Área: INO

Síntese e caracterização de nanomaterias envolvendo óxido de grafeno reduzido e $NiCoP_2O_7$ com aplicação no armazenamento de energia

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Palavras-Chave: *Nanopartículas, Pirofosfato, Supercapacitor, Bateria.*

Highlights

Title: Synthesis and characterization of nanomaterials involving graphene oxide and $NiCoP_2O_7$ for energy storage applications

Synthesis of $NiCoP_2O_7$/rGO nanocomposites via polyol method.

Application for energy storage.

Crystalline Ni/Co pyrophosphates obtained at 700 °C.

Amorphous nanomaterials obtained greater capacity.

Resumo/Abstract

The advancement of electronic devices demands new, more efficient, and environmentally friendly materials for battery production. The 2030 Agenda, proposed by the UN, has among its goals ensuring clean, sustainable, and accessible energy for all. Therefore, the development of new technologies to meet energy demands is necessary. Nanocomposites involving graphene and Ni/Co pyrophosphate exhibit several beneficial properties for supercapacitor production, making them excellent materials for energy storage applications. Thus, this project aims to meet these demands through the synthesis of innovative nanocomposites based on reduced graphene oxide (rGO) and Ni/Co pyrophosphate nanoparticles. For this purpose, the materials were synthesized using a modified polyol method and subjected to pyrolysis for 1 hour at 300, 500, and 700 °C under an inert atmosphere. The materials were characterized by XRD, TGA, Raman, FTIR, SEM, and EDS. Through these characterization techniques, it was observed that crystalline Ni/Co pyrophosphates were obtained only at 700 °C. At lower temperatures, the nanocomposites exhibited an amorphous structure. Also, samples without rGO and pyrolyzed in higher temperature showed larger particles size. The samples were also evaluated by electrochemical techniques such as cyclic voltammetry, charge–discharge, and impedance. A potentiostat with a conventional three-electrode setup immersed in 1 mol L^{-1} KOH electrolyte was used. The working electrode was an FTO (fluorine-doped tin oxide) substrate modified with the nanocomposite. All voltammograms showed the $Ni_xCo_{y(}OH)_2/Ni_xCo_yOOH$ redox pair, typical of these metals in alkaline media. Comparing the nanomaterials obtained under different conditions, the NiCo pyrophosphate/rGO nanocomposites produced by pyrolysis at 300 °C exhibited the highest capacity (59.37 mA h g^{-1} at 0.4 A g^{-1}). In the future, the materials will also be characterized by TEM and XPS. Currently, the materials are being tested for applications in electrochemical sensors and in direct liquid fuel cells using glycerol as fuel, a byproduct of biodiesel production. Furthermore, at CEMHTI - France, asymmetric devices were developed in KOH 1M, with results similar to those obtained in FTO, demonstrating potential for real applications.

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