SANTOS

XXII B-MRS Meeting 2024

September 29th to October 3rd

PROCEEDINGS

Sociedade Brasileira de Pesquisa em Materiais

Proceedings of the XXII B-MRS Meeting

Santos, SP 2024

Conteúdo, revisão textual e gramatical: Resposanbilidade dos respectivos autores.

ISBN: 978-85-63273-63-5

Flexible carbon fiber improves power density and mechanical stability for application in redox flow batteries

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Due to the current focus on manufacturing safer and bioinspired batteries, organic and organometallic compounds have been proposed as active compounds in energy storage devices. Nevertheless, to achieve a better performance in a redox flow battery (RFB), it is necessary to understand the carbon electrode surfaces, as the electrochemical charge transfer reactions occur at the electrode. Thus, there is much to be improved in the chemical and electrochemical stability of the electrodes, as they rapidly degrade after several charge and discharge cycles, significantly restricting their long-term use. Based on this, we studied the conventional SGL 39AA electrode and proposed the application of a flexible carbon fiber never used in an RFB, the Delpho electrode. Studies show that the Delpho electrode has a higher current and power density and is more robust than the SGL 39AA. Furthermore, Raman measurements confirm the Delpho electrode functionalization sustained by the ratio of the intensity of D- and G- bands (I_D/I_G). In line with the Raman measurements, X-ray photoelectron spectroscopy (XPS) displays a rise in the atomic ratio of oxygen to carbon (O/C), confirming functionalization by organic functional groups. The images obtained by scanning electron microscopy (SEM) serve as a support to confirm the structural and chemical surface characterization. In addition, compared with those produced with SGL 39AA, larger power densities were obtained using the Delpho electrode. In summary, we strictly propose that the Delpho electrode is a promising electrode for application in an RFB that does not degrade after charge and discharge cycles and provides a higher power density.

Acknowledgements: The authors gratefully acknowledge the FAPESP for the financial support of the research projects.

Ref:[1] SEDENHO, G. C. et al. Effect of Molecular Structure of Quinones and Carbon Electrode Surfaces on the Interfacial Electron Transfer Process, ACS Appl Energy Mater 3, p. 1933-1943, 2020.