Synthesis of suitable catalysts to produce synthesis gas through dry reforming of methane for green kerosene

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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. According to the current research, an electrical solution of the transport, e.g. for the transport by air, is impossible. The solution is a partly use of 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.
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].
Currently, 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 about 800 °C and atmospheric pressure. Specific amounts of water shall help to reduce the expected amount of carbon deposition on the catalysts.
So far, first characterizations of different catalysts are showing good results for conversion rate, yield, and selectivity. The decision for a suitable catalyst is still open, but the results show a tendency to nickel-catalysts, especially because of the low reaction rate for cobalt. The final decision will be done soon, so hopefully, there will promising results until 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.