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Investigation of Electrocatalytic Properties of MnO_2-ZnO/rGO Aerogel Nanocomposite

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In recent decades, environmental concerns and the global energy crisis caused by the reduction of fossil fuels have led to an intensive search for clean and renewable energy sources, especially through electrocatalytic processes. On the other hand, the morphology and structure of the manufactured electrocatalysts can have useful features for better catalytic performance [1][2]. Therefore, the design and synthesis of innovative high-performance nanocomposites in the electrochemical processes, such as the oxygen evolution reaction (OER) and hydrogen evolution reaction (HER), is very important and has attracted a lot of attention in recent years [3][4]. In this study, the novel MnO_2-ZnO/rGO aerogel nanocomposite was synthesised to consider the OER and HER studies. The synthesized rGO aerogel, MnO_2 and ZnO nanoparticles, MnO_2/rGO aerogel and ZnO/rGO aerogel binary nanocomposites, and MnO_2-ZnO/rGO aerogel ternary nanocomposite have been characterized by using X-ray powder diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), field emission scanning electron microscopy (FE-SEM) coupling with energy dispersive spectroscopy (EDS), Brunauer-Emmett-Teller (BET) theory to investigate the structure, functional groups, morphology with elemental distribution, and specific surface area of materials, respectively. The obtained results of FE-SEM and XRD revealed that the graphene aerogel has incorporated nanoparticles of MnO_2 and ZnO in the form of a substrate with high porosity and large pore size, without collapsing the surface structure. In addition, cyclic voltammetry, electrochemical impedance spectroscopy, and linear sweep voltammetry have been employed to consider the electrochemical behaviors of synthesized samples. The electrochemical results show that MnO_2-ZnO/rGO only shows lower OER activity than MnO_2/rGO, but in terms of HER, it has good electrocatalytic activity compared to the rest prepared samples.

Keywords: MnO_2-ZnO/rGO, aerogel, HER, OER

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