Surface Modification for Enhanced Cycling Performances of Lithium-manganese-rich layered oxides

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Introduction

Lithium and manganese-rich $xLi_2MnO_3 \cdot(1-x)LiMO_2$ (M = Ni, Co, Mn) composite cathode materials are one of the most investigated cathode materials due to their ability to provide high discharge capacity. Lithium and manganese-rich layered cathode oxides are considered as the solid solutions or nanocomposites between layered monoclinic Li_2MnO_3 and rhombohedral $LiMO_2$. However, $xLi_2MnO_3 \cdot(1-x)LiMO_2$ cathode materials suffer from high initial irreversible capacity and poor cycling stability [1, 2]. The development of this type composite cathode materials for lithium ion battery is still the challenge for meeting current and future energy storage requirements.

The surface modification of the materials is an effective way to overcome those disadvantages according to many work have been reported [3-5]. In this work, we report that the cycle performance of $0.5Li_2MnO_3$ $0.5LiMn_{0.5}Ni_{0.5}O_2$ was significantly improved though a surface modification. The X-ray diffraction study confirms that the material has layered $LiMn_{0.5}Ni_{0.5}O_2$ structure along with the formation of the superlattice ordering of Li_2MnO_3 without any major change in the crystal structure with the surface modification. The lower resistance to charge transfer in the modified sample is responsible for its better performance

References:

[1] C.S. Johnson, J.S. Kim, C. Lefief, N. Li, J.T. Vaughey, M.M. Thackeray, Electrochem Commun, 6 (2004) 1085-1091.
[2] P. Rozier, J.M. Tarascon, J Electrochem Soc, 162 (2015) A2490-A2499.
[3] S.-H. Kang, M.M. Thackeray, Electrochem Commun, 11 (2009) 748-751.
[4] W. Lei, W. Xiaowei, L.G. Qiang, L.H. Ze, L. Ji, D.S. Xue, Surface Innovations, 6 (2018) 13-18.
[5] X.Y. Liu, J.L. Liu, T. Huang, A.S. Yu, Electrochim Acta, 109 (2013) 52-58.