The Improvement for the Electrochemical Performances of $\text{LiNi}_{1/3}\text{Co}_{1/3}\text{Mn}_{1/3}\text{O}_2$ Cathode Materials for Lithium-ion Batteries by both the Al-doping and an Advanced Synthetic Method

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doi: 10.20964/2019.04.57

Received: 6 January 2019/ Accepted: 14 February 2019 / Published: 10 March 2019

The Al-doped $\text{LiNi}_{1/3}\text{Mn}_{1/3}\text{Co}_{1/3-x}\text{Al}_x\text{O}_2$ ($x=0, 0.01, 0.03, 0.05$) cathode materials have been successfully synthesized via a simple template-sacrificial method with MnO_2 as the sacrificial template. The structure and properties of the as-obtained samples were measured by XRD, SEM and electrochemical test methods. Though the Al-doped samples delivered lower initial capacities, the rate performance and the cycling stability were dramatically enhanced. By Al-doping and an advanced synthetic route, the $\text{LiNi}_{1/3}\text{Co}_{1/3}\text{Mn}_{1/3}\text{O}_2$ cathode materials have been improved. The doped material ($x=0.03$) has the most excellent electrochemical performances. It delivers an initial discharge capacity of 197.6 mAh g^{-1} at 0.1 C in the voltage of $2.5\text{-}4.6 \text{ V}$, and has a capacity retention of 96.4% after 50 cycles at 0.2 C .

Keywords: Lithium-ion battery; cathode materials; Al doping; $\text{LiNi}_{1/3}\text{Co}_{1/3}\text{Mn}_{1/3}\text{O}_2$; template-sacrificial method

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