

Semester project:

Degradation phase characterization based on single-cell accelerated stress tests via electrochemical impedance spectroscopy and distribution of relaxation time methods

The Group of Energy Materials (GEM) is currently working on the degradation characterization of SolydEra single cell based on electrochemical impedance spectroscopy (EIS) and distribution of relaxation time (DRT). There are generally two degradation phases, including (1) wear-in process in the beginning with high degradation rate, and (2) intrinsic degradation rate after wear-in process. To better understand the relationship between operating parameters and the degradation phases, we use accelerated life tests (ALTs) to investigate the cell degradation phases via the controllable parameters, e.g., cell temperature, humidity of both fuel flow and air flow.

The proposed study will be provided with several sets of 1000-hour ALTs results. Using DRT method, Nyquist plot and Bode plot to analyze these EIS measurements, we can build up the relationship between the operating parameters and characteristics of different degradation phases, for example, the duration and rate of wear-in process, and the rate of intrinsic degradation.

In this project, the work of student at GEM will consist of using DRT tools, Nyquist plot and Bode plot to characterize the degradation phases of different cells after long-term ALTs. The degradation rates will be analyzed based on the change of voltage, total impedance, individual impedance.

Your Tasks:

- Assist to mount cell and perform EIS/IV measurements during the ALTs.
- Use DRT tools developed by GEM and other researchers to analyze the EIS results.
- Investigate the relationship between the degradation phases and operating parameters.

Skills

- Understanding of electrochemistry and work principle of solid oxide cells.
- Results interpretation and report writing
- Coding skills and software: Matlab
- Lectures: Engines and fuel cells

Administrative

This project is a part of collaborative research work between GEM (EPFL) and HydroQuebec. The project will be supervised by Hangyu (GEM). If interested, please send your CV, with short motivation letter, to Hangyu.

Location

This research work will be conducted at EPFL, Sion.

Supervisors

Hangyu Yu, mailto: hangyu.yu@epfl.ch