Analytical Imaging of Batteries with X-ray Compton Scattering

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Analytical imaging with X-ray Compton scattering is one of the newly developed techniques that enables the in-situ and operando observation of working batteries. By scanning the focused high-energy X-ray beams throughout the body of a battery, the variable amount of mobile ions is monitored by detecting Compton scattered X-rays. The detected X-rays are analysed in terms of its line-shape, and a parameter evaluated (called S-parameter), which varies with material composition, is employed for estimating ion concentration. In this paper we apply this technique to a commercial lithium battery (CR2032) under discharge and present a lithium migration behaviour in a quantitative manner.

Figure 1 shows the intensity map of Compton scattered X-rays for the discharging battery as a function of internal position and discharging time [1]. The values of S-parameter and lithium concentration x in Li\textsubscript{x}MnO\textsubscript{2} along the indicated line are in Fig.2. In this presentation the detail of this analytical imaging technique is also given.

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Fig.1 Intensity map of Compton scattered X-rays for discharging battery (CR2032).

Fig.2 S-parameter and Li concentration along the line A in Fig.1.