Preparation and Electrochemical Performance of Manganese-Doped Nickel Hydroxide Cathode Materials

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Buffer solution method can maintain the stability of pH in the reaction process, so that the physical and chemical properties of the product are good. Manganese-doped $\text{Ni}_{1-x}\text{Mn}_x(\text{OH})_2$ ($x=0.15, 0.18, 0.22, 0.25$) was prepared by buffer solution method. X-ray diffraction measurements showed that the samples were mainly composed of $\beta\text{-Ni}(\text{OH})_2$, and some of the Mn-doped samples contain a small amount of impurities. Scanning electron microscopy measurements showed that the crystal particles of Mn-doped samples were small. The specific surface area measurements results showed that the BET surface area of Mn-doped samples were more and the Mn-doped samples had mesoporous structures. Cyclic voltammetry results showed that the difference between the oxidation peak potential and the reduction peak potential of the Mn-doped samples was small. The Mn-doped samples demonstrated better electrochemical performance than commercial $\beta\text{-Ni}(\text{OH})_2$. Constant current charge-discharge results showed that samples with an Mn content of 18 mol% yielded the highest discharge specific capacity, the best cycle stability with discharge specific capacity of 314.5 mAh g^{-1} at 800 mA g^{-1} , while the discharge specific capacity of commercial $\beta\text{-Ni}(\text{OH})_2$ was 195 mAh g^{-1} . It shows that Mn doping can improve the discharge specific capacity of the positive electrode and make the battery have good charge and discharge performance at high current. When the sample with Mn content of 18 mol% was cycled at 800 mA g^{-1} for 30 cycles, the discharge specific capacity did not decrease, while other samples containing Mn and commercial $\beta\text{-Ni}(\text{OH})_2$ showed different degrees of discharge specific capacity. As a positive electrode material, $\text{Ni}_{0.82}\text{Mn}_{0.18}(\text{OH})_2$ has good cycle stability. A series of experimental results have proved that a proper amount of Mn doping (18 mol%) can effectively improve the electrochemical performance of nickel electrodes and reduce the cost of cathode materials.

Keywords: Buffer solution method; Mn-doped $\text{Ni}(\text{OH})_2$; Rate capability; Cyclic stability

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