



Master Thesis Project / Vertieferpraktium “Polymer Electrolytes for Potassium-ion Batteries”

The well-known shortcoming of lithium-ion batteries (LIBs) is the limited abundance of lithium and cobalt sources. Recently the intense attention of academia and industry has been devoted to the development and investigation of post-lithium systems. Potassium-ion batteries (PIBs) can be considered as an alternative to LIBs due to their lower cost and wide voltage window, which is comparable to Li-ion batteries.

Moreover, both conventional LIBs and PIBs include flammable liquid electrolytes and low melting point separators which causes safety concern. In order to avoid safety threats solid polymer electrolytes (SPEs) can be applied in K-ion batteries.

The key factors defining the choice of materials for SPE are ionic conductivity, mechanical properties and electrochemical stability. Material with the convenient properties can be achieved by varying the ratio between coordinative unit of polymer and potassium-based salt. All-solid PIBs have not received any great attention so far which leaves us a large room for research.

The project includes following parts:

1. Preparation of SPEs based on different polymeric materials and K-ionic salts
2. Characterization of ionic conductivity and mechanical properties of novel SPEs
3. Investigation of electrochemical stability of the chosen materials with convenient properties
4. Assembly and testing of polymer-electrolyte-based PIBs

Your tasks include:

- Casting of thin films for SPEs
- Assembly of Swagelok-type battery cells
- Characterization of ionic conductivity and mechanical properties of the materials by the analytical techniques (EIS, DSC, TGA, XRD)
- Electrochemical characterization of the materials and cells

Please note that the thesis project is carried out in an international team and hence the project supervision, team meetings and thesis writing will be mostly held in English. Experience in chemistry of polymers, chemical engineering or material science would be preferable.

If you are interested in this project and would like to know more please contact **Anna Khudyshkina** (anna.khudyshkina@kit.edu) or **Dr. Fabian Jeschull** (fabian.jeschull@kit.edu).