

Fifty Years of Fischer-Tropsch-Synthesis in the Slurry Phase: A Science-Historical Approach

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Studies on FTS with suspended catalysts can be traced back to World War II. A demonstration unit was set onstream around 50 years ago by Koebel and coworkers, it became known as the Rheinpreussen – Koppers Plant. The core of the plant was a slurry bubble column reactor. Though at that time this type of multiphase reactor was rarely explored, hardly understood and its scale-up seemed risky, the demonstration unit could be operated safely and successfully. Indeed, the FTS data on suspended promoted Fe catalyst from the demonstration unit served as a reference base for a long time. However, due to the plenty of cheap oil the FTS was economically not attractive. Only SASOL continuously pursued the production of fuels by coal conversion processes.

It was only after the oil embargo in the early 70's that a revival of synthesis gas conversion processes for fuels and chemicals took place worldwide. Among the various processes the FTS in the slurry bubble column plays a prominent role and several companies developed different process strategies and proposals. In the meantime the bubble column reactor is well accepted by the Chemical Engineering Community as a versatile tool and an industrial reaction vessel to carry out multiphase reactions. The number of scientific and technical papers is large, a nearly exponential increase in publications could be observed for two decades.

The contribution briefly focuses on bubble column slurry reactors, outlines their characteristics such as heat and mass transfer, phase holdups, mixing properties and reaction rates and also elucidates the major performance principles. The salient advantages as well as the limitations of bubble column slurry reactors are worked out and compared with other reactors. Finally, the paper points out to some recent results with new catalysts and process development.