Bulk sensitive soft X-ray edges probing in electrodes for battery application

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To this day, elucidating the charge transfer process in electrode material upon electrochemical cycling remains a challenge, primarily due to the complexity of chemical reactions at the electrode surfaces. Here we present an elegant and reliable method to probe bulk sensitive soft edges for elucidating anodic and cathodic charge compensation contribution via x-ray Raman scattering spectroscopy. By using hard x-ray incident beam this technique circumvents surface limitation and avoids self-absorption problematic. In addition it does not require complex sample preparation or experimental setups, making it an ideal tool for potential *in situ* analysis of electronic structure of electrode materials. For the first time we monitored bulk soft edges of both oxygen and transition metal of the cathode material Li2FeSiO4 during one complete electrochemical cycle. We reveal that redox mechanism relies primarily on iron (cathodic) contribution, but that the oxygen (anodic) plays an active role in the charge compensation process throughout the electrochemical reaction. Moreover, we were able to support the experimentally observed changes of the electronic structure with *ab initio* based simulation.