

Operando analysis of in-plane structure change of graphite anode of Li ion battery during the charge/discharge process using synchrotron radiation diffraction

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In-plane structure change of graphite anode of Li ion battery during the charge/discharge process was investigated by *operando* measurement using synchrotron radiation diffraction at Super Photon ring-8 (Spring-8), Japan. The measurement was carried out with BL28XU beam line at Spring-8. High-energy X-ray with a beam size of 0.2 mm × 0.2 mm and wavelength of 0.049592 nm was used to obtain 2D diffraction patterns in the transmission geometry. The diffraction data was detected with PILATUS 100K two-dimensional detector (Rigaku Corporation), which can provide a greatly shortened time for data collection. The exposure time was set to 10 s, and about 4000 XRD profiles were obtained during the discharge and charge process. The Al-laminated half-cell composed of graphite and Li electrodes (20 X 30 mm) in 1M-LiPF₆/EC+EMC(3:7) was placed on the X-ray beam, and was 3rd discharged and 4th charged in the range of 2.5 V to 0.05 V at 0.2 C.

It is well-known that the structure change occurs along *c*-axis depending on the stage number [1]. In the present study, it was found that the in-plane structure along *a, b*-axes also changes depending on the stage number. Moreover, the electron density distributions of stage I and II compounds were calculated based on the lattice constants decided from the diffraction profiles. As a result, their in-plane arrangements were somewhat different from each other in spite of the same structure type of $p(\sqrt{3} \times \sqrt{3})R30^\circ$ [2].

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References:

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