

Semester Project (10 ECTS)

Administrative

Supervision: Dr. Du Wen, Prof. J. Van Herle

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Location: Sion or remotely (travel allowance offered)

Remarks: If interested, please send your CV, with a short motivation letter, to Du Wen.

Project description:

The transition toward sustainable energy systems has accelerated the development of highly efficient electrochemical technologies, including solid oxide electrolysis (SOE). Owing to its high operating temperature and multifunctional modes, SOE, particularly in co-electrolysis mode (co-SOE), offers an efficient, flexible pathway to convert renewable electricity, steam, and CO₂ into syngas. This syngas serves as a key intermediate for Fischer–Tropsch (FT) synthesis of e-fuels, positioning co-SOE as a promising technology for circular fuel production.

Among FT fuels, sustainable aviation fuel (SAF) has attracted exceptional attention because of the aviation sector's limited alternatives. In Europe, meeting ambitious SAF deployment targets set by the European Union, including the ReFuelEU Aviation initiative, will require major advances in cost-effective, large-scale SAF production.

SOE is particularly well suited for integrated co-electrolysis due to its superior efficiency, ability to utilize waste heat, and flexibility in tailoring the H₂/CO ratio for FT synthesis. Compared to alternative electrolysis technologies, SOE enables direct CO₂ conversion and avoids other challenges related to corrosion, system complexity, and gas separation. Nevertheless, large-scale integration of co-SOE with FT synthesis also faces challenges, including heat integration, cell degradation and coking (carbon deposits in electrode), cost reduction, and understanding the impacts of direct reactor coupling and feedstock impurities.

This project will address these challenges from system level modeling and optimization and will be done in collaboration with GEM and IPESE.

Your tasks:

- Understanding co-electrolysis and Fischer–Tropsch processes.
- Data collection, such as market data, industrial data.
- Conducting TEA and LCA of the co-SOE/FT system under different scenarios.
- Detecting the key process via the results and carrying out a sensitivity analysis for different scenarios.

Skills:

- Understanding of energy concept and life cycle assessment
- Results interpretation and report writing