Influence of dodecyl sulfate anions doped hydroxide precursor on enhanced electrochemical properties of $\text{LiNi}_x\text{Co}_y\text{Mn}_{1-x-y}\text{O}_2$ as lithium-ion battery cathodes

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Lithium-containing nickel-cobalt-manganese ternary transition metal oxides (e.g., $\text{LiNi}_x\text{Co}_y\text{Mn}_{1-x-y}\text{O}_2$, abbreviated as NCM) may combine the lithium extraction/insertion advantages of LiCoO_2 , LiNiO_2 and LiMnO_2 “single-component” cathode materials because of a well-known synergistic effect at the optimal Ni:Co:Mn molar ratio of 1:1:1. This paper deals with optimized preparation and enhanced electrochemical properties of $\text{LiNi}_x\text{Co}_y\text{Mn}_{1-x-y}\text{O}_2$ cathode material modified by the addition of anionic surfactant (i.e., sodium dodecyl sulfate SDS) into the hydroxide-precursor precipitation system of equimolar-ratio divalent transition metal sulfates. In the absence and presence of additive SDS, the finally resulting products of NCM and SDS-NCM show the leakage of elemental Co in each formula $\text{LiNi}_x\text{Co}_y\text{Mn}_{1-x-y}\text{O}_2$, and their crystallites possess an average particle size of 450 ± 100 and 250 ± 40 nm, respectively. This modification makes a relatively high SO_4^{2-} content in SDS-NCM with the better electrochemical properties (e.g., capacity $\sim 135.4 \text{ mAh g}^{-1}$, at 20 mA g^{-1} , in the 150th cycle) than those of NCM (capacity $\sim 93.8 \text{ mAh g}^{-1}$, at 20 mA g^{-1} , in the 150th cycle). In a word, both the structure optimization and performance-enhanced mechanism of SDS-NCM are discussed in detail in context.

Keywords: Ternary transition metal hydroxide, anionic surfactant, cathode, lithium-ion batteries.

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