The Different Roles of $\text{Ni}^{2+}/\text{Ni}^{3+}$, $\text{Ni}^{3+}/\text{Ni}^{4+}$, and $\text{Mn}^{3+}/\text{Mn}^{4+}$ in Li-rich Layered Nanostructured $\text{LiNi}_x\text{Mn}_{1-x}\text{O}_2 \cdot \text{Li}_2\text{MnO}_3$ with High Capacity

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We prepared $\text{LiNi}_x\text{Mn}_{1-x}\text{O}_2 \cdot \text{Li}_2\text{MnO}_3$ ($x = 0.6, 0.7, 0.8, 0.9, 1$) Li-rich layered nanostructured cathode materials without Co by co-precipitation, and studied the effects of $\text{Ni}^{2+}/\text{Ni}^{3+}$, $\text{Ni}^{3+}/\text{Ni}^{4+}$, and $\text{Mn}^{3+}/\text{Mn}^{4+}$ on their electrochemical properties. The change trend of discharge capacity for $\text{LiNi}_x\text{Mn}_{1-x}\text{O}_2 \cdot \text{Li}_2\text{MnO}_3$ was influenced by the change trend of the capacity provided by the reduction processes of $\text{Ni}^{2+}/\text{Ni}^{3+}$, $\text{Ni}^{3+}/\text{Ni}^{4+}$, and $\text{Mn}^{3+}/\text{Mn}^{4+}$. Analysis shows that the capacity from nickel is closely related to the content of divalent nickel. As the content of divalent nickel increases, the capacity increases. Compared with divalent nickel, the capacity provided by trivalent nickel basically does not change with the nickel content increasing. The capacity from manganese is affected by the manganese content and the nickel in Li_2MnO_3 .

Keywords: Lithium-rich layered materials, Cathode materials, Electrochemical performance

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