

Analysis of the Cyclability of Lithium-polymer Batteries

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Abstract

Lithium ion batteries and similar energy storage devices have an increasing importance for the modern society as they are present in many portable electronic devices and have perspectives in the fields of electric vehicles and renewable energy accumulation.

Herein, we present results from charge and discharge cycles on batteries under controlled conditions. The cyclability of commercial lithium-polymer pouch batteries under different charge/discharge rates and temperatures was studied. Based on the results, the relationship between the state of charge and the cell voltage was obtained, as well as degradation of the cells, i.e., the decrease of the energy capacity after a number of cycles.

The experimental results were compared with simulations based on Newman's model for Lithium Ion Batteries, carried out using the COMSOL Multiphysics® software. The batteries and fuel cell and the heat transfer modules were used to couple between the temperature and the electrochemical interactions. The results show the correlation between temperature, C-rate and degradation in lithium ion batteries. It is specially remarkable the decrease of the apparent capacity of batteries at low temperatures, and the increase of the degradation at higher temperatures. These results are essential for the design of mechanisms that could prevent battery failure.

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