Synthesis and Electrochemical Properties of Fe-Doped LiMnPO_4 Nanocomposite Prepared by a Hydrothermal Process in a High-Pressure Reactor

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$\text{LiMn}_{1-x}\text{Fe}_x\text{PO}_4$ powders with varied Fe concentrations ($x=0, 0.2, 0.3, 0.4$) were prepared in a high-pressure reactor by a hydrothermal process. The effect of the Fe dopant concentration on the crystal structure, morphology, surface area and electrochemical properties were studied. $\text{LiMn}_{1-x}\text{Fe}_x\text{PO}_4$ with a higher Fe concentration presented better cyclic performance, and the capacity retention of a $\text{LiMn}_{0.60}\text{Fe}_{0.40}\text{PO}_4$ electrode after 20 cycles was 97.2% at 25°C with an initial capacity of 145 mAh/g at a 0.1C rate. $\text{LiMn}_{0.60}\text{Fe}_{0.40}\text{PO}_4$ also delivered discharge capacities of 151 mAh/g and 109.3 mAh/g at rates of 0.05C and 5C, respectively. Because the total charge/discharge capacity of $\text{LiMn}_{1-x}\text{Fe}_x\text{PO}_4$ was enhanced as the Fe concentration increased while the average discharge voltage was reduced, a high specific energy value of 513 Wh/kg was achieved in the $\text{LiMn}_{0.70}\text{Fe}_{0.30}\text{PO}_4$ material.

Keywords: Hydrothermal process; $\text{LiMn}_{1-x}\text{Fe}_x\text{PO}_4$; Lithium-ion battery; Cation doping

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