Synthesis and Characterization of $MnCo_2O_4$ Cuboidal Microcrystals as a High Performance Psuedocapacitor Electrode

Syam G. Krishnan, Mohd Hasbi Ab Rahim, Rajan Jose
Nanostructured Renewable Energy Materials Laboratory, Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, 26300 Kuantan, Malaysia

ABSTRACT
Manganese cobaltite ($MnCo_2O_4$) is currently under screening as a high performance supercapacitor electrode owing to its high theoretical capacitance, improved electrical conductivity and long term cyclic stability. Herein, we report synthesis of $MnCo_2O_4$cuboidal microcrystals using hydrothermal method and compare its performance with its flakes prepared by solid combustion process. Crystal structure, surface properties, and electrochemical properties of the flakes are studied using X-ray diffraction, gas adsorption, field emission scanning electron microscopy, cyclic voltammetry, galvanostatic charge–discharge cycling, and electrochemical impedance spectroscopy. The electrochemical properties of $MnCo_2O_4$ flakes synthesized using hydrothermal synthesis are superior to that synthesized using the solid combustion process. Electrochemical properties of the cuboidal microcrystals (~specific capacitance, *CS*~600 F g^{-1} @ 0.5 A g^{-1}) are superior to those synthesized by the combustion process (*CS* ~128 F g^{-1}) due to improved faradic utilization of active surface area, layered cuboidal morphology, faster OH^- ion penetration owing to higher diffusion coefficient, and larger voltage range available for electrochemical reaction.

KEYWORDS: $MnCo_2O_4$; Pseudocapacitors; Electrochemical energy storage; Metal cobaltites

DOI: 10.1016/j.jallcom.2015.10.007