rWGS as a Key-step to Transform CO_2 into Valuable Products - Accelerated R&D Applying Advanced High Throughout Technology

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Abstract

Carbon management is a major challenge, attracting growing interest for transforming the chemical industry and transportation sector towards greater sustainability. Making use of existing assets and smart integration of CO_2 into the industrial value chain are key strategies for a fast transition.

The production of sustainable syngas from CO_2 and the integration of this process into the existing refinery for chemicals and fuels production is an important step on the road from CO_2-to-value, *e.g.* sustainable aviation fuel from power-to-liquid plants. The reverse water-gas shift (rWGS) reaction can serve as key process to utilize CO_2 from industrial exhaust streams, biogas, or direct air capture to generate sustainable syngas, which can be fed into the existing Fischer-Tropsch (FT) assets.

We are describing the most advanced high-throughput approach for accelerated catalyst screening and parameter optimization for the rWGS process. hte's flexible 16-fold setup is equipped with high-temperature reactor technology operated at elevated pressures, high-precision *online* GC analytics for full C, H and O recovery as well as tailor-made software solutions for big data handling. Our internal rWGS study includes testing of Cu and Ni catalysts to investigate the influence of temperature, pressure, GHSV and H_2/CO_2 ratio on the catalytic performance. The Cu catalysts produced methanol as byproduct, whereas the Ni catalysts only produced methane besides the CO. In the course of parameter optimization, the selectivity of the catalysts could be improved, and reaction conditions could be found where the catalysts were active and selective. Operating rWGS at elevated pressures allows coupling with the established FT processes.

This presentation will describe the CO_2-to-value path with focus on CO production *via* rWGS supported by performance results from high throughput experimentation. Furthermore, hte outlines its experience in FT as well as hydrocracking to cover the full process chain towards CO_2 neutral fuels and chemicals within the carbon management context.