In-Situ Analysis with Neutron and Photons of Electrode Materials for electrochemical Energy Storage

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Lithium ion batteries are the most common secondary batteries that are used in mobile devices, automotive applications or as intermediate energy storage system in households and industry. However, the immense research in this field has pushed this storage system close to its theoretical energy density limits. Further progress in higher energy densities relies on the utilization of novel electrode concepts at the anode and cathode side. These new next-generation electrodes like silicon anodes and sulfur cathodes with nine and five times higher energy densities[1,2], respectively, are promising candidates for the post lithium ion era.

However, these new concepts are challenging due to their complex chemistry and unsolved capacity fading issues. Therefore it is important to employ sophisticated analysis methods to study these systems *in-situ*. This will yield new insights into the underlying degradation mechanisms. Sulfur cathodes were analyzed with a novel operando cell to study macroscopic structure formations with *operando* X-ray radiography.[3] The lithiation and delithiation process in silicon anodes was investigated with *in-situ* neutron reflectometry.[4] The results of these two experiments will be discussed in this presentation.

References:
[1] *Chem. Rev. 114*, 11751–11787 (2014)
[2] *J. Power Sources 202*, 308–313 (2012)
[3] *PCCP 18*, 10630 (2016)
[4] *ACS Nano 10*, 7458–7466 (2016)