Deliverable report

Deliverable No:	D2.5
Dissemination level:	Confidential (CO)
Title:	FT catalyst benchmarking results and optimal FT process specifications

Date:	25/10/2021
Version:	FINAL
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Grant Agreement Number:	817612
Project Type:	H2020-LC-SC3-RES-21-2018-development of next generation biofuels and alternative renewable fuel technologies for road transport
Project acronym:	REDIFUEL
Project title:	Robust and Efficient processes and technologies for Drop In renewable FUELs for road transport
Project start date:	01/10/2018
Project website:	www.redifuel.eu
Technical coordination	FEV (DE) (www.fev.com)
Project management	Uniresearch (NL) (http://www.uniresearch.com)

Executive Summary

The first synthesis step of the REDIFUEL concept is the Fischer-Tropsch-reaction (FT) of synthesis gas, a mixture of hydrogen and carbon monoxide to a mixture of hydrocarbons. Unlike in conventional FT where long-chain paraffins are sought for, in this project the aim was to produce a hydrocarbon mixture rich in olefins with 5–10 carbon atoms. These olefins are converted in the hydroformylation step to alcohols to be used as a component of a diesel fuel.

The research focus of this task was the development of FT process technology towards the production of desired products by optimizing the operation conditions and benchmarking the catalysts developed in the project. Furthermore, this task was responsible of the production of a 1 kg batch of FT catalyst to be used in the pilot test campaigns with real gasification gas.

This deliverable reports the following actions:

- Preparation of the catalyst for laboratory and bench-scale experiments according to the recipe developed in the project
- Benchmarking tests with a laboratory-scale tubular reactor
- Tests with INERATEC's lab-scale microchannel reactor
- Additional tests with the tubular reactor using two additional catalysts
- Benchmarking tests with a special kind of annular gap reactor
- The effect of sulphur impurities on catalyst performance
- The effect of hydrogen / carbon monoxide feed ratio on catalyst performance
- The effect of protective atomic layer deposition (ALD) coating on catalyst stability

The catalysts developed in the project produced desired olefins in high selectivity but there was a big difference in their activity. It was confirmed that the catalyst was not very sensitive to changes in feed gas composition and that it was not immediately deactivated even by 5 ppm-levels of sulphur compounds. The excess methane formation with high conversion levels indicated that the reaction heat with the annular gap reactor was not well controlled. The skewed product distribution caused by high methane selectivity shall be corrected when these results are used as basis for modelling and techno-economic assessments.

Acknowledgement

H2020-LC-SC3-RES-21-2018-DEVELOPMENT OF NEXT GENERATION BIOFUELS AND ALTERNATIVE RENEWABLE FUEL TECHNOLOGIES FOR ROAD TRANSPORT

Acknowledgement:
The author(s) would like to thank the partners in the project for their valuable comments on previous drafts and for performing the review.

Project partners:
1 - FEV - FEV EUROPE GMBH - DE
2 - MPI - MAX-PLANCK-GESELLSCHAFT ZUR FORDERUNG DER WISSENSCHAFTENEV - DE
3 - CSIC - AGENCIA ESTATAL CONSEJO SUPERIOR DE INVESTIGACIONES CIENTIFICAS - ES
4 - VTT - Teknologian tutkimuskeskus VTT Oy - FI
5 - RWTH - RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN - DE
6 - OWI - OWI – Science for Fuels gGmbH - DE
7 - VUB - VRIJE UNIVERSITEIT BRUSSEL- BE
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10 - INER - INERATEC GMBH - DE
11 - T4F - TEC4FUELS - DE
12 - UNR - UNIRESEARCH BV - NL

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement no. 817612