Synthesis and Electrochemical Properties of Na and Mg co-Doped $\text{LiFe}_{0.65}\text{Mn}_{0.35}\text{PO}_4/\text{C}$ Cathode Materials for Lithium-Ion Batteries

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In this paper, $\text{Li}(\text{Fe}_{0.65}\text{Mn}_{0.35})_{0.98}\text{Mg}_{0.02}\text{PO}_4/\text{C}$, $\text{Li}_{0.98}\text{Na}_{0.02}\text{Fe}_{0.65}\text{Mn}_{0.35}\text{PO}_4/\text{C}$ and $\text{Li}_{0.98}\text{Na}_{0.02}(\text{Fe}_{0.65}\text{Mn}_{0.35})_{1-x}\text{Mg}_x\text{PO}_4/\text{C}$ ($x = 0.01, 0.02, 0.03, 0.05$) were successfully synthesized by sol-gel method and modified by Na^+ doped and Mg^{2+} doped. The effects of Na^+ and Mg^{2+} doping on the structure, morphology and electrochemical performance of $\text{LiFe}_{0.65}\text{Mn}_{0.35}\text{PO}_4/\text{C}$ were investigated by X-ray diffraction (XRD), scanning electron microscopy (SEM), Energy Dispersive Spectroscopy (EDS), and electrochemical tests. The results show that when $x=0.03$, the material has the best electrochemical performance. The first discharge capacity at 0.1 C is as high as 147.7 mAhg^{-1} ($1 \text{ C}=170.2 \text{ mAhg}^{-1}$) at the potential range of 2.5–4.5 V, When returning to 0.1 C after 40 cycles, the discharge specific capacity is still up to 142.1 mAhg^{-1} . In addition, the R_{ct} values and the Li^+ diffusion coefficient of $\text{Na}_{0.02}\text{Mg}_{0.03}$ were 215.2Ω , $4.501 \times 10^{-14} \text{ cm}^2\text{s}^{-1}$, respectively.

Keywords: Lithium-ion battery, sol-gel method, $\text{LiFe}_{0.65}\text{Mn}_{0.35}\text{PO}_4/\text{C}$, Na^+ doping, Mg^{2+} doping

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