Karlsruher Institut für Technologie

Institut für Angewandte Materialien
Elektrochemische Technologien
Adenauerring 20 b
76131 Karlsruhe

Bachelor-/Master thesis

Process-Structure-Property Correlations of Binder/Additive Networks in High-Capacity Electrodes for Lithium-Ion-Batteries

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
☒ Material Science
☒ Mechanical Engineering
☒ Chemical Engineering
☒ Physics
☒ Technical Mathematics

Language

☒ English
☒ German

Starting date

As soon as possible

Contact person

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Motivation

Sustainable energy supply requires not only the use of renewable energies, but also the storage and short-term availability of energy in various applications. The optimization of electrochemical energy storage systems such as Li-ion batteries (LiB) in terms of capacity, power density and service life is therefore a current research topic in science and industry. Germany wants to establish itself as a centre of excellence for the production of high-performance battery cells. Mixing and dispersion processing plays an important role during electrode manufacturing as they strongly influence the formation of the conductive additive network. Current research focuses on the reliability of these production steps and ultimately its effect on battery performance. At our institute you will get the possibility to take part in cutting edge research in the field of renewable energy storage and conversion.

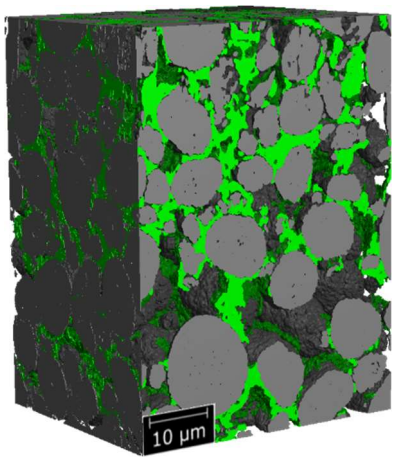

Figure 1: Locally resolved 3D-reconstruction of the conductive network inside a Lithium-Ion-Battery cathode

Your Task:

The aim of this work is to investigate electrode structures from different mixing and dispersion processes and to evaluate them with regard to the relevant influencing variables. 3D structural simulations on real electrode structures as well as an electrochemical characterization of the electrodes will be used to understand underlying structure-property correlations. In this way, you are directly involved in real scientific issues and can apply the knowledge you have acquired practically. You will also be in close contact with a large number of other students and have the opportunity to contribute your own ideas.

- Recording OCV curves as a basis for structurally resolved discharge simulations
- Definition of the simulation domain on real electrode structures from tomography data
- Carrying out spatially resolved simulations in the simulation environment GeoDict
- Documentation of results and preparation of two presentations

Application

We offer a lively atmosphere and the opportunity to work in an interdisciplinary team on an innovative topic. We expect an independent attitude and the motivation to learn and understand a fresh topic. If you are interested in working with us or have any questions, please contact Adrian Lindner with a short introduction.

Prof. Dr.-Ing. Ulrike Krewer