 1948, 213 pp.

⁸ Storch, H. H., Golumbic, N., and Anderson, R. B., Fischer-Tropsch and Related Syntheses: John Wiley & Sons, Inc., New York, N.Y., 1951, 610 pp.

⁹ Anderson, R. B., The Thermodynamics of the Hydrogenation of Carbon Monoxide and Related Reactions: Chap. 1 in Catalysis, vol. IV (P. H. Emmett, ed.), Reinhold Publishing Corp., New York, N.Y., 1956, pp. 1-27.

¹⁰ Anderson, R. B., Catalysts for the Fischer-Tropsch Synthesis: Chap. 2 in Catalysis, vol. IV (P. H. Emmett, ed.), Reinhold Publishing Corp., New York, N.Y., 1956, pp. 29-255.

¹¹ Anderson, R. B., Kinetics and Reaction Mechanisms of the Fischer-Tropsch Synthesis: Chap. 3 in Catalysis, vol. IV (P. H. Emmett, ed.), Reinhold Publishing Corp., New York, N.Y., 1956, pp. 257-371.

¹² Hofer, L. J. E., Crystalline Phases and Their Relation to Fischer Tropsch Catalysts: Chap. 4 in Catalysis, vol. IV (P. H. Emmett, ed.), Reinhold Publishing Corp., New York, N.Y., 1956, pp. 373-441.

¹³ Shultz, J. F., Hofer, L. J. E., Cohn, E. M., Stein, K. C., and Anderson, R. B., Synthetic Liquid Fuels From Hydrogenation of Carbon Monoxide, Part 2: Bureau of Mines Bull. 578, 1959, 139 pp.