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Three-dimensional lithium mapping of graphite anode using laser-induced breakdown spectroscopy

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ABSTRACT

Herein, a method has been described to rapidly obtain a semi-quantitative three-dimensional lithium distribution of a lithium-ion battery graphite anode using laser-induced breakdown spectroscopy (LIBS) measurements. LIBS measurements of the graphite anodes with a diameter of 10 mm were performed in an argon atmosphere of 1000 Pa until the depth of 150 μm using the Li emission line of 610.4 nm. The emission intensity was measured for the pitch of 500 μm in plane. Homogeneous and inhomogeneous lithium distributions were observed in the anodes after both charge and charge-discharge processes. The inhomogeneous lithium distribution after the charge process was attributed to the preferentially reacted area in the anode, while that after the charge-discharge process was likely related to the low desolvation reaction rate of lithium ions at the solid electrolyte interphase. These inhomogeneous lithium distributions were consistent with the results from the charge-discharge curves and the lithium ion transfer mechanism. Thus, it was proven that it is possible to acquire a three-dimensional lithium distribution of a graphite anode of a lithium-ion battery by LIBS measurements.

Keywords: Three-dimensional distribution, semi-quantitative lithium analysis, laser-induced breakdown spectroscopy, graphite anode