$Na_xCoO_{2\pm\delta}$ cathode material synthesized by Inverse Micro- Emulsion Method for use in Sodium ion batteries

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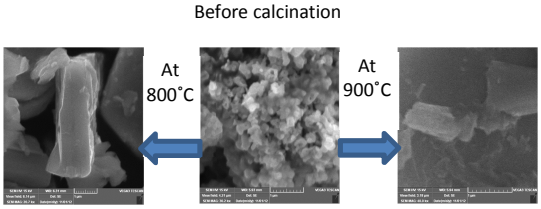
Abstract:

Sodium ion batteries are attractive candidate is an alternative energy storage sources for Lithium ion batteries because of its abundance and low cost compared to lithium metal. The cost of lithium based raw materials has increased by two fold since, the first practical applications in 1991, and it may drastically increase as a result of commercialization of large scale lithium ion batteries. As compared to lithium, sodium resources are inexhaustible in our planet (1), and also sodium exhibiting standard electrode potential very close to lithium (-2.71V vs. SHE). At present, sodium ion battery research is fascinating, because of its limitations like bigger atomic size and less structure stability during cycling, but much research is devoted for developing a viable practical battery. Different type of sodium battery cathode materials with unique crystal structure like layered, Maricite, and NASICON are being tried by many researchers (2). The present work relates to the system of layered type material viz $NaCoO_2$.

In our work inverse micro emulsion method (3, 4, 5) is employed for the synthesis of $NaCoO_2$.The structure and morphological features of the prepared materials has been investigated by powder XRD and Scanning electron microscopy. Obtained XRD pattern depict that hexagonal crystal system of $NaCoO_2$ (JCPDS reference pattern is 00-030-1182). The particle size ranges from 0.5 to 1 µm as shown in the SEM images. Electrochemical characterisation of $NaCoO_2$ were conducted using cyclic voltammetry, between 2.5 V to 4.3 V at a scan rate 0.1 mV/s. Galvanostatic charge- discharge studies were done at different C-rates and electrochemical impedance spectroscopy measurement were able conducted at 100 kHz to 5 mHz. For all the electrochemical experiments the CR-2032 coin cell were fabricated with Na foil as a reference and 1M $NaClO_4$ in PC: EC (1:1 V/V) as the electrolyte. Further the studies are in progress to understand the material properties and to Improve its stability. $Na_xCoO_{2\pm\delta}$ could possibly be a as futuristic cathode material for Sodium ion batteries.



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