Nitrogen-doped MWNCTs under low catalyst concentrations

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The formation of carbon nanotubes at different catalyst concentrations is a line of research that allows us know their growing mechanism, structural modifications and devise new alternatives for different applications. In this work, the effect of low catalyst concentration on the growth of nitrogen-doped multiple wall carbon nanotubes (N-MWCNT) was investigated using aerosol assisted chemical vapor deposition method (AACVD). Thermal decomposition of a benzylamine / ferrocene mixture was used as carbon, nitrogen source and as a source of the catalytic particle. The AACV was developed in a temperature range of 700 ºC to 900 ° C under an Ar/H_2 atmosphere (95-5%). The ferrocene weight content varied from 0.01 to 0.5%. The morphology, diameter, thermal stability, degree of graphitization and crystallinity phases present in the sample were verified by scanning electron microscopy (SEM), transmission electron microscopy (TEM), thermogravimetric analysis (TGA), Raman spectroscopy, and X-ray diffraction (XRD), respectively. Additionally, the thermal stability of ferrocene was analyzed by TGA. Our results showed that low concentrations of ferrocene led to the growing of N-MWCNTs with a bamboo-type morphology. Ferrocene decomposition mechanism and its interaction with the precursors is discussed. It should be noted that the low ferrocene concentration responsible for the formation of Fe-based nanoparticles in a nitrogen-rich environment produce novel N-MWCNTs with outstanding properties for applications in energy storage and sensor devices.