Transformation of supercapacitive charge storage behaviour in a multi elemental spinel $CuMn_2O_4$ nanofibers with alkaline and neutral electrolytes

Ria Kunwar[a], Syam G. Krishnan[b], Izan Izwan Misnon[a], Fatemeh Zabihi[c], Shengyuan Yang[c], Chun-Chen Yang[d] & Rajan Jose[a]*

[a] Nanostructured Renewable Materials Research Laboratory, Faculty of Industrial Sciences and Technology, University Malaysia Pahang, Kuantan, 26300, Malaysia

[b] Graphene & Advanced 2D Materials Research Group (GAMRG), School of Engineering and Technology, Sunway University, No.5 Jalan Universiti, Bandar Sunway, Selangor, Petaling Jaya, 47500, Malaysia

[c] State Key Laboratory for Modification of Chemical Fibers and Polymer Materials, International Joint Laboratory for Advanced Fiber and Low-Dimension Materials, College of Materials Science and Engineering, Donghua University, Shanghai, China

[d] Battery Research Center for Green Energy, Ming Chi University of Technology, New Taipei City, Taiwan

ABSTRACT

Electrode material has been cited as one of the most important determining factors in classifying an energy storage system's charge storage mechanism, i.e., as battery-type or supercapacitive-type. In this paper, we show that along with the electrode material, the electrolyte also plays a role in determining the charge storage behaviour of the system. For the purpose of our research, we chose multi-elemental spinal type $CuMn_2O_4$ metal oxide nanofibers to prove the hypothesis. The material is synthesized as nanofibers of diameter ~ 120 to 150 nm in large scales by a pilot scale electrospinning set up. It was then tested in three different electrolytes (1 M KOH, 1 M Na_2SO_4 and 1 M Li_2SO_4), two of which are neutral and the third is alkaline (KOH). The cyclic voltammograms and the galvanostatic charge–discharge of the electrode material in a three-electrode system measurement showed that it exhibit different charge storage mechanism in different electrolyte solutions. For the neutral electrolytes, a capacitive behaviour was observed whereas a battery-type behaviour was seen for the alkaline electrolyte. This leads us to conclude that the charge storage mechanism, along with the active material, also depends on the electrolyte used.

KEYWORDS

Capacitive charge storage; Electrochemical double layer capacitors; Energy storage materials; Pseudocapacitors; Ternary manganates

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