Department of Chemistry

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Research colloquium

Synthesis, characterization and studies on electrochemical properties of Sc-doped $LiMn_2O_4$ and $LiNi_{0.5}Mn_{1.5}O_4$ spinels as cathode materials for lithium ion batteries.

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Guide: U.V Varadaraju
Co-guide: Raju Prakash (ARCI)

Date: 03:09:2019, Time: 4.00PM
Venue: CB310 Seminar Hall (II Floor)

Abstract

Lithium ion batteries (LIB's) are the most widely used power sources in portable applications because of their high energy density. It is well known that, high energy density can be achieved by either high discharge capacity or high voltage. Among the various high voltage cathode materials the spinel $LiNi_{0.5}Mn_{1.5}O_4$ is the most promising cathode material for LiBs due to its high operating voltage (4.7V *vs.* Li^+/Li). The 3D Li-ion diffusion characteristic of the spinel structure is conducive for high power density of the battery. In addition, due to the low material cost and environmental friendliness, the manganite received much attention over the decades. However, there are certain drawbacks associated with the material the predominant one being dissolution of manganese in the electrolyte. To date many efforts have been made to solve the above mentioned problem such as surface coating by oxide materials, doping mono, di and trivalent cations and architecture (crystal structure, morphology, particle size and surface area) design. Herein, we synthesised Sc- doped $LiNi_{0.5}Mn_{1.5}O_4$ spinel and studied the effect of doping in increasing the structural stability and enhancing the electrochemical performances. In addition, Sc- doped $LiNi_{0.5}Mn_{1.5}O_4$ phases with different morphology, particles size and surface area were synthesised and their electrochemical performance was studied. Finally, the full cell ($LiNi_{0.5}Mn_{1.44}Sc_{0.06}O_4/Li_4Ti_5O_{12}$) was fabricated and the electrochemical performance was studied.

References:

1. T. Nagaura and K. Tozawa, Prog. Batt. Solar Cells, 9, 209 (1990)
2. X.Cao, X.He, J.Wang, H.Liu, S.Roser, B.R.Rad, M.E.B Streipert, J.Li, R.Wanger, M.Winter, I.C-Laskovic, ACS Appl.Mater.interfaces 2016, 8, 25971-25978.

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