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Fabrication and Electrochemical properties of CNF/MFe2O4: (M = Mn, CuMn) Composite Nanofiber for Electrochemical capacitors

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Carbon nanofibers composite with manganese or copper manganese ferrite (CNF/MFe2O4: M = Mn, CuMn) have been successfully fabricated by a combination of electrospinning and heat treatment process. The structure and morphology of prepared samples were characterized by means of TGA, XRD, SEM, BET, XAS and XPS. The potential application of the prepared samples as an electrode material for supercapacitor was studied using CV, GCD and EIS techniques. The specific capacitance of about 122, 219, and 344 F/g were observed for CNF/MnFe2O4 carbonizaed at 500, 600 and 700 oC, respectively. The improvement is due to increasing of surface area with increased carbonization temperature. In this work, the ACNF/CuxMn1-xFe2O4 (x=0.2, 0.4, 0.6, and 0.8) were also prepared due to the activated carbon and cupper doping in manganese ferrite are two of the effective approaches to enhance the energy storage in supercapacitors. It was found from the result that, Cu content has a significant effect on the electrochemical performance of ACNF/CuxMn1-xFe2O4 electrodes. ACNF/Cu0.2Mn0.8Fe2O4 shows the best specific capacitance of 384 F/g compared to the other three samples. This might be largely attributed to the phase transition and anti-sites defects of spinel crystal cell resulting from the Cu substitution for Mn. By comparing the capacity of CNF/MnFe2O4 and ACNF/CuMnFe2O4 carbonized at 600 oC, the ACNF/CuMnFe2O electrode exhibited a maximum specific capacitance of 384 F/g, where as non-activated CNF/MnFe2O4 showed the specific capacitance of about 220 F/g .The superior electrochemical performance of ACNF/CuMnFe2O may due to large surface area from activation process and high conductivity from cupper doping. Moreover, the combination of the pseudocapacitance behavior of MFe2O4 (M = Mn, CuMn) and the electric double layer capacitance of CNF (or ACNF) well supported the enhancement of specific capacitance.

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