Surface modified $Li[Ni_{0.6}Co_{0.2}Mn_{0.2}]O_2$ as a positive electrode for rechargeable lithium batteries

Chang-Heum Jo, Seung-Taek Myung

Department of Nano Technology and Advanced Materials Engineering, Sejong University, Gunja-dong, Gwangjin-gu, Seoul, 143-747, Republic of Korea
Corresponding to smyung@sejong.ac.kr

Lithium secondary battery is promising as a energy storage system. In this respect, studies toward improvement of electrode performances are being proceed to assure long life cycling performances, thermal stability, safety, and so on. In particular, positive electrode materials, which are considered as a major component to constitute a battery, are important to being far investigated to accomplish the above-mentioned properties. Several kinds of 4 V class positive electrode materials are commercially available. Among them, $LiCoO_2$ is the most common electrode material in rechargeable lithium batteries. Although the $LiCoO_2$ has many advantages, this material has poor capacity retention because of dissolution of Co and structural instability at deeply charged state. To improve the nature of active material, surface modification approach is effective to overcome those limited properties of active materials. Actually, Metal oxides as coating materials have been extensively studied. In this study, metal phosphate coatings, which are assumed to provide thermal stability, are applied on the surface of $Li[Ni_{0.6}Co_{0.2}Mn_{0.2}]O_2$. We, here, report the resulting structural, electrochemical and thermal properties of the surface modified $Li[Ni_{0.6}Co_{0.2}Mn_{0.2}]O_2$.

H_3PO_4 and metal salts were selected as starting materials for surface modification of $Li[Ni_{0.6}Co_{0.2}Mn_{0.2}]O_2$. A solution anhydrous ethanol containing metal phosphates was stirred at 30 ^oC for 5 hours. Then, active materials were added into the solution. And the solution was evaporized at 80 ^oC in air and the resulting precipitates were then heated at 500 ^oC in air. Also, the coated powders were characterized by XRD, SEM, and HR-TEM. Electrochemical properties of coated powders were examined by galvanostatic cycle test and electrochemical impedance spectroscopy.

Metal phosphates coatings shows uniform coating layers, as observed by TEM. Thickness of coating layer is of about 5nm. Electrochemical test with half cells in voltage range of 3 - 4.3 V at 25 ^oC indicates that coated materials have better capacity retention and coulombic efficiency, rate capability, and low resistance. Thin coating layers seem to effective to improve the electrochemical properties. Also, metal phosphates coatings give decrease of residual lithium and byproduct on the surface of particle, as confirmed by ToF-SIMS. Details will be mentioned at the conference site.