

De Silva, R.C.L.
Perera, V.P.S.
PAPER

Synthesis and Characterization of Sodium Cobalt Oxide Nanostructures for Sodium-ion Batteries

R.C.L. De Silva, & V.P.S. Perera, Department of Physics, Open University of Sri Lanka.

The secondary lithium-ion battery has been widely used in various kinds of personal digital accessories, and is expected to be further spread into larger-sized applications such as power sources of hybrid automobiles. While cathode materials for secondary lithium-ion battery have been so far made mostly from lithium cobalt oxide, the development of substitute materials is essential because of the depletion and increasing prices of lithium and cobalt resources.

The sodium-ion secondary battery is an alternative for lithium ion rechargeable battery utilizing mostly abundant sodium which has high electrochemical potential after the lithium. Therefore, in this study we have synthesized sodium cobalt oxide by the solid state reaction of cobalt carbonate and sodium carbonate at 700 °C. The product was characterized by X-ray diffraction (XRD) technique. The apparent peaks presented for 2θ values of XRD at 16, 33, 38 and 46 degrees matching the sample with the standard confirmed the proper synthesis of sodium cobalt oxide which is the active cathode material of the secondary sodium-ion battery. The average crystal size of the sodium cobalt oxide was found to be 42 nm by using the Scherrer equation for the peak, which appeared at 16 degrees in the XRD.

The cathode of sodium-ion battery was fabricated on stainless steel plates by spreading a slurry made grinding sodium cobalt oxide with 5% of carbon black in absolute alcohol and drying at 120 °C. The sodium-ion batteries were fabricated in N₂ atmosphere using Na foil as anode and polyester membrane as the separator. The electrolyte was 1M solution of NaClO₄ in propylene carbonate. The preliminary studies showed that the cell has discharge capacity of 20 mAhg⁻¹ discharging at current rate of 50 mA g⁻¹. Further studies need to be carried out to test for long cycle life and other battery performance requirements.