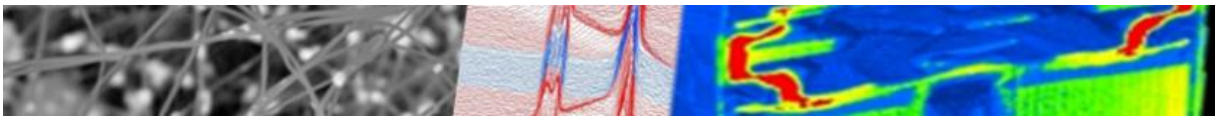
Karlsruher Institut für Technologie

Institut für Angewandte Materialien



Master Thesis

"Synthesis and Surface Analysis of Prussian Blue Analogues for K-Ion Batteries"

Starting date: as soon as possible

A bottleneck for Li-ion batteries (LIBs) is the abundance of raw materials such as cobalt, nickel or even lithium. Possible alternative technologies are post-Li-ion systems, which use other alkali metals, such as sodium or potassium. The (electro)chemistry of potassium-ion batteries (KIBs) in particular is similar to that of state-of-the-art LIBs and therefore an interesting system to explore for next generation energy storage.
Key to long lasting batteries are electrode materials with a high reversibility for the electrochemical insertion/deinsertion and a (kinetically) stable electrode-electrolyte interface. Prussian blue analogues (PBAs) belong to this class of potential candidates for positive electrode materials in KIBs because of their high operating potential and high reversibility and durability. The cycle life of a battery is mostly determined by its capacity fade. The main origin of capacity fade are irreversible reactions (side reactions) that consume charge carriers (Li- or K-ions) at highly oxidative or low reductive conditions. It is thus paramount to understand which side reactions take place at the electrode-electrolyte interface and how this interface can be tailored to reduce the amount of irreversible reactions during battery operation.
Therefore, this project consists of following two parts:

1) *synthesis of Prussian blue analogues, material characterization and electrochemical testing of the prepared materials as positive electrodes (cathode) in K-ion batteries.*
2) *Surface characterization of KIBs by means of X-ray photoelectron spectroscopy (XPS)*

Your tasks will include for example:

- *Synthesis of Prussian blue analogues (experience with synthetic works under inert gas is advantageous)*
- *Assembly of K-ion cells*
- *Electrochemical characterization of the electrode materials*
- *XPS-characterization of the electrode surfaces including data evaluation*
- *Morphology studies using scanning electron microscopy*

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

If you are interested in this project or would like to have more information, please contact
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