Exfoliation of multi-walled carbon nanotubes by hydrogen plasma for application as capacitors devices

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The main characteristics for charge-storage devices are high energy density and great power density, which can be improved by materials with high surface area. Carbon nanotubes (CNTs) present not only a high active area but also high electrical conductivity and chemical stability. These properties can promote better ions transportation, facilitating the double layer charging. Besides, exfoliation of CNTs can be applied to increase the surface area. In this work, we present a new approach for multi-walled carbon nanotubes – reduced graphene oxide (MWCNTs-RGO) obtainment. We have grown the carbon nanotubes by thermal chemical vapor deposition using a tubular reactor. Camphor solution was used as precursor. Fe-Co catalyst particles were deposited by dip-coating method. We have synthesized MWCNTs at 700°C. For CNTs exfoliation, we applied hydrogen plasma. After, oxygen plasma treatment was carried out aiming carbon nanotubes funcionalization. The samples were characterized by Raman Scattering Spectroscopy, Scanning Electron Microscopy with Field Emission Gun (SEM-FEG), Energy Dispersive X-Ray Spectroscopy (EDX) and electrochemical analyses. The CNTs exfoliation was observed in SEM micrographs, in which carbon nanotubes presented open edges on their surfaces. In Raman spectra, we notice an increase in defects density after exfoliation process by the raise in D band intensity. Electrochemical analyses showed that exfoliation process increased the capacitive behaviour. Further, this nanocomposite showed itself to be a promising alternative for development of capacitor devices.

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