Surface modified $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$ cathode material by using nano particle coating for lithium secondary battery

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In this study, nano-crystallized $LiCoO_2$ was coated on the surface of $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$ powders via sol-gel method. The influence of coated $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$ about electrochemical behavior was discussed. The surface morphology characterization was achieved by transmission electron microscopy (TEM). Nano-crystallized $LiCoO_2$ was clearly observed on the surfaces of $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$. The phase and structural change of the cathode materials before and after coating were revealed by X-ray diffraction spectroscopy (XRD). It showed that $LiCoO_2$ coated $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$ cathode exhibited distinct surface morphology and lattice constants. Fig.1. of Cyclic voltammertry (2.8-4.6 V) shows that the characteristic voltage transition on cycling exhibited by the bare compound are suppressed by 7 wt% $LiCoO_2$ coating. This behavior implies that $LiCoO_2$ prevent structural change of $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$ or reaction with electrolyte on cycling. In addition, $LiCoO_2$ coated $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$ compound highly improves rate capability, one of the important battery performances, by varying discharge current at 0.1 - 4.0C rate. From the correlation between these characteristics of bare and coated $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$, the role of $LiCoO_2$ coating played on the electrochemical performance of $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$ was probed.

Key words: Cathode material; $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$; sol-gel coating; $LiCoO_2$; Lithium ion battery

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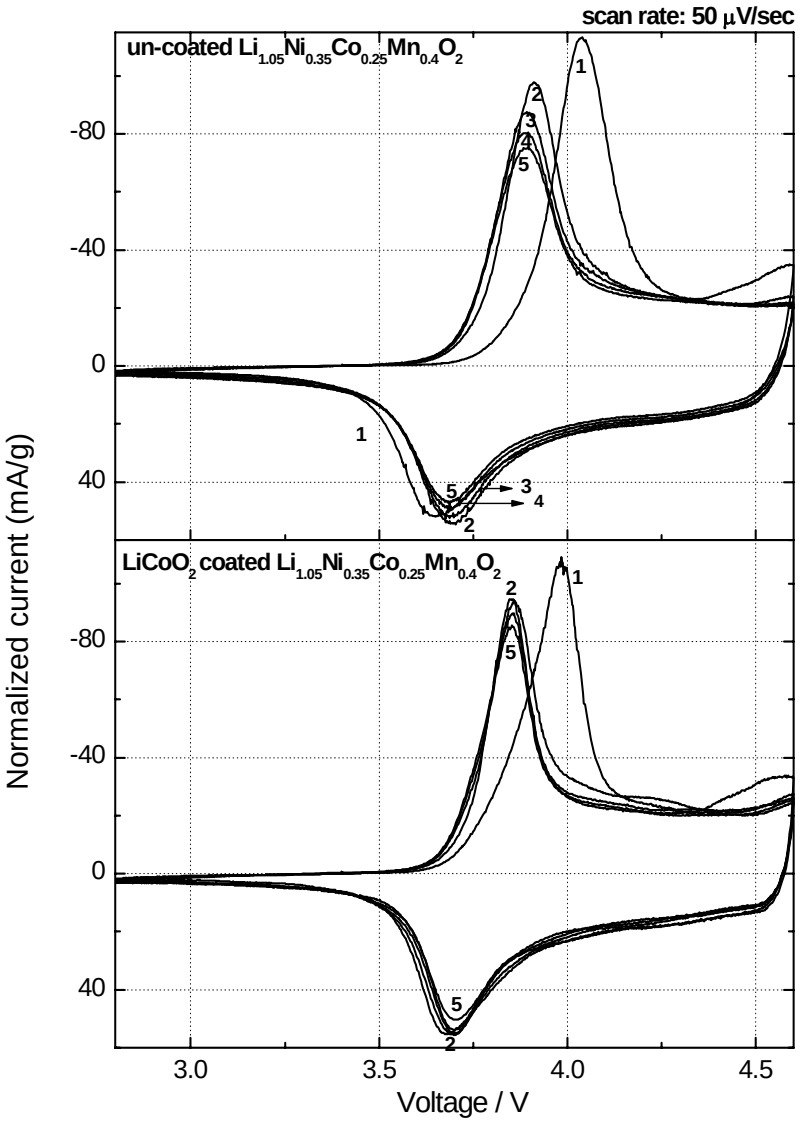

Fig. 1. Cyclic voltammertry of the bare and 7.0 wt. % $LiCoO_2$ oxide(nano-particle) coated $Li_{1.05}Ni_{0.35}Co_{0.25}Mn_{0.4}O_2$ cell between 2.8 and 4.6 V at a scan rate of 50 s^{-1}.