Improved Electrochemical Performance of Ni-rich Cathode Materials via Al Gradient Doping

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An Al gradient-doped $\text{LiNi}_{0.80}\text{Co}_{0.19}\text{Mg}_{0.01}\text{O}_2$ (Al(GD)-LNCMgO) cathode was prepared via chemical co-precipitation followed by calcination. The average doping concentration of Al in the Al(GD)-LNCMgO was ~2 mol.% with ~7 mol.% on the particle surface. Al(GD)-LNCMgO returned values for initial efficiency, rate capability, cycle-life, thermal stability, and air-exposed stability that were superior to those of Al and Mg co-doped $\text{LiNi}_{0.78}\text{Co}_{0.19}\text{Mg}_{0.01}\text{Al}_{0.02}\text{O}_2$ (LNCMgAlO), $\text{LiNi}_{0.80}\text{Co}_{0.19}\text{Mg}_{0.01}\text{O}_2$ (LNCMgO), and $\text{LiNi}_{0.81}\text{Co}_{0.19}\text{O}_2$ (LNCO). The Mg substitution and Al-rich surface of Al(GD)-LNCMgO suppressed the reactions of electrolytes with the material and inhibited increases in resistance. Doping Mg and Al in LNCO can also accelerate Li-ion diffusion.

Keywords: lithium ion battery, cathode material, Mg doped, Al gradient-doped, electrochemical performance..

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