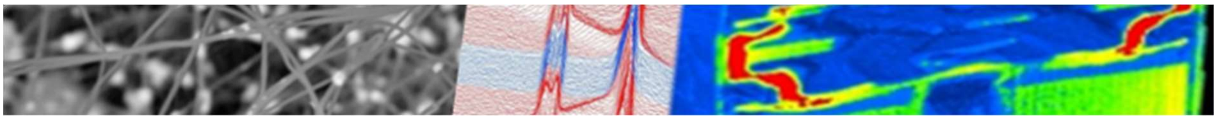
Karlsruher Institut für Technologie

Institut für Angewandte Materialien



Bachelor/Master Thesis

“SEI stability in Lithium ion batteries”

Starting date: As soon as possible

In Lithium ion batteries, the interface between the negative electrode and the electrolyte is of particular importance because the potential at which Lithium ions are inserted into the commonly used graphite material is outside the electrochemical stability window of the electrolyte.
This leads to electrolyte decomposition. Luckily, solid decomposition products form a passivation layer on the electrode surface. This layer is called the solid electrolyte interphase (SEI). The SEI has two important tasks: 1) it needs to block electrons from reaching the electrolyte where they can react further and 2) at the same time the SEI has to be highly conductive for lithium ions so that they can move in and out of the active material (i.e. graphite). As long as the SEI performs these two important tasks the battery will function properly without losing capacity.
This means, that the SEI needs to be stable, i.e. not dissolve or decompose during the battery operations. If the SEI is not stable, it will continuously reform which then consumes electrolyte and ultimately the battery will lose capacity over time. This constitutes one of the major limitations of Li ion batteries and is a topic of great concern to researchers in the field.

With this Bachelor/Master Thesis, we will look closer at the SEI stability by combining electrochemical characterization, x-ray photoelectron spectroscopy (XPS) and high-performance liquid chromatography (HPLC). Your tasks therefore include:

- Assemble battery cells to form an SEI on the negative electrode
- Characterize the SEI composition at various stages of lithiation using XPS
- Characterize the SEI composition after different storage conditions using XPS
- Determine the electrolyte composition before and after SEI formation and after possible SEI dissolution using HPLC

You will perform these experiments using model systems as negative electrodes as well as commercial graphite electrodes to correlate your findings to as realistic systems as possible.

If you are interested or have any further questions, please **contact**
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