

Solid Oxide Cell based Electrochemical Impedance Spectroscopy Dataset for Deep Learning and Neural Network Applications

Semester Project (10 ECTS)

Administrative:

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Location: Sion or remotely (travel allowance offered)
Remarks: If interested, please send your CV, with a short motivation letter, to Hangyu Yu.

Project description:

The Group of Energy Materials (GEM) has now a great amount of solid oxide cell (SOC) based electrochemical impedance spectroscopy (EIS) data in multiple scales (cell, short stack, and whole stack) and multiple types (anode supported cells and electrolyte supported cells). Via distribution of relaxation times (DRT) method and equivalent circuit models (ECM), different electrochemical processes inside the cell can ideally be separated into the gas conversion, the surface exchange, the gas diffusion and the electrode charge transfer. However, due to the different cell geometry and measurement noise, it is hard to completely decouple the electrochemical processes. In this case, deep learning and neural networks are introduced to help solve this question, utilizing GEM's abundant historical EIS data.

The proposed study will be provided with EIS data from different projects. Specifically, the following information will be examined: (1) frequency, total impedance, and phase; (2) number of cells and interconnectors; (3) cell configuration and material. Referring to the existing EIS dataset in the lithium battery field, all these information will be gathered to build up the first SOC EIS dataset in the field.

The following skills are recommended for this project: (1) understanding of electrochemistry and work principle of solid oxide cells, (2) results interpretation and report writing, (3) coding skills with python, and (4) lecture of Engines and fuel cells.

Your tasks:

1. Literature review about the existing dataset in fuel cell, electrolyzer, and battery field.
2. Data collection in GEM and from the literatures.
3. Use pandas to create a SOC based EIS dataset in Python environment.