PÔSTER - RESUMO - DISPOSITIVOS ELETRÔNICOS, ELETROQUÍMICOS, SUPERCAPACITORES E BATERIAS

DESIGN AND CHARACTERIZATION OF TEXTILE ELECTRODES WITH NI/RGO/CUO AND NI/RGO/MNO_2 FOR WEARABLE SUPERCAPACITORS

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The rapidly growing demand for next-generation wearable electronics and smart textiles is driving an urgent search for energy storage systems that are not only electrochemically efficient but also lightweight, mechanically flexible, and safe. Conventional rigid batteries fail to meet the deformability requirements of these applications, making textile-based supercapacitors a promising alternative. In this context, natural cellulose-based substrates, such as cotton, offer a sustainable and porous scaffold for functionalization with conductive and pseudocapacitive nanomaterials [1,2].

In this work, we successfully developed and characterized two distinct cotton-based hybrid electrodes for flexible supercapacitors: (i) Ni/RGO/CuO and (ii) Ni/RGO/MnO2. The electrode fabrication involved a multi-step approach designed to optimize conductivity and electrochemical surface area. First, a metallic nickel layer was deposited onto the cotton fibers via an autocatalytic electroless plating technique [2] to serve as a highly conductive current collector. Subsequently, graphene oxide (GO) was applied by a drop-casting method, followed by an electrochemical reduction process to restore the

graphitic network and enhance charge transport. The pseudocapacitive metal oxides were then integrated: CuO was synthesized through the chemical oxidation of electrochemically deposited copper using an alkaline persulfate solution, while MnO2 was grown via a hydrothermal method at 70°C for 1 h, followed by direct drying.

Comprehensive morphological and chemical characterization was performed using SEM, EDS, and XPS. These techniques confirmed the uniform deposition of the active materials along the fiber axis, the preservation of the open porosity essential for electrolyte diffusion, and the presence of the expected oxidation states for reversible redox reactions.Cyclic voltammetry measurements in 3 mol·L?¹ NaOH showed pseudocapacitive behavior for both electrodes. The Ni/RGO/CuO electrode exhibited well-defined redox pairs with peaks centered around 0.35 V (vs. Ag/AgCl), while the Ni/RGO/MnO2 electrode showed a more diffuse pseudocapacitive current, associated with a mixed capacitive-faradaic response characteristic of the Mn4?/Mn³? redox transition in alkaline media. Peak current densities in the range of 2 to 5 mA·cm?² at 10 mV·s?¹ demonstrate the high electrochemical activity of the materials and highlight their potential for application in asymmetric energy storage devices.

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Palavras-chave: textile electrodes; flexible supercapacitors; wearable supercapacitors.