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Parvin Asen, Saeed Shahrokhian, Azam Iraji zad

PII: S1572-6657(18)30462-4
DOI: doi:10.1016/j.jelechem.2018.06.048
Reference: JEAC 4146

To appear in: *Journal of Electroanalytical Chemistry*

Received date: 17 April 2018
Revised date: 25 June 2018
Accepted date: 27 June 2018

Please cite this article as: Parvin Asen, Saeed Shahrokhian, Azam Iraji zad , Ternary nanostructures of Cr2O3/graphene oxide/conducting polymers for supercapacitor application. Jeac (2018), doi:10.1016/j.jelechem.2018.06.048

Ternary nanostructures of Cr_2O_3/graphene oxide/conducting polymers for supercapacitor application

Parvin Asen[1], Saeed Shahrokhian[1, 2]*, Azam Iraji zad[1]

[1]*Institute for Nanoscience and Technology, Sharif University of Technology, Tehran, Iran*

[2]*Department of Chemistry, Sharif University of Technology, Azadi Avenue, Tehran 11155-9516, Iran*

Abstract. In this work, nanostructured composites of Cr_2O_3-graphene oxide (Cr_2O_3/GO) with conducting polymers; polyaniline (PANI) and polypyrrole (PPy) with the shape of cauliflower were synthesized via s simple and low cost one-step chronoamperometry method. The structures and morphologies of the resulting ternary nanocomposites were characterized by using Fourier transform infrared spectroscopy, X-ray diffraction, field emission scanning electron microscopy, and energy-dispersive X-ray spectroscopy. The electrochemical capacitive properties of the prepared nanocomposites were evaluated by using cycle voltammetry, galvanostatic charge-discharge, and electrochemical impedance spectroscopy. The as-synthesized Cr_2O_3/GO/PANI and Cr_2O_3/GO/PPy composites exhibit a highest specific capacitance of 525 and 495 F g^{-1} at 5 A g^{-1} in the three-electrode tests, respectively. Interestingly, Cr_2O_3/GO/PANI and Cr_2O_3/GO/PPy composites retain 84 and 80 % of their initial capacitance values after 4000 charge-discharge cycles, suggesting good electrochemical stability of the nanocomposite electrodes. The assembled symmetric devices based on Cr_2O_3/GO/PANI and Cr_2O_3/GO/PPy composites show a high specific capacitance of 263 and 100 F g^{-1} at the current density of 5 Ag^{-1}, respectively.

Keywords: Supercapacitor; Polypyrrole; Polyaniline, Graphene oxide, Ternary composite, Chromium oxide

Corresponding author, Tel.: +98-21-66165359; Fax: +98-21-66012983

E-mail addresses: shahrokhian@sharif.edu