Studies on Spinel and Layer Structured Cathode Materials for Li-ion Batteries

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Abstract

Pure and cationic co-doped lithium mangante spinels were studied as positive electrodes for Li-ion battery applications both in bulk and thin film forms. All the samples were synthesized by Chemical Solution Method. The severe capacity fading in bulk $LiMn_2O_4$ cathodes were dramatically improved by cationic co-doping approach with Al and Li or Cr and Li. However, the capacity fading was not observed in pure $Li_xMn_2O_4$ (x = 1.2-1.4) thin films after an initial drop in the first few (~5) cycling of operation. The XPS analyses results were correlated with the capacity fading mechanisms both in bulk and thin film lithium manganate. In the case of thin films the fundamental intercalation processes between the electrodes and the interfacial processes between the cathode-electrolyte interfaces were predicted from the cyclic voltametry and chronoamperometry results. Also various stable layered oxide cathodes ($LiAl_xCo_{1-x}O_2$, $LiNi_{0.8}Co_{0.2}O_2$ and 5% Mo and Zr coped $LiNi_{0.8}Co_{0.2}O_2$, $Li(Mn_{1/3}Ni_{1/3}Co_{1/3})$) were synthesized and their structural and electrochemical properties were discussed. In some of these layered oxides superior electrochemical properties were achieved. Further work on the process optimization is presently being carried out.