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Li(Ni1/3Co1/3Mn1/3)O2 as a Suitable Cathode for High Power Applications

고출력 리튬이차전지용 $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ 양극활물질 연구

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Since its introduction in 1990, the rechargeable lithium-ion battery with high energy density and power capability has become an important power source for portable electronic devices, such as cellular phones and laptop computers and, more recently, hybrid electric vehicles (HEV).

In this work, the electrochemical performance of the layered $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ material have been investigated as a promising cathode for a hybrid electric vehicle (HEV) application. A $C/Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ cell, cycled between 2.9 and 4.1V at 1.5C rate, does not show any sign of capacity fade up to 100 cycles, whereas at the 5C rate, a loss of only 18% of capacity is observed after 200 cycles. The $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ host cathode converts from the hexagonal to a monoclinic symmetry at a high state of charge. The cell pulse power capability on charge and discharge were found to exceed the requirement for powering a hybrid HEV. The accelerated calendar life tests performed on $C/Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ cells charged at 4.1V and stored at 50℃ have shown a limited area specific impedance (ASI) increase unlike $C/Li(Ni_{0.8}Co_{0.2})O_2$ based-cells. A differential scanning calorimetry (DSC) comparative study clearly showed that the thermal stability of $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ is much better than that of $Li(Ni_{0.8}Co_{0.2})O_2$ and $Li(Ni_{0.8}Co_{0.15}Al_{0.05})O_2$ cathodes. Also, DSC data of $Li(Ni_{1/3}Co_{1/3}Mn_{1/3})O_2$ cathode charged at 4.1, 4.3, and 4.6V are presented and their corresponding exothermic heat flow peaks are discussed.