A Sustainable Approach to Aviation Fuels Production: Focus on Fischer-Tropsch Catalysis

D.J. Moodley[1], J.M. Botha[1], R. Burton[1], E. van Steen[2], M. Claeys[2], A. Zimina[3], J.-D. Grunwaldt[3]

[1]Research and Technology, Sasol, 1 Klasie Havenga Rd, Sasolburg, 1947

[2] Catalysis Institute, Department of Chemical Engineering, University of Cape Town, Rondebosch 7701, South Africa

[3]Institute of Catalysis Research and Technology, Karlsruhe Institute of Technology, Hermann-von-Helmholtz Platz 1, 76344 Eggenstein-Leopoldshafen, Germany

* Denzil.moodley@sasol.com

Sustainability pathways with Fischer-Tropsch technology

Sasol is a world-leader in the development and application of the Fischer-Tropsch (FT) technology with more than 70 years' experience. Our own facilities and licensed technologies already produce more than 200 000 bbl/day of products. In an effort to reach our GHG emission reduction targets and decarbonize our operations we plan to leverage our proprietary technology, know-how and expertise to produce sustainable fuels and chemicals from green hydrogen and sustainable carbon sources, *via* the Power-to-Liquids (PtL) process [1].

Catalysis with commercial Fe and Co catalysts

FT chemistry can be used in different ways to convert a sustainable source of carbon into hydrocarbons suitable as jet-fuel feedstock [2]. One indirect route involves conversion of CO_2 + green H_2 to CO and water *via* reverse water gas shift (RWGS). CO produced in this way is then combined with H_2 to produce syngas which is converted into useful hydrocarbon products over a suitable Fischer Tropsch Synthesis (FTS) catalyst, typically cobalt. A direct route involves tandem catalysis combining RWGS and FTS, converting the green H_2 and CO_2 directly into a range of products. This can be achieved with iron catalysts which are active for both RWGS and FTS at typical FT reaction conditions. The potential of cobalt and Fe catalysts for this will be discussed, along with strengths and weaknesses of each catalyst system. Planned future applications of both systems will be discussed.

Catalyst Research for Sustainable Kerosene (CARE-O-SENE)™

We will highlight the CARE-O-SENE consortium work (Figure 1) which is funded by the German Federal Ministry of Education and Research (BMBF) and Sasol. Here, we showcase aspects of collaborative work to understand, develop & scale-up new

cobalt catalysts that are stable at high conversion and that yield high selectivity in slurry phase reactors. The scale-up of this state-of-the-art PtL catalyst, amongst the best in its class, is seen as an enabler for Sasol's recently founded eco-FT business unit, which has ambitions to target the SAF market. The work also demonstrates the power of industry-academia collaboration to advance FT technology.

Future perspectives for sustainable catalysis

Further improvements and developments in catalyst and process design will be required to achieve our sustainability targets, and these are discussed further. Some new perspectives for: (a) producing catalysts in a greener and more efficient manner [2]; (b) integrated approaches using experimental data, advanced and operando characterization, theory, modeling and digital platforms and [3]; (c) moving beyond SAF and towards value added green chemicals, will be highlighted.

Figure 1: CARE-o-SENE™: Closing the complexity, materials, and scale-gap to advance the state of science and application of cobalt Power-to-Liquids catalysts

References

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