Enhanced Electrochemical Performance of $0.4\text{Li}_2\text{MnO}_3\text{-}0.6\text{LiMn}_{0.35}\text{Ni}_{0.3}\text{Co}_{0.35-x}\text{Al}_x\text{O}_2$

Dongyun Zhang^{1,*}, Wenping Li¹, Nan Li¹, Jin Qiao¹, Zifeng Ma² and Chengkang Chang^{1,3,*}

¹ School of Materials Science and Engineering, Shanghai Institute of Technology, 100 Haiquan Road, Shanghai 201418, China

² School of Chemistry and Chemical Engineering, Shanghai Jiaotong University, 800 Dongchuan Road, Shanghai 200240, China

³ Shanghai Institute of Innovative Materials, Shanghai University, 99 Shangda Road, Shanghai, 200444, China

*E-mail: dyz@sit.edu.cn

doi: 10.20964/2018.07.35

Received: 4 March 2018 / Accepted: 9 May 2018 / Published: 5 June 2018

$0.4\text{Li}_2\text{MnO}_3\text{-}0.6\text{LiMn}_{0.35}\text{Ni}_{0.3}\text{Co}_{0.35-x}\text{Al}_x\text{O}_2$ layered structured cathode materials have been successfully prepared via a high temperature solid state method with different Al contents. X-Ray diffraction (XRD), scanning electron microscopy (SEM), cyclic tests, electrical conductivity tests and electrochemical impedance spectrum (EIS) were employed to investigate the reason for the enhanced electrochemical performances. XRD and SEM results revealed that the introduction of Al into the lattice determines the interlayer spacing and thus the growth manner of the crystals and greatly promotes the electrochemical performance. At $x=0.05$, the maximum values achieved are 249.9 mAh/g for the initial specific capacity and 99.2% for the capacity retention after 50 cycles. Such good results are caused by the improvement in both the electrical conductivity and the Li ion conductivity. The electrical conductivity for the pristine material without Al doping is measured as $2.52\times 10^{-8}\text{ S cm}^{-1}$, while the sample with $x=0.05$ exhibits a value of $8.87\times 10^{-8}\text{ S cm}^{-1}$. The calculated Li ion diffusion also shows similar results, confirming the promotion of the electrochemical performances after Al incorporation into the layered structure. All the results demonstrate that Al doped layered material is very promising for use as a cathode for lithium secondary batteries.

Keywords: lithium ion battery, electrical conductivity, specific capacity, impedance, cyclic performance

[FULL TEXT](#)

© 2018 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).