



Bachelor or Master Thesis

“Impact of formation cycles on SEI formation on Li ion battery anodes”

Starting date: as soon as possible

In the project “InSEIde” we will look at silicon/carbon (Si/C) composites as alternative high capacity anodes for Li ion batteries. In order for this material class to become a true competitor for the commercially used graphite, its cycling stability needs to be improved. One of the obstacles to overcome is the instability of the solid electrolyte interphase (SEI) on silicon-based electrodes. We therefore aim to understand the SEI formation and its behavior during extended electrochemical cycling on a fundamental level using electrochemistry as well as advanced surface and interface characterization tools. Based on these investigations, we will derive strategies to improve the SEI stability and design electrode protection layers.

In this stage of the project, we will set the base line for our future developments concerning designed interfaces. The aim of this bachelor/master project is therefore to study commercial Si/C electrodes and investigate the SEI composition and electrode morphology in dependence of the formation procedure, i.e. the first electrochemical cycles in a battery. You will compare your findings from Si/C composites to state-of-the-art graphite electrodes as well as simplified model systems and discuss your results in the context of the current literature on SEI layers on battery anodes.

Your tasks will include for example:

- Assembly of Li ion battery test cells based on Si/C and graphite electrodes
- Electrochemical characterization of the electrode materials
- Synthesis of Si/C composites and preparation of battery electrodes
- SEI characterization using photoelectron spectroscopy including data evaluation
- Morphology studies using scanning electrochemical microscopy

Ideally, you have a background in chemistry, chemical engineering, material science or similar and have an interest in surface analytics.

We will discuss the final outline of the project together and can adjust the experimental plan according to your level (i.e. Bachelor/Master). Depending on your starting date, part of your experimental work can be performed at the synchrotron facility BESSY II in Berlin during our hard x-ray photoelectron spectroscopy beam time, which allows us to probe deeper into the material.

If you are interested in this project or would like to have more information, please contact **Dr. Julia Maibach (julia.maibach@kit.edu)**