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Production of Fischer-Tropsch suitable syngas for green jet-fuel through dry reforming of methane-CO_2-mixtures

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One of the key challenges of the 21st century is global warming, which is primarily driven by CO_2 emissions. According to current knowledge and status of research, the complete electrification of certain transport sectors, particularly aviation, is not feasible. A promising alternative is the partial substitution of conventional crude oil based fuels by sustainable liquid fuels based on biogas and/or CO_2 and renewable hydrogen. Research into the development of such fuels began in 2023 with the launch of the project *PlasmaFly [1]*. The project is coordinated by the University of Stuttgart and involves several partners, including Overspeed, Infraserv Hoechst, LINDSCHULTE, and the University of Bayreuth (Chair of Chemical Engineering). Together, they aim to develop sustainable jet-fuel derived from biogas. The University of Bayreuth is responsible for the synthesis and characterization of catalysts for the dry reforming of methane.
This endothermic reaction enables the conversion of methane and CO_2 into syngas. Although catalyst deactivation due to carbon deposition remains a major challenge, nickel is considered the most promising active metal, as noble metals are prohibitively expensive for industrial applications [2].
Currently, the University of Bayreuth is working on the development of a nickel-based catalyst with a reduced deactivation rate. The process is carried out at high temperatures of approximately 800 °C and atmospheric pressure. The controlled addition of water is expected to mitigate carbon deposition on the catalyst surface. So far, a catalyst consisting of 10 wt % nickel supported on aluminium oxide has been selected. Experimental results demonstrate favorable conversion rates, yields, and selectivities. Despite the formation of carbon deposits, if no steam is added to the feed gas, only a minor loss of catalytic activity has been observed. Consequently, current research focuses on further suppressing coking phenomena. It is anticipated that, by the time of the conference, results for a stable, high-performance catalyst will be available.

References:

[1] NOW GmbH, (2023), Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie, PlasmaFly, BMDV, Berlin
[2] Budiman W. A. et al, (2012), Dry Reforming of Methane Over Cobalt Catalysts, Springer, Catal. Surv. Asia, 183-197