Lithium Rich Transition Metal Oxides as high capacity positive electrode materials in Li-ion cells

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Development of new materials for Li-ion batteries is mandatory to satisfy the increasing demand for devices with higher capacity, energy, prolonged calendar life and increased safety. One of the bottlenecks to improve lithium ion technology is the development of positive electrode materials with improved eco-compatibility, reduced costs and enhanced performance.

Promising candidates are Li/Mn-rich layered oxides with a general stoichiometry $Li_{1+x}M_{1-x}O_2$, in which M is a mix of transition metal as Ni, Mn, Co. From the structural point of view, these materials belong to the family of layered materials and attract growing attention for their large specific capacity (typically >200 mAh g^{-1}), and high working potentials (4-5V vs. Li). Nevertheless, their practical use in a Li-ion device is still limited by several issues: (i) large irreversible capacity loss in the first cycle, (ii) poor rate capability, (iii) mean working potential decay upon cycling and (iv) large Co content. Several strategies to mitigate these issues have been proposed, including tailored synthetic strategies, doping with other metals (like Fe, Cr, Zr and others) and coatings.

In this communication we present the synthesis and characterization of a lithium rich layered phase with stoichiometry $Li_{1.2}Ni_{0.13}Co_{0.13}Mn_{0.54}O_2$. The goal is to investigate the electrochemical performance in lithium cells in comparison to the available literature on similar materials.

Materials have been synthesized with a sol-gel synthesis. Composition, structural and morphological analyses have been carried out by the means of ICP-OES (inductive coupled plasma optical emission spectroscopy) XRD (X-ray diffraction) and SEM (Scanning electron microscopy). The electrochemical properties have been studied by cyclic voltammetry and galvanostatic tests.