Electrochemical Properties of $Na(MnCo)O_2$ Cathodes for Sodium-ion Batteries

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The sodium-ion battery has long been overshadowed by the lithium-ion battery due to its higher capacity, energy density, and power density. However, the high cost and limited natural abundance of lithium and the possibility of using much safer aqueous electrolytes in sodium-ion batteries [1-4] have sparked renewed interest in sodium-ion battery development, particularly for applications with land-based power requirements, such as electrical grid stabilization. In such applications, portability is not an issue, so the benefits of high capacity, or low weight, are not as prevalent here. Several cathode materials such as $NaCoO_2$, $Na(NiMn)O_2$, $Na(CoMnNi)O_2$ etc. have been investigated for sodium battery applications [5-8]. Recently, structural and electrochemical properties of P2-$Na_{2/3}Co_{2/3}Mn_{1/3}O_2$ has been reported [9]. In the present work, we synthesized $Na(MnCo)O_2$ by wet chemistry method and investigated its electrochemical properties.

Synthesis of various $Na(Mn_xCo_y)O_2$ compounds u Pechini process and EDTA citrate methods were utilized and the specific compositions include: $NaMn_{0.3}Co_{0.7}O_2$ and $NaMn_{0.5}Co_{0.5}O_2$, where the latter sample was synthesized by both methods. The Pechini method uses active species as nitrate salt, ethylene glycol and citric acid in a 1:1:1 ratio respectively in de-ionized water. The samples were dried in an oven overnight at 120°C and then heat-treated at different temperatures to achieve the desired phases.

Samples were characterized by XRD for phase analysis. Electrochemical studies were done by preparing CR2032 coin cells. The cathode was prepared by casting slurry of 80% active material, 10 wt.% super carbon and 10 wt.% polyvinylidene difluoride (PVDF) binder in n-methyl-2-pyrrolidone (NMP) solvent on aluminum foil. The electrolyte composition of 1 M $NaClO_4$ in EC/DMC (1:1) and Na pellets as the anode were used. We will report in detail about the synthesis of $Na(Mn,Co)O_2$ cathodes and its electrochemical performances for sodium ion batteries.

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