

X-ray Absorption Spectroscopy of a Poly Sodium 4-Styrenesulfonate Intercalated Graphite Oxide Electrode

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We investigated the electronic structures of a poly sodium 4-styrenesulfonate intercalated graphite oxide (PSSGO) electrode and a precursor graphite oxide (GO) electrode using X-ray absorption spectroscopy (XAS). Both electrodes were obtained from electrochemical cells. We found that in the C K-edge XAS spectra the π^* state intensity originating from the sp² hybridization of graphite decreases predominantly in the graphite oxide and PSSGO electrodes. This indicates that the negatively charged electrolyte ion (BF₄⁻) is absorbed onto the electrodes and is transferred to the π^* state of the both electrodes. The analysis of their F K-edge spectra reveals that more BF₄⁻ ions were found in the PSSGO electrode than in the graphite oxide electrode. This indicates that more electrolyte ions are absorbed in the PSSGO than in the graphite oxide electrode. We argue that this is the main reason why PSSGO cells have higher capacitance, higher energy density, and higher power density when compared to the graphite oxide cells. We also found that BF₄⁻ is the primary working ion that can be inserted into the interlayers of the PSSGO electrode.

Keywords: Graphite oxide, XAS