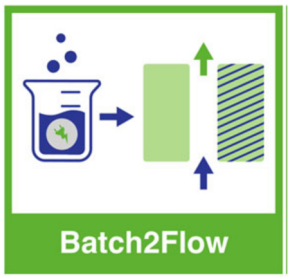
Karlsruher Institut für Technologie

IAM-ET Electrocatalysis Group

Institut für Angewandte Materialien
Elektrochemische Technologien
Adenauerring 20 b
76131 Karlsruhe

Bachelor- / Masterthesis

Investigation of the Performance of Different Electrochemical Hydrogenation Reactors



Research area

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

Alignment

- ☒ Experimental
- ☒ Electrical Characterization
- ☐ Material analysis
- ☒ Modeling
- ☒ Simulation
- ☒ Literature Research

Course of study

- ☒ Electrical engineering
- ☒ Mechanical Engineering
- ☒ Chemical Engineering
- ☒ Physics
- ☒ Techno mathematics
- ☒ Materials Science

Starting date

As soon as possible

Contact person

Emmanuel Stripling
Raum 336
Tel: +49 721 608-48934
E-Mail: Emmanuel.Stripling@kit.edu

http://www.iam.kit.edu/et/

Motivation

To achieve climate goals, it is essential to electrify the chemical industry. A promising approach is the use of electro-organic synthesis routes. These offer several advantages compared to thermally induced reactions. Renewable electricity can be used directly for oxidation or reduction reactions. This often eliminates the need for toxic or hazardous oxidizing or reducing agents. Additionally, electrochemical reactions usually take place under normal conditions, avoiding high pressures and extreme temperatures.

The reaction conditions are usually parameterized in easily accessible batch reactors. To transfer the processes to an industrial scale, the optimal reaction parameters must be transferred to a flow reactor (flow cell). However, this usually leads to unexpected performance losses. Therefore, it is necessary to examine the individual reaction and transport conditions more closely and to establish a scientifically sound foundation.

The performance of an electrochemical reactor is largely determined by the mass transport of reactants from the bulk to the electrode surface, as well as by the membrane. Thus, the examination of different mass transport conditions in the respective reactor types is an essential component of characterization. This should be classified using dimensionless numbers (e.g., Reynolds, Sherwood, Fourier numbers). CFD as well as experimental measurement methods can be used for mass transport investigations. In addition, reactor performance is classified through various test series, whereby the different conversions and selectivities should be determined using HPLC-MS.

Possible tasks:

- Experimental investigations on the reaction kinetics of the hydrogenation reaction
- CFD simulation to investigate mass transport conditions (in batch or flow reactors)
- Experimental investigations of different operating conditions (concentrations, currents, temperature, etc.) in batch reactors
- Experimental investigations of different operating conditions (concentrations, currents, temperature, etc.) in flow reactors
- Investigation of mass transport conditions in batch reactors or flow reactors

Notes

We offer you excellent supervision and the opportunity to work in an interdisciplinary team on a forward-looking topic. IAM-ET offers a constantly growing team with expertise in the field of battery, fuel cell and electrocatalysis research at Campus South. Independent working and the motivation to work on current research topics are required. For further information, please contact your contact person Emmanuel Stripling at any time. If you are interested, please send your CV, transcript of records and certificate of enrollment to Emmanuel.Stripling@kit.edu.