Electrochemical Evaluation of Co-Al Dual-doped LiMn$_2$O$_4$ Spinels Synthesized Via Hydrothermal Method

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In order to improve the cycling performance of LiMn$_2$O$_4$-based cathode materials, the Co-Al dual-doped Li$_{1.088}$Al$_{0.037}$Co$_{0.028}$Mn$_{1.847}$O$_4$ cathode materials were prepared by hydrothermal method followed by heat treatment. XRD patterns reveal that the dual-doped Al and Co in spinel lithium manganese oxide does not affect the Fd3m space group of the cathode materials. SEM shows that all Li$_{1.088}$Al$_{0.037}$Co$_{0.028}$Mn$_{1.847}$O$_4$ samples exhibit a uniform, nearly cubic structure morphology with narrow size distribution. The effect of the dual-doped Co-Al on the electrochemical performance of Li$_{1.088}$Al$_{0.037}$Co$_{0.028}$Mn$_{1.847}$O$_4$ was investigated by galvanostatic charge-discharge test, cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS). The results demonstrate that the synthesized Co-Al dual-doped LiMn$_2$O$_4$ materials gain better cycling stability and rate performance, which retains a capacity retention of 95.9% after 100 cycles at 1 C and deliver a higher capacity of 77.5 mAh·g$^{-1}$ at 8 C. This indicates superior cycling and rate performance compared with pristine one and single-phase doping of Al and Co.

Keywords: Lithium ion batteries; Co-Al dual-doping; Hydrothermal method; Spinel lithium manganese oxides

FULL TEXT

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