Development of $LiFePO_4$-Based High Power Li-ion Batteries for HEVs

HEV용 $LiFePO_4$-Based High Power Li-ion Battery의 개발

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Many goals have been established for the incorporation of rechargeable lithium batteries in hybrid electric vehicles (HEVs), including low price, long calendar life, safety and high power capability [1]. Previous work was reported about a limited cycle life for this cell due to the consumption of the cycleable lithium at the anode [2]. In this work, we report on the improvements to both anode and cathode which result in an increased cell cycle life and the area specific impedance (ASI).

The twelve-cm^2 pouch cells contained cathodes based on the carbon-coated $LiFePO_4$ from the University of Montreal, carbon black and PVdF binder (Kureha). The anodes were prepared from natural graphite (Superior Graphite) and PVdF binder (Kureha). The pouch cells were assembled with Celgard 2500 and 1M $LiPF_6$+EC/DEC (1/1) electrolyte in an Ar-filled glovebox. Cycle-life testing was carried out with constant cycling (C/2) between 2.5 and 4.0V. A reference performance test (RPT) was carried out every 80 cycles. After cycling, the post-test electrochemical analysis of the electrodes was carried out in half-cells with Li reference and counter electrodes and the same electrolyte.

Post-test electrochemical analysis of cycled electrodes showed that these electrodes did not lose their original capacity when provided a large source of Li, even after 400 cycles. However, it was revealed, in the half-cell studies of the cathode, that 45% of cyclable lithium was consumed during cycling. Cells cycled with and without periodic high-current-pulse RPT measurements showed similar cyclability but a faster rate of impedance rise during cycling for the cell subjected to the RPT. This may possibly result from lithium deposition during the charging pulses at high SOC.

References

1. PNGV FreedomCar manual etc. T.Q. Duong, *J. Power Sources*, 89, (2000) 244
2. J. Shim, K.A. Striebel, *J. Power Sources*, 122, 188 (2003).