Low-cost LiMO_2 (M = Ni and Fe) Positive-Electrode Materials for Lithium Ion Batteries

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Nickel-rich layered lithium transition-metal oxides, $\text{Li}_{1.2}\text{Ni}_{1-x}\text{M}_x\text{O}_2$ (M=transition metal), have been investigated intensively as high-energy cathode materials for lithium batteries because of their high specific capacity and relatively low-cost. However, oxygen loss from the lattice during the first charge and gradual structural transformation during cycling process can result in capacity fading and potential decay of the cathode materials, due to the fact that the highly oxidizing nature of tetravalent nickel. Herein, we report for the first time a series of promising and low-cost LiMO_2 (M = Ni and Fe) cathode materials for lithium ion batteries. We have successfully synthesized it by calcination of Ni_4Fe -layered double hydroxides (LDHs). The synthesized LDHs have been calcined in air or under oxygen flow for different period of time. Our results showed that it is possible to prepare low-cost with good electrochemical performance LiMO_2 from calcination of Ni_4Fe -LDHs at 750 °C for 12 h under flow of oxygen. The synthesized material showed excellent electrochemical performance with high capacity retention when cycled in the potential range of 2 to 4.5 V. It delivers a discharge capacity of 204 mAh/g at 20 mA/g and retains 85% of its capacity after 100 cycles.

Keywords: low-cost; cathode materials; lithium ion battery; layered double hydroxides

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