Synthesis of suitable Fischer-Tropsch-Catalysts to produce kerosene and modelling of the Fischer-Tropsch-Reactor

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Abstract

To the pivotal challenges of the 21st century belongs the problem of global warming, mainly caused by the CO_2-emissions. To face this challenge, the Federal Government of Germany has currently (2021) released a Power-to-Liquid-Roadmap. An only electrical solution of the transport is impossible, e.g. for transport by air, so the alternative are at least partly sustainable liquid fuels. A contribution of the development of such fuels has just started in 2023 under the project name 'PlasmaFly' [1].
Coordinated by the University of Stuttgart, several project partners, Overspeed, Infraserv Höchst, LINDSCHULTE, and the University of Bayreuth, are involved, to work on a solution for the development of sustainable kerosene out of biogas [1]. The task of Bayreuth (Chair of Chem. Eng.) focusses on the synthesis of catalysts and their characterization for the dry reforming of methane. To reach this goal, a respective laboratory plant has been developed.
This endothermic reaction enables the conversion of methane and CO_2 to synthesis gas. While several noble metals allow a high reaction rate and stable performance, they are too expensive for commercial use. Promising alternatives are metals like nickel or cobalt, with the disadvantage of deactivation from carbon deposition [2].
So far, the University of Bayreuth works on a solution for a catalyst with high performance and low deactivation rate. The process is running at high temperatures of 800 °C and atmospheric pressure. Specific amounts of water shall help to reduce the expected amount of carbon deposition on the catalysts.
Right now, first tests for kinetic characterizations are running, to get a better understanding of different parameters, like required amount of water, ratio of carbon monoxide and hydrogen in the synthesis gas, and deactivation rate of the catalysts. First promising results will be hopefully presented at the conference.

References

[1] NOW GmbH, Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie, „PlasmaFly", BMDV, Berlin, 2023.
[2] Budiman W. A. et al., Dry Reforming of Methane Over Cobalt Catalysts: A Literature Review of Cataylst Development. Catal. Surv. Asia, 2012, 183-197.