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Valorizing Manganese Residue: GO/MnHCF Nanocomposite

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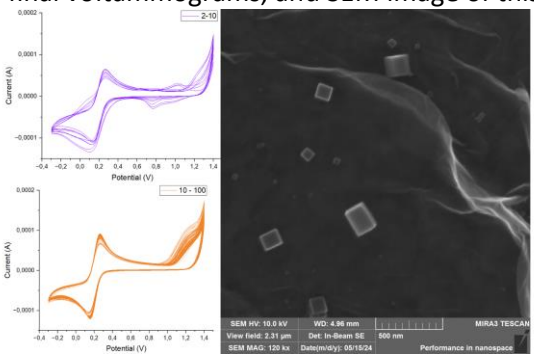
The search for new materials is crucial for technological advances. In this context, graphene oxide (GO) and manganese hexacyanoferrate (MnHCF) have been widely studied due to their properties and great potential for applications, including energy storage devices, offering cheaper and more sustainable options for application in sodium-ion aqueous batteries (NIBs) [1,2]. This work proposes an innovative methodology for the synthesis of the GO/MnHCF nanocomposite through a modified Hummers method, reutilizing manganese, which is often an unwanted residue in this process. The Hummers method is one of the most utilized for GO production, standing out for its efficiency in large-scale production. The synthesis involves the in situ generation of the oxidizing agent Mn_2O_7, through the reaction between H_2SO_4 and $KMnO_4$, which is responsible for the oxidation of the graphite structure. However, at the end of the reaction, several components present are not required, necessitating a washing step that generates a large amount of aqueous waste containing manganese oxide, manganese ions, sodium sulfate, and residual sulfuric acid. Through modifications in the synthesis, washing, exfoliation, and film formation steps, thin GO films with distinct physical, chemical characteristics and different quantities of manganese and other residues were obtained. The films were prepared using the liquid-liquid interfacial method developed in our laboratory [3]. To investigate the formation of the GO/MnHCF nanocomposite, the GO films were studied through electrodeposition using the cyclic voltammetry technique. These films were characterized by UV-Vis Spectroscopy, X-ray Diffractometry (XRD), Scanning Electron Microscopy (SEM), Raman Spectroscopy, as well as electrochemical methods. The reutilization of components from the GO synthesis can be a viable and sustainable strategy to produce advanced materials for energy storage applications. As a future perspective, tests are expected to be conducted to evaluate the performance of the prepared material in NIBs.

Figure 1. Voltammograms demonstrating the electrodeposition of one of the films, showing distinct profiles between the initial and final voltammograms, and SEM image of this same film.



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References

[1] HUSMANN, Samantha; RAMOS, Maria K.; ZARBIN, Aldo J. G. Electrochimica Acta, v. 422, p. 140548, (2022).
[2] FERREIRA, Caroline M.; RAMOS, Maria K.; ZARBIN, Aldo J. G. European Journal of Inorganic Chemistry, p. 3373-3384, (2021).
[3] ZARBIN, Aldo J. G. Materials Horizons, 8, 1409, (2021).