



Master`s Thesis

Model-assisted Performance Investigations in PEM Water Electrolysis

Research area

- Batteries
- Fuel cells and electrolysis
- Electrolysis / Power-to-X

Alignment

- Literature Research
- Method Development
- Experiments
- Modeling & Simulation
- Data Analysis

Course of study

- Electrical engineering and IT
- Mechanical Engineering
- Chemical Engineering
- Physics
- Material Sciences

Language

- English
- German

Starting date

2025 / Upon agreement

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Hydrogen plays a central role in the energy transition. Polymer electrolyte membrane water electrolysis (PEMWE) is a key technology for hydrogen production. The central research question is how to improve the performance and reduce degradation. Particularly, the water splitting reactions at the anode is the largest obstacle. Highly active electrocatalysts are, thus, needed to reach high conversion rates. For the development of such catalysts, it is crucial to understand the electrochemical processes and their changes during operation.



The topic of the master`s thesis will be to investigate the influence of H₂-crossover on catalyst performance under realistic operation conditions in PEMWE full cells. For this purpose, first, a proper measurement method to use the mass spectrometer (MS) will be implemented. Then, electrochemical measurements such as cyclic voltammetry and impedance spectrometry will be carried out at the test bench to determine the catalyst performance in a full cell. Moreover, the H₂-crossover process will be implemented into the existing microkinetic model in MATLAB. Finally, the gained information will be used to deepen the knowledge on the catalyst performance and catalyst surface states under the technically-relevant and dynamic operation conditions.

Areas of responsibility:

- Literature research
- Method development for gas analysis via mass spectrometer
- Electrochemical measurements, e.g. cyclic voltammetry and impedance spectroscopy
- Improving the already existing matlab script for the simulation of cyclic voltammograms
- Evaluation and interpretation of the results
- Thesis writing

Enjoy an exciting topic in the field of sustainable and green energy technology and work together with a motivated and interdisciplinary team in a friendly working atmosphere. We offer excellent support throughout the duration of the master`s thesis. Additionally, your work would be a valuable reference for the future vacancies at the institute. If we have raised your interest, please feel free to contact us. We kindly ask you to send your CV and current transcripts to goezde.kardes@kit.edu. If you have further questions, do not hesitate to contact Mrs. Kardeş.