Effects of Zn Doping Amount on the Electrochemical Properties of $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$ Lithium-Ion Cathode Materials

Hongyan Sun ^{1,2}, Xin Kong ^{1,2}, Shaoping Feng ^{1,2}, Guiyang Liu ^{1,2,*}

¹ Department of Chemistry, College of Science, Honghe University, Mengzi, 661199, Yunnan, China

² Local Characteristic Resource Utilization and New Materials Key Laboratory of Universities in Yunnan, Honghe University, Mengzi 661199, Yunnan, China.

*E-mail: liuguiyang@tsinghua.org.cn

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The effects of Zn doping for Mn site on the electrochemical properties of $\text{LiNi}_{0.5}\text{Mn}_{1.5-x}\text{Zn}_x\text{O}_4$ ($x=0, 0.01, 0.03, 0.05, 0.08, 0.10$) have been systematically investigated. The $\text{LiNi}_{0.5}\text{Mn}_{1.5-x}\text{Zn}_x\text{O}_4$ samples, which were synthesized by a modified low temperature solution combustion synthesis method, were characterized by X-ray diffraction(XRD), infrared spectroscopy(FT-IR), scanning electron microscopy(SEM), galvanostatic charge-discharge testing, cyclic voltammetry(CV) and electrochemical impedance spectroscopy(EIS). All samples have perfect cubic spinel structures with a combination of ordered and disordered space groups. The microstructure is almost not affected by the amount of Zn doping obtained from the SEM results. The electrochemical performances are obviously improved by Zn doping, which are shown from cycle stability, rate capability and high temperature cycling performance. The cycle performance is promoted with the increasing of Zn doping content both at 25 °C and at elevated temperature of 55 °C. The first charge-discharge efficiency and rate capability first increase and then decrease with the increase of Zn doping content, which is best when the Zn doping content is 0.05. Meanwhile, the impedance of products significantly decreases after Zn doping.

Keywords: Electrochemical performance, $\text{LiNi}_{0.5}\text{Mn}_{1.5}\text{O}_4$, lithium-ion batteries, Mn site, Zn doping

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