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Synthesis and Characterization of ZIF-67-NiO/Graphene Sponge for Supercapacitor Applications

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Nowadays, the use of electrical appliances to supply the daily electrical energy that can replace the use of fossil fuels is very indispensable and important. Not only the harmful phenomena of greenhouse gas production and the increase in earth's heat, but also the dependence of clean energy generation such as solar and wind energy on weather conditions, has pushed researchers towards the challenge of continuous energy supply [1]. Therefore, among electrical devices capable of storing energy, in recent years, supercapacitors (SCs) with high energy density and high charge/discharge speed have attracted the attention of researchers [2]. In this study, to develop supercapacitors, a graphene sponge (GS) has been used as a three-dimensional substrate derived from graphene. Furthermore, to increase the energy density, the GS substrate has been decorated by using nanostructures such as zeolitic imidazolate framework-67 (ZIF-67) and nickel oxide (NiO). In this comparative study, the synthesized GS, ZIF-67, NiO, ZIF-GS, NiO-GS, and ZIF-NiO-GS have been characterized by X-ray powder diffraction, Fourier transform infrared spectroscopy, and field emission scanning electron microscopy coupling with energy dispersive spectroscopy to investigate the structure, functional groups, and morphology with elemental distribution, respectively. The obtained results of XRD show that the target ZIF-67 has been correctly synthesized and has. Furthermore, the images related to the carbon substrate e have shown the favorable sponge shape and it confirms the synthesis of GS successfully. In addition, cyclic voltammetry, electrochemical impedance spectroscopy, and chronoamperometry studies have been used to measure the specific capacitance and the charge transfer resistance of the desired structures.

Keywords: NiO-ZIF-67, Graphene sponge, Supercapacitors, EIS, charge/discharge

References

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