Karlsruher Institut für Technologie

IAM-ET Electrocatalysis Group

Institut für Angewandte Materialien
Elektrochemische Technologien
Adenauerring 20 b
76131 Karlsruhe

Bachelor or Master thesis

Experimental analysis of electrochemical hydrogen peroxide synthesis using RRDE

Research Area

- ☐ Batteries
- ☐ Fuel Cekks and Electrolysis
- ☒ Electrocatalysis

Orientation

- ☒ Experimental
- ☒ Electrochemical Characterization
- ☐ Material Analysis
- ☒ Development of a measurement technique
- ☐ Modeling
- ☐ Simulation
- ☒ Literature Research

Course of Studies

- ☒ Electrical Engineering
- ☒ Mechanical Engineering
- ☒ Chemical Engineering
- ☐ Physics
- ☐ Mathematics
- ☒ Industrial Engineering

Start Date

As soon as possible

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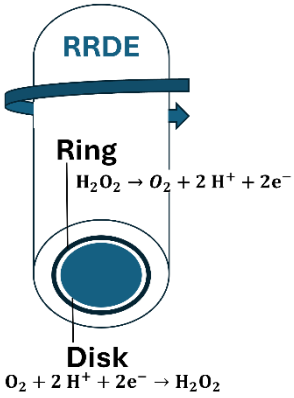
Motivation

Hydrogen peroxide (H_2O_2) is a versatile oxidizing agent with applications in the chemical industry, water treatment and medicine. The **electrochemical synthesis of H_2O_2** from oxygen and water is a sustainable alternative to the conventional, energy-intensive anthraquinone process, especially in decentralized applications. A key requirement for industrial implementation is the development of efficient and selective catalysts.

The **rotating ring-disk electrode (RRDE)** is an established method for investigating the selectivity and efficiency of electrochemical reactions.



The aim of this work is to **validate the RRDE measurement setup for electrochemical hydrogen peroxide synthesis and to carry out investigations into catalyst performance and stability**. For this purpose, the measurement methodology will first be tested for reproducibility. Subsequently, several palladium- and gold-based catalysts will be examined using various electrochemical stationary and dynamic methods.

The work is divided into the following steps:

- Literature research on electrochemical H_2O_2 synthesis and RRDE methodology
- Familiarization with the measurement setup and validation of the methodology
- Investigation of the catalyst performance (activity, selectivity and stability) of selected palladium- and gold-based catalysts
- Evaluation, interpretation and discussion of the experimental results

Additional tasks for a Master's thesis:

- Conducting extended studies with a selection of additional catalysts and catalyst classes to identify material-specific influences on the efficiency and selectivity of H2O2 electrosynthesis
- Systematic comparison of catalyst activity and selectivity under different electrolysis conditions, such as pH variation, different electrolyte compositions

Note

The IAM-ET is an institute with expertise in the field of battery, fuel cell and electrolysis research at Campus South. An independent way of working and the motivation to familiarize yourself with new topics are required. For further information please contact Elisabeth Oldenburg (elisabeth.oldenburg@kit.edu). If you are interested, please get in touch.