Monitoring micro-damage in Lithium-ion battery by analysing acoustic emission signal

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Abstract

Lithium metal battery was evaluated by using acoustic emission (AE) technique. AE measurement system was set for acquiring an AE signal during accelerated charge/discharge cyclic test. Particle cracking, the formation of solid electrolyte interphase (SEI) layer, and cracking of the SEI layer were confirmed by microstructural observation after the cycle test. The charge/discharge process was divided into four stages (i.e., A, B, C, and D) based on the relation between state-of-voltage and damages. AE Signals in each stage were successfully detected and correlated with the damage mechanism. The AE time-domain characteristics (i. e., waveform, amplitude, and duration) in each stage were similar. On the other hand, AE signal could be classified into two distinct groups (i.e., high and low frequency) on basis of the frequency characteristic. Stages containing high-frequency components of 250-300 kHz were related with cracking phenomenon, while low-frequency AE signals in different stage were emitted from SEI layer formation. Based on correlation between frequency-domain characteristic and damage type on the electrode, In-situ evaluation of the damage progression in lithium metal battery by monitoring AE activities for the classified signal is suggested.

Keywords: Acoustic emission, damage mechanism, lithium ion battery, damage progression