

Semester Project - Spring 2023

European Project: REACTT (<https://www.reactt-project.eu/>)

Understanding Solid Oxide Electrolysers (SOE) fault conditions footprint by using Total Harmonic Distortion as an advanced in-situ diagnostic tool to increase the lifetime of SOE technology

Context

Solid oxide electrolyzers (SOE) are electrochemical devices that convert electrical energy into chemical energy at high efficiency. This is especially relevant together with intermittent renewable energy where it allows for a seasonal storage of solar energy, for example. In reverse mode (solid oxide fuel cell, SOFC), electricity can be produced by using the same device. Their lifetime is currently not yet sufficient in both modes for large-scale commercialization. A control strategy to avoid or overcome harsh conditions is key to prevent a strong degradation that would arise from those fault conditions. Total harmonic distortion (THD) is a promising online monitoring tool to quickly detect several faulty conditions such as a decrease of hydrogen, a high steam conversion or humidity in the air.

Objectives and tasks

In the frame of the REACTT project, GEM lab is testing short stacks (6 cells, 150W) manufactured by SolydEra, to investigate the footprint of 4 fault modes on the THD measurement. The goal is to detect a trend for each fault mode on the THD. This will eventually be implemented in a control strategy so that the event can be recognized and handled timely.

The semester project will focus on THD data analysis, with Matlab, generated by two different equipment. In addition to THD, the student will investigate the global behavior of the stack through parameters like cell voltage, current density, temperature, pressure, and flow rates. In addition, IV curves and EIS (electrochemical impedance spectroscopy) are also used to deepen the understanding of the stack behavior.

Contact: Audrey Wesoly

Audrey.wesoly@epfl.ch