NaCrO2 cathode for rechargeable sodium ion batteries

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Layered lithium intercalation compounds LiMeO2 (where Me is transition element) materials have been widely studied and applied as cathode materials for practical lithium ion batteries. Cost of lithium resource, however, has doubled since commercialization in 1991, and tight supply is expected due to the ever increasing demands of electric vehicles and energy storage systems. Indeed, the lithium resource is unevenly distributed in Southern America. Meanwhile, sodium resources are abundant and unlimited everywhere. Recently, layered NaMeO2 materials are being intensively studied because of reversible Na+ insertion/extraction, in particular, NaCrO2 (R-3m) in Na cell. Here, we report physical and electrochemical properties of NaCrO2.

The NaCrO2 powder was synthesized by solid-state method. Stoichiometric mixture of Na2CO3 and Cr2O3 powders were pelletized, and the pellet was heated at 900 oC in Ar. All chemicals and products were handled in an Ar-filled gloved box to avoid air exposure. Phase identification of the products was made using X-ray diffraction (XRD) with Cu K α radiation and the collected XRD data were analyzed by the Rietveld refinement. Electrochemical test were carried out in coin type sodium cells. Galvanostatic electrochemical charge and discharge tests in 1M NaClO4 in PC solution were carried out at room temperature.

XRD pattern of the produced NaCrO2 demonstrated a phase-pure product and it was crystallized to O3 type layer structure with space group of R-3m. The delivered capacity was approximately 110 mAh (g-NaCrO2)-1 in voltage range of 2 – 3.6 V and 97 % of the capacity was retained during 50 cycles. Also, the Na/NaCrO2 cell exhibited surprising high rate properties. Details will be discussed in the conference site.