



Ph.D Position

"Towards the development of Na- and K-ion capacitors"

Starting date: May 2017 or later

Li-ion capacitors are one of the most widely studied hybrid/asymmetric capacitors in the last years. However, the need of alternative metals which are more abundant and cheaper than lithium was recently driving the research towards the development of Na-ion capacitors. Despite the materials for Na-ion batteries are continuously developed, they are mostly designed for high energy application, only few examples are reported for high power.

Beside, Potassium is another appealing possibility to develop novel battery concept. In addition, K⁺ ion is weaker solvated than Li⁺ and Na⁺, conferring to the electrolyte a higher ionic mobility and a faster charge/discharge. However, at the state of the art there are very few reports concerning K-insertion materials and no publications reporting the study and development of K-ion capacitors.

Job description:

Because of the above mentioned reasons, the aim of this thesis is to synthesize advanced key-materials for Na-ion and K-ion supercapacitors. Structural characterization will be conducted by using ex-situ and in-situ techniques. The developed materials will also be employed in a complete asymmetric-hybrid system containing capacitor-type (e.g. activated carbon) and battery-type materials. Electrochemical characterization will be performed by means of Cyclic Voltammetry, Galvanostatic charge/discharge and Electrochemical Impedance Spectroscopy measurements.

This work will be a proof of concept for the realization of asymmetric-hybrid systems employing double layer-types and ion-insertion-types materials beyond the conventional Li-ion capacitor technology. The substitution of Li with the more abundant Na and K can drive the research versus novel energy storage concepts where cheaper elements can be employed as alternative to lithium.

Requirements:

The candidate is expected to have a background in material synthesis and/or electrochemistry and good communication skills. Fluent German and knowledge of English are required.

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