Synthesis of Carbon Nanotubes at Atmospheric Pressure for Supercapacitor Applications

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Abstract

Scalable and qualitative synthesis of carbon nanotubes (CNTs) is a challenge for industrial use. The floating catalyst chemical vapor deposition (FC-CVD) process allows the continuous growth of CNTs in a free-oxygen atmospheric pressure ambient from a floating-catalyst at high temperature above 1200^{0}C. In this work, ferrocene ($C_{10}H_{10}Fe$) was used as a catalyst source and methane (CH_4) as a carbon source while thiophene (C_4H_4S) was used as a sulphur source to affect the carbon diffusivity at the surface of catalyst nanoparticles in order to stimulate the CNTs growth. Scanning electron microscopy (SEM), transmission electron microscopy (TEM) and Raman spectroscopy were used to characterize the CNTs. Raman spectrum shows the D, G, and G' bands, which indicate the high graphitization of CNTs with a ratio I_G/I_D = 1.174. NiO_x nanoparticles where synthesized using plasma-liquid interaction process using helium (He) plasma and ethanol as an electrolyte. The CNTs were dispersed in the electrolyte with suspended nanoparticles and then it was sprayed over a graphite substrate to be used as electrochemical electrode. The specific capacitance obtained from the cyclic voltammetry (CV) for graphite, graphite-CNTs, graphite-NiO_x and graphite-NiO_x-CNTs showed an increase in the specific capacitance from 0.5 to 2.0 F/g using 0.1M of sodium sulphate (Na_2SO_4) as electrolyte.

References

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Figures

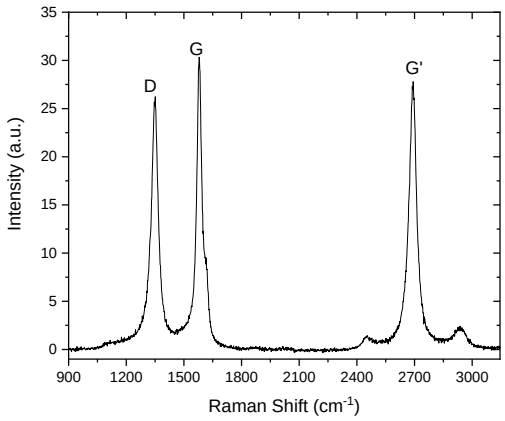

Figure 1: Raman Spectrum for CNTs ribbons obtained by FC-CVD.

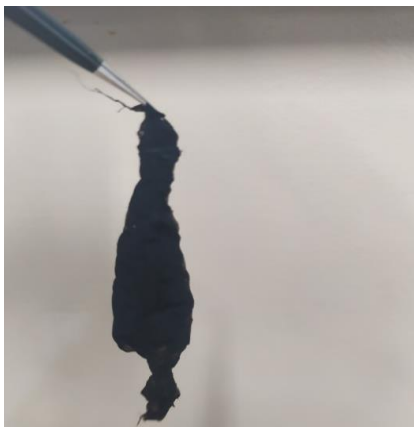

Figure 2: CNTs bundle obtained by FC-CVD.