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Enhanced Electrochemical Performance of Si-doped $LiMn_2O_4$ Cathode Material for LiBs Prepared using Mn_3O_4 Octahedrons

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We proposed a co-modification strategy of Si-doping and octahedral morphology to improve the electrochemical performance of $LiMn_2O_4$. The Si-doped $LiMn_2O_4$ sample ($LiSi_{0.05}Mn_{1.95}O_4$ octahedrons) was prepared by high-temperature solid-state method with Mn_3O_4 octahedrons as manganese precursor and SiO_2 nanoparticles as silicon dopant. XRD and SEM characterization results indicated that the introduction of Si^{4+} ions does not produce the substantive impact on the inherent spinel structure of $LiMn_2O_4$ and $LiSi_{0.05}Mn_{1.95}O_4$ octahedrons present relatively uniform particle size distribution. When cycled at 1.0 C, $LiSi_{0.05}Mn_{1.95}O_4$ octahedrons exhibited higher initial reversible capacity than that of the undoped $LiMn_2O_4$. After 100 cycles, $LiSi_{0.05}Mn_{1.95}O_4$ octahedrons showed better cycling stability with higher capacity retention rate of 94.7%. Moreover, $LiSi_{0.05}Mn_{1.95}O_4$ octahedrons presented good rate capability and high-temperature cycling performance. Such good electrochemical performance has much to do with the synergistic modification of Si-doping and octahedral morphology.

Keywords: $LiMn_2O_4$; Silicon doping; Octahedral morphology; Mn_3O_4 octahedrons; Electrochemical performance

FULL TEXT