

Lift-off to sustainable aviation fuels: Optimization of Fischer-Tropsch performance with Manganese promotion

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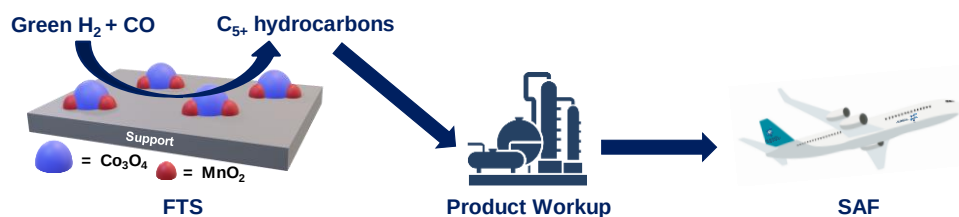
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Abstract

A global drive towards power-to-liquid (PtL) ventures has resulted in Fischer-Tropsch synthesis (FTS) being put under the microscope to produce sustainable aviation fuels (SAF).¹ FTS is still regarded as one of the most effective pathways to produce a variety of long chain hydrocarbon products, including wax, fuels and oxygenates.² Product formation primarily occurs through iron (Fe) or cobalt (Co) catalysis in a variety of reactors. Although more expensive, Co is still being preferred for low-temperature (LT) application due to its higher activity, -selectivity and inherent lower water-gas shift activity.³ In addition, the selectivity during Co LTFTS can be improved even further by adding different metal (oxide) promoters.⁴ For example, the addition of a small amount of manganese (Mn) improves C₅₊ selectivity and overall activity by improving CO dissociation, O removal from the surface, decreasing H₂ uptake (longer hydrocarbons) and/or reducing Co particle size. Manganese as the promotor of choice is regarded as an excellent option due to more than 70% of the global Mn reserves finding their origin in South Africa.⁵ Forming part of the initial phase of the CARE-o-SENE consortium between SA and Germany towards a decarbonised future, this study aimed to i) review and consolidate the prevailing view on the role on Mn promotion based on past studies and ii) investigate the impact of and optimize the Mn loading for selectivity and activity. A series of silica supported Co catalysts have been prepared on laboratory-scale, characterized and applied in FTS using micro-slurry reactors, leading the way towards scale-up efforts that will be compared to state-of-the-art catalysts.



Scheme 1: Production of sustainable aviation fuels via Fischer-Tropsch synthesis.

References

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