



Master thesis

Model-based investigation of a new approach for cathode characterization

Research area

- ☒ Batteries
- ☐ Fuel cells and electrolysis
- ☐ Electrocatalysis

Alignment

- ☐ Experimental
- ☐ Electrical Characterization
- ☐ Material analysis
- ☐ Development of measurement technology
- ☒ Modeling
- ☒ Simulation
- ☒ Literature Research

Course of study

- ☒ Electrical engineering and IT
- ☒ Mechanical Engineering
- ☒ Chemical Engineering
- ☒ Physics
- ☒ Techno mathematics
- ☒ Industrial Engineering

Language

- ☒ English
- ☐ German

Starting date

November 2023

Contact person

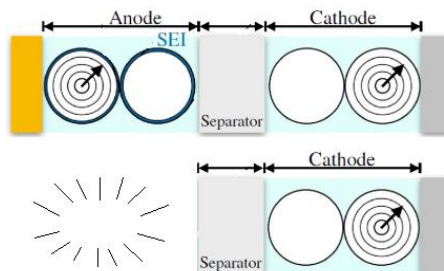
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Motivation

A lot of battery related research nowadays focuses on new cathode materials and configurations. Besides the experimental investigation of the new cathode materials, modeling plays an important role, especially for interpretation of the experimental data. That helps with optimization of the material as well as with the reduction of experiments needed.

The widely used P2D model for a Lithium-Ion Battery models cathode and anode together, as the behavior of the anode influences the behaviour of the cathode and vice-versa. Provided that we have a setup, where behaviour of the anode does not influence the cathode at all, we can considerably simplify the model (as well as reduce the number of unknown model parameters) by excluding the anode from the model – e.g. making a half cell model. How good will be such a model in comparison with the original one in reproducing the measured EIS and C-rate data?



Areas of responsibility:

Your goal will be to develop a new half-cell model, based on the original full cell model. Then you need to test if the model behaves the same way and if not, how much worse is half-cell model compared to the original one. That will be done by parametrizing both models on the same experimental data.

In case that the condition of zero influence of anode on cathode is fulfilled, the parameters obtained from parametrization of both models should match perfectly. How well is this condition fulfilled on the studied experimental setup?

Workpackages:

- Understanding the way how the model works (physical principles and their implementation in the code.)
- Development of a half cell model based on the existing full cell model
- Parametrization of both models.
- Comparison of the obtained parameters, sensitivity study of the model to the parameters.
- Writing of the thesis and preparation of two presentations (midterm and final)

Application

We offer lively atmosphere and the opportunity to work in an interdisciplinary team on an innovative topic. Interested candidates are asked to send a brief motivation letter, curriculum vitae and grades to the email address mentioned. Please contact Jakub Jambrich for more detailed information.

Prof. Dr.-Ing. Ulrike Krewer