

Semester project:

Degradation analysis of 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). Unlike conventional research focusing on the material and microstructure of the single cell, we use accelerated stress tests (ASTs) to characterize the cell degradation 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 ASTs results, which consists of three parts, (1) the first fingerprint before the ASTs including multiple EIS and current-voltage (IV) measurements, (2) EIS measurements during the 1000-hour tests, and (3) the second fingerprint after the ASTs with same measurements as the first fingerprint. Using DRT method, Nyquist plot and Bode plot to analyze these EIS measurements, we can expose the degradation mechanism and the degradation trend of the cell.

In this project, the work of student at GEM will consist of using DRT tools, Nyquist plot and Bode plot to characterize the degradation phenomena of the cell after long-term ASTs. 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 ASTs.
- Fingerprints comparison by considering (1) different cells, (2) before/after the long-term ASTs.
- Use DRT tools developed by GEM and other researchers to analyze the EIS results.

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

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