

Application of Fischer-Tropsch Technology at scale for sustainable fuels and chemicals production

Sasol is a world-leader in the development and application of the Fischer-Tropsch (FT) technology with more than 70 years of experience. Our own facilities and licensed reactor technologies already produce more than 200 000 bbl/day of Fischer-Tropsch products. As one part of the efforts, 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, e.g. via Biomass/Power-to-Liquids (BPtL) processes.

Coming from this basis, Sasol together with its partners intends to grow and support new sustainable businesses through licensing, catalysts sales and technical with the focus on sustainable chemicals and aviation fuel (SAF) in specific. FT technology is a viable pathway for SAF as it is a well-established technology and is feedstock-agnostic, with very high GHG elimination potentials (90%). Furthermore FT-derived synthetic fuels have several favourable properties that can also reduce the significant non-CO₂ emission impacts of aviation fuels.

The target is to apply Sasol's Fischer-Tropsch know-how into Power-to-X (PtX) respectively Power-to-Liquid (PtL) processes. An ideal PtX process needs a reliable and constant green energy source. Geothermal energy is such preferred source. This energy feeds a water electrolysis combined with an e-Reverse Water Gas Shift (e-RWGS) reaction or alternatively CO₂/water co-electrolysis to produce the syngas (a mixture of hydrogen and carbon monoxide) which is the feedstock for the Fischer-Tropsch process. As a sustainable CO₂ source, CO₂ from a Direct Air Capture unit (DAC) like the demonstration unit from Climeworks (Orca project) could be applied.

Despite that there are more and more mandatory SAF blending mandates (RED II) the success of SAF will also depend on an overall high process efficiency and finally cost competitiveness. Here comes the Fischer-Tropsch catalyst development program into the play. Current state of the art catalyst allows to produce 50-70% of SAF from an FT-crude. With the next catalyst generation, the aim is to achieve more than 80% SAF yields.

The risk-mitigated approach will be outlined that is used to scale the low temperature Fischer-Tropsch (LTFT) technology and the cobalt FT catalysts from laboratory scale (100g) right up to commercial scale (tonnes), utilising Sasol's vast experience and lessons learned from years of technology and catalyst development, dating from the early nineties. We will highlight the CARE-O-SENE consortium work which is funded by the German Federal Ministry of Education and Research (BMBF) and Sasol. Here, we showcase aspects of collaborative work together with our consortium partners in Germany and South Africa, to understand, develop & scale-up new cobalt catalysts that are stable at high conversion and that yield high wax selectivity in fixed-bed, micro-channel and slurry phase reactors. This collaborative approach utilizes fundamental understanding combined with industrial catalyst know-how to speed up innovation cycles and accelerate catalyst development.

The scale-up of this state-of-the-art cobalt catalyst, amongst the best in its class, is seen as an enabler to produce high kerosene yields, which is an imperative to maximise the conversion of renewable feedstock. Future commercialisation of the Fischer-Tropsch technology is a key challenge that needs to be addressed to meet the demand of the growing SAF market.