CHARACTERIZATION OF CARBON NANOTUBES MANUFACTURE BY PLASMA CVD TECHNIQUE

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The electrical properties of carbon nanotubes (CNTs) make them valuable assets for use in microelectronics, and therefore constituting a very important contribution in the field of nano technology in our particular case, for making nano sensors [1,2].
In this paper, we present the experimental results, discussion, and conclusions, referring to their manufacture by technical PECVD (Plasma Enhanced Chemical Vapor Deposition) reactor in a horizontal pyrex tube, using methane as precursor gas and RF discharge 1000w output power acting as a means of ionizing thus achieving the synthesis of carbon nanotubes on a substrate of iron (AISI 316), heated with an electric heating internal at varying temperatures of 200 ° C to 800 º C, the same was used coated ferric nitrate $Fe(NO_3)_3$, which served as a catalyst and central nucleation. Also we used as substrate a copper grid coated ferric nitrate $Fe(NO_3)_3$. The results obtained depended on the different process conditions, with the aim of this work, not only the manufacture of carbon nanotubes of practical application in sensors, but also the study of the influence of different process conditions on the final results, which were verified by Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM).

For sample preparation we dropped suspension of carbon nanotubes in isopropyl alcohol on the copper grid with carbon film for the pictures shows on figure 1 to 3 and for the picture shows on figure 4 to 6 we used directly the copper grid. Figure 1 shows a SEM image of nanotubes and figure 2 a TEM details, in this pictures we can see carbon nanotubes of many diameters. On figure 3 we can see that the diameters are between 8.5 and 12 nm and the typical bamboo structure. Figure 4 shows a nanotube growth from the copper grid with an iron particle [3]. Figure 5 shows a SEM image of carbon nanotubes grown from the copper grid, they have several microns. Figure 6 shows a TEM details, these carbon nanotubes seems very rigid.

To be a method of production of nanotubos of carbon, not conventional, the results as for the quantities taken place by process, of approximately 0,1gr, as well as morphology and dimensions were satisfactory, being usable in the production of nano sensors. One observes that with the increase of temperature the diameter of the nanotubo tends to decrease, what could be interpreted as that, to a bigger kinetics of the species, the mass of the same ones becomes more difficult, creating less massive structures, on the other hand, the results agree with other works [4].

References

[1] M.S.Perez et al. *Sensors,10 (2010) 3857.*
[2] E. Morinubo et al. *The Science and Technology of Carbón Nanotubes.* Pergamon, 1999.
[3] X. Devaux et al. *Physica E*,40 (7) (2008), 2268.
[4] J. L. Song et al. *xxtcl.sxicc.ac.cn/EN/abstract/abstract8731.shtml*,2010.

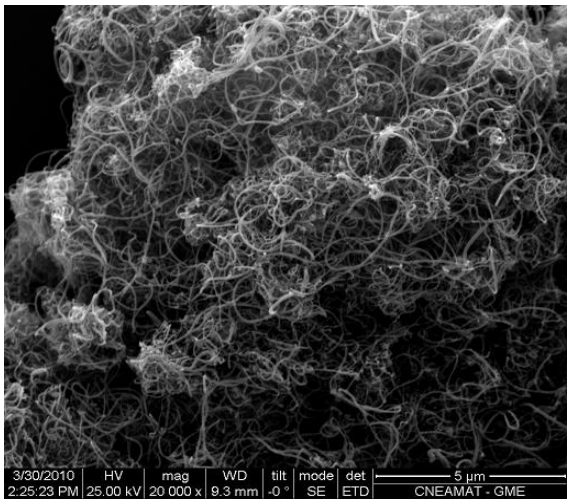

FIG. 1. SEM image of carbon nanotube.

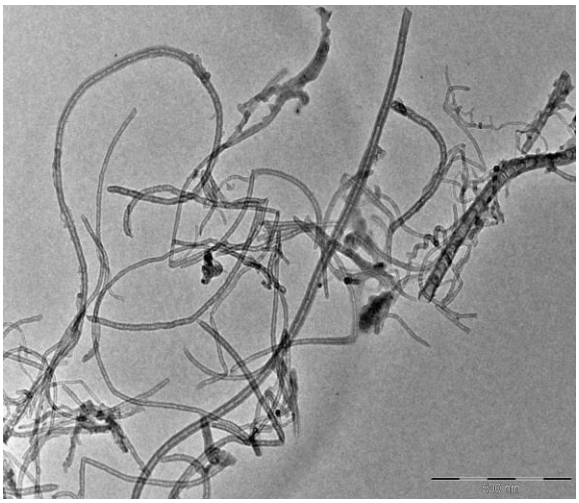

FIG.2. TEM image of carbon nanotube. Scale 500 nm.

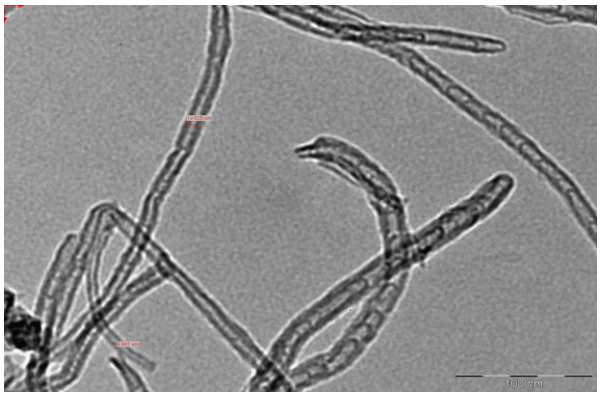

FIG.3. TEM image. Scale 100 nm.

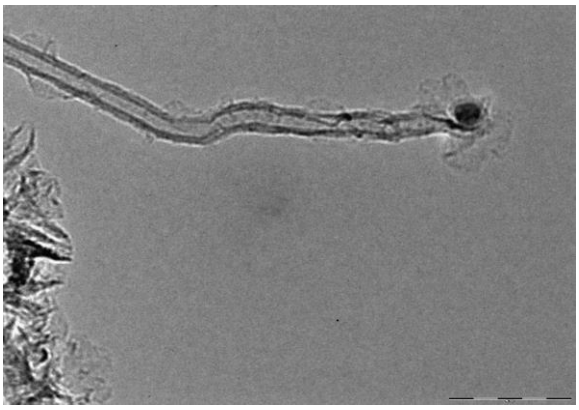

FIG.4. TEM image. Iron particle. Scale 50 nm.

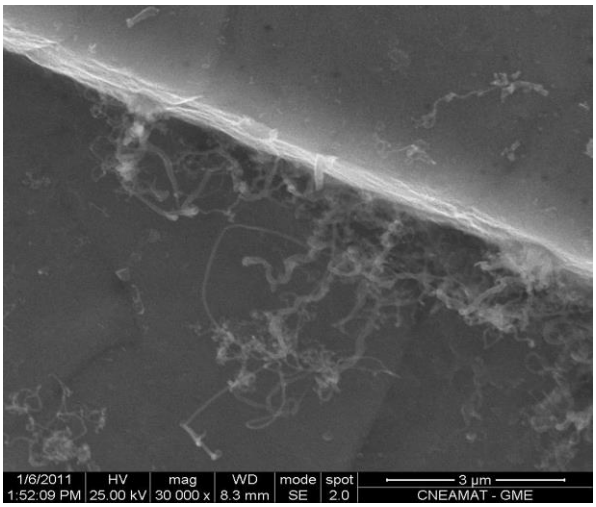

FIG.5. SEM image of carbon nanotube grown on a copper grid.

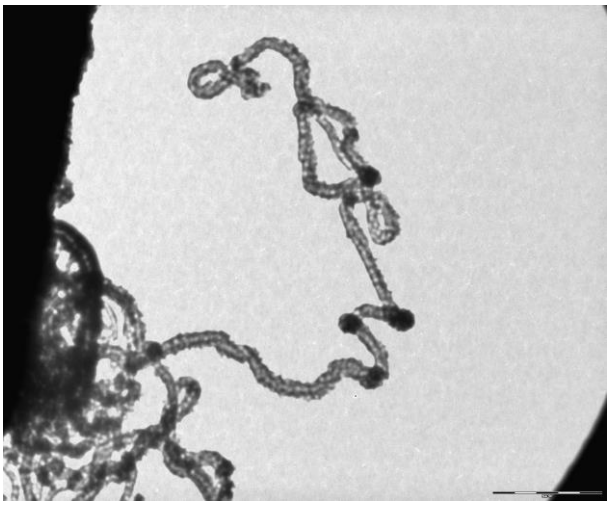

FIG.6. TEM image of carbon nanotube. Scale 500 nm.