

Characterization of a LiFePO₄ Battery Cell with Mechanical Responses

Authors : Ki-Yong Oh, Eunji Kwak, Due Su Son, Siheon Jung

Abstract : A pouch type of 10 Ah LiFePO₄ battery cell is characterized with two mechanical responses: swelling and bulk force. Both responses vary upon the state of charge significantly, whereas voltage shows flat responses, suggesting that mechanical responses can become a sensitive gauge to characterize microstructure transformation of a battery cell. The derivative of swelling s with respect to capacity Q , (ds/dQ) and the derivative of force F with respect to capacity Q , (dF/dQ) more clearly identify phase transitions of cathode and anode electrodes in the overall charge process than the derivative of voltage V with respect to capacity Q , (dV/dQ) . Especially, the force versus swelling curves over the state of charge clearly elucidates three different stiffness over the state of charge oriented from phase transitions: the α -phase, the β -phase, and the metastable solid-solution phase. The observation from mechanical responses suggests that macro-scale mechanical responses of a battery cell are directly correlated to microscopic transformation of a battery cell.

Keywords : force response, LiFePO₄ battery, strain response, stress response, swelling response

Conference Title : ICGEES 2018 : International Conference on Green Energy, Environment and Sustainability

Conference Location : London, United Kingdom

Conference Dates : September 27-28, 2018