Study on the Power Fade After Pulse Cycle Life Test for Cylindrical Li-ion Battery Cells with High Power-type

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Lithium battery has been widely used for the mobile application, handy-phone, and note-type computer, and etc. Now it has attracted the interest on the application for fuel cell vehicle (FCV) because of the promising high-power sources. On the other hand, the battery for FCV requires the long period life over 15 years. Therefore, the development of the estimation method of the cycle and calendar life has been strongly needed and several mechanisms have been proposed to explain the degradation for lithium batteries. Although the deterioration on the lithium battery has instinct problem on the electrodes, the deterioration on the electrodes is still uncleared. Detailed information on the change in the both cathode and anode electrodes is very important in order to determine the origin of degradation of electrochemical performance of battery cell and, therefore, the relationships between the chemical composition, the structure change, the changes in the morphology and surfaces, and their electrochemical properties were studied in this study. The goal for the project is to develop an understanding of the effect of accelerated cycle and calendar life testing on the performance of Li-ion battery cells, especially on constructing the model of degradation based on these parameters.

We fabricated the cylindrical battery cells to our specification for this study. The cell chemistry is summarized in Table.1. Each cell was characterized using standard battery test procedure given in the partnership for a new generation of vehicles (PNGV) Battery Test Manual. We checked the changes in the cell capacity, AC impedance at 1 kHz, and DC resistance at every several cycles. The electrodes after PNGV test were characterized by ICP spectroscopy, XRD, XANES, ^{7}Li NMR, and AC impedance measurements, respectively.

In this paper, we will report on the relationships between the degradation of the battery cell and the changes in the electrode. Furthermore, it will be discussed on constructing the model of degradation based on these parameters from the perspective of the effect of accelerated cycle life testing on the performance of Li-ion battery cells.

Table 1 Cell Chemistry

Cell capacity	400mAh
Positive electrode	$LiNi_{0.8}Co_{0.2}O_2$
Negative electrode	Hard Carbon
Electrolyte	1M $LiPF_6$ in EC:DEC(1:1)
Separator	20 μm thick separator

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