IMPEDANCE SPECTROSCOPY-BASED PARAMETER IDENTIFICATION OF LITHIUM-ION BATTERIES FOR DEGRADATION ANALYSIS

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ABSTRACT

Accurate estimation of the internal state of lithium-ion batteries (LIBs) is important to understand aging phenomena and enable improvement of future generations of LIBs. We propose parameter identification method of LIBs with impedance-based circuit model for degradation analysis. Electrochemical impedance spectroscopy (EIS) is one of the most attractive diagnostic techniques due to its convenience, quickness, accuracy, and low cost. To figure out the degradation pattern, we identify physical parameters of 12 types of equivalent circuit models (ECMs) from battery impedance spectra using the Levenberg-Marquardt (LM) algorithm. Furthermore, the Akaike information criterion is used to decide the most suitable ECM for fitting EIS data. Ultimately, with the optimized parameters from the best-fitting ECM, we utilize the Gaussian process to predict the state-of-health (SOH) and remaining useful life (RUL) of LIBs. The results demonstrate that the proposed method enables physical interpretation of aging pattern of LIBs and forecasts SOH and RUL accurately.