

SYNTHESIS, CHARACTERISATION AND INVESTIGATION OF NITROGEN-DOPED CARBON SUPPORTED MN-CO NANOPARTICLES

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The development and investigation of various materials used in fuel cells, as renewable energy source, is a major challenge among the scientific community. In this study, nitrogen-doped carbon (N-doped C), that has graphene-like structure, has been chosen as a support for the deposition of Mn-Co nanoparticles (Mn-CoNPs) using microwave heating method with the aim to use them as anode material for direct hydrazine fuel cells (DHFCs), likewise, identify its features as supercapacitor. For comparison, pure CoNPs/N-doped C and MnNPs/N-doped C catalysts have been synthesized under identical conditions.

The structure, morphology, and composition of nanocomposites have been characterized using Transmission Electron Microscopy (TEM), Raman Spectroscopy, X-ray Photoelectron Spectroscopy (XPS) and Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES). Moreover, electrochemical performance has been investigated by cyclic voltammetry (CV) in a 1 M Na₂SO₄ solution at the scan rates of 1, 5, 10, 20, 100 and 150 mV s⁻¹. Cyclic voltammograms on the prepared catalyst were also recorded in a 0.05 M N₂H₄ + 1 M NaOH solution at a potential scan rate of 10 mV s⁻¹.

It has been determined that Mn-CoNPs/N-doped C, CoNPs/N-doped C, and MnNPs/N-doped C catalysts show an enhanced electrocatalytic activity towards the oxidation of hydrazine in an alkaline medium and it is controlled by the diffusion processes. What is more, it was found that the specific capacitance (C_s) value for the Mn-CoNPs/N-doped C nanocomposite in a 1 M Na₂SO₄ solution was equal to 497.5 F g⁻¹ at a scan rate of 1 mV s⁻¹ and decreased to 254.4 F g⁻¹ at a scan rate of 150 mV s⁻¹. The Mn-CoNPs/N-doped C catalyst preserves 51.1 % of its specific capacitance as the scan rate increases from 1 mV s⁻¹ to 150 mV s⁻¹. The obtained results confirmed the good performance of the prepared Mn-CoNPs/N-doped C nanocomposite as the electrode material for supercapacitors application.