Non-wovens carbon nanofibers doped and covered with carbon nanotubes as binderless hybrid hierarchical electrode for lithium storage

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Abstract

This study is an investigation of a hybrid hierarchical electrode produced by electrospinning and chemical vapor deposition methods. The binderless hybrid hierarchical electrode is composed by carbon nanofibers with carbon nanotubes inside and outside the fibers. Single-walled or multi-walled carbon nanotubes are present inside the nanofiber as a dopant and they are incorporated during the carbon nanofiber electrospun production. After that, multi-walled carbon nanotubes are grown onto the surface of the carbon nanofiber using chemical vapor deposition method.

The suitability of carbon nanofibers for lithium storage applications was investigated by electrochemical methods using charge and discharge curves, cyclic voltammetry and impedance spectroscopy. The morphology of the flexible binderless hybrid hierarchical electrodes was investigated by scanning electron microscopy. The additional incorporation of oxide nanoparticles (manganese, zinc or both) by electrodeposition method are responsible to improve the specific capacitance of the electrode, showing new perspectives to use this electrode configuration to produce lightweight, flexible and conductive electrode for lithium ion batteries without binder addition.

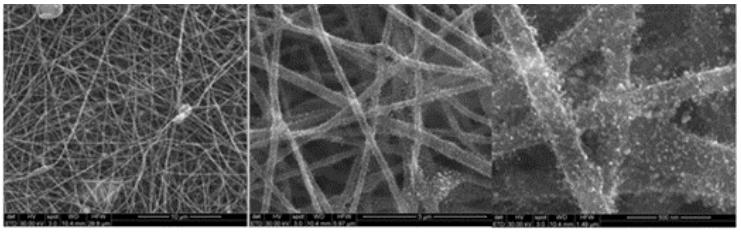


Figure 1. SEM images of CNT-doped-CF/CNTs.

Recent Publications

1. Christian Müller, Ammar Al-Hamry, Olfa Kanoun, Mahfujur Rahaman, Dietrich R. T. Zahn, Elaine Yoshiko Matsubara and José Mauricio Rosolen. Humidity Sensing Behavior of endohedral Li-doped and undoped SWCNT/SDBS composite films. Sensors, 2019.
2. F. F. S. Xavier, C. G. O. Bruziquesi, W. S. Fagundes, E. Y. Matsubara, J. M. Rosolen, A. C. Silva, M. C. Pereira, S. C. Canobre and F. A. Amaral. A new synthesis method and electrochemical behavior of PPy/α-Bi_2O_3 core/shell for supercapacitor electrodes. Journal of B (Print), v.16, p.9487 - 9496, Brazilian Chem. Soc. 2018.
3. ZANCANELA, D. D.; FARIA, A. N.; Simao, A. M. S.; MATSUBARA, E. Y.; ROSOLEN, J. M.; Ciancaglini, P. Comparative Studies of Carbon Nanotubes: Implications for Alkaline Phosphatase Activity and Mineralized Matrix in Osteoblasts Cultures. Journal of Nanoscience and Nanotechnology (Print), v.16, p.9487 - 9496, 2016.
4. ZANCANELA, D. D.; Simao, A. M. S.; MATSUBARA, E. Y.; ROSOLEN, J. M.; Ciancaglini, P. Defective Multilayer Carbon Nanotubes Increase Alkaline Phosphatase Activity and Bone-Like Nodules in Osteoblast Cultures. Journal of Nanoscience and Nanotechnology (Print), v.16, p.1437 - 1444, 2016.
5. Matsubara, Elaine Y.; TAKAHASHI, GIULIANA H.; MACEDO, NADIA G.; GUNNELLA, ROBERTO; MAURICIO ROSOLEN, J. Electronic enhancement of hybrid specific capacity of carbon nanotubes/bone charcoal composite with Ag nanoparticles decoration. Journal of Electroanalytical Chemistry, v.765, p.58 - 64, 2016.



Biography

Elaine Yoshiko Matsubara holds a BA (2002) in Chemistry, PhD (2010) in Carbon Nanomaterials for Energy Storage Devices from the University of São Paulo (USP), a part of her PhD studies from the Instituto de Ciencias de Los Materiales de Madrid (Spain), ENEA (Italian National Agency for New Technologies Energy and Sustainable Economic Development), University of Rome La Sapienza (Italy), and a post-doc in Photovoltaic Energy Devices from the State University of São Paulo (UNESP). She is presently Researcher at University of São Paulo (USP), Brazil. Her work focuses on synthesis of doped carbon nanotubes, 3D hybrid hierarchical carbon composite materials and chemical and electrochemical graphene production to application and development of lithium and sodium ion batteries, sensors and

capacitors. Her experience is focuses on Materials Science with emphasis in energy devices and nano composites to filtration, catalysis, environmental remediation and polymer reinforcement.

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Notes/Comments: Antoinette Robertson, on behalf of the organizing committee invited me to participate at the event as a Keynote Speaker.