SUN-to-LIQUID - Integrated Solarthermochemical Synthesis of Liquid Hydrocarbon Fuels

Authors: Valentin Batteiger, Christoph Falter, Andreas Sizmann

Bauhaus Luftfahrt, Munich (Taufkirchen), Germany

The aviation industry has set the ambitious target to reduce the 2050 CO_2 emissions of air transportation to 50% of the 2005 emissions. Low-carbon alternative fuels are expected to contribute significantly to achieving this target. Several biofuels have been approved for civil aviation, but the environmental impact of producing biofuels at the required scale is controversial. In contrast, solar fuels from water and CO_2 can be produced with high yield from non-arable land, thereby offering the perspective of a truly sustainable supply of jet fuel. Consequently, renewable CO_2 as a feedstock can become a critical ingredient for a sustainable growth of airborne mobility.

The presentation will introduce the solar-thermochemical fuel production pathway by discussing the results from the EU-project SOLAR-JET (2011-2015). Technical aspects will be covered by a presentation of the scientific advances leading to the synthesis of a first sample of kerosene from water, CO_2 and concentrated sunlight in a laboratory environment [1]. The expected economic performance and climate impact of synthetic fuels from solar energy will be discussed based on the SOLAR-JET system analysis [2].

Within the EU-project SUN-to-LIQUID (2016-2019) the solar fuel technology will be transferred from the laboratory to the field. The implementation in Móstoles, Spain, comprises a high-flux solar concentration system, an up-scaled solar reactor system, and on-site gas-to-liquids conversion. Complementing research is dedicated to redox materials and heat recovery to improve energy conversion efficiency, and to the preparation of further scale-up.

References:

[1] D. Marxer, P. Furler, J. Scheffe, H. Geerlings, C. Falter, V. Batteiger, A. Sizmann, A. Steinfeld, *Demonstration of the entire production chain to renewable kerosene via solar-thermochemical splitting of H_2O and CO_2*, Energy Fuels, 2015, 29 (5), pp 3241–3250, and references therein.

[2] C. Falter, V. Batteiger, and A. Sizmann; *Climate Impact and Economic Feasibility of Solar Thermochemical Jet Fuel Production*, Environ. Sci. Technol., 2016, 50 (1), pp 470−477