

SYNTHESIS, PURIFICATION AND CHARACTERIZATION OF CARBON NANOTUBES

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Abstract:

Carbon nanotubes have been synthesized by F. INASMET to have available material with suitable properties for their later applications. Because of that, it has been designed a tubular reactor of fluidized bed in order to scale up it for industrial applications and to obtain high yields of products.

The carbon nanotubes have been synthesized by chemical vapor deposition technique (CVD) using methane as precursor gas and a metallic catalyst. The characteristics of obtained products depends on the working conditions such as the temperature and the pressure of operation, the volume and concentration of methane, the size and the pretreatment of metallic catalyst, and the time of reaction.

In order to eliminate the impurities formed in the synthesis process such as graphite compounds, amorphous carbon, fullerenes, coal and metal nanoparticles, a purification process is required¹. Oxidative treatments in gaseous phase and in liquid phase, acid treatment, microfiltration, thermal treatment, ultrasounds, are among others the methods used by F. INASMET. A purification protocol has been established.

On the other hand, a good dispersion of carbon nanotubes for most of the applications and specially for suitable characterization is required. The CNTs have been dispersed in organic solvents (N-methyl pyrrolidone) combining techniques such as ultrasonication and centrifugation for its solubilization.

Techniques such as Raman Scattering, Thermal Gravimetric Analysis, Scanning Electronic Microscopy or Atomic Force Microscopy have been used for the qualitative characterization of the samples. The technique of X-Rays Diffraction has been employed for the evaluation of the effects of thermal and chemical treatments on the product as well as to determine their crystalline organization. This technique, together with UV-FTIR has been used to obtain the diameter distribution of the carbon nanotubes².

Several functionalization groups are being tested for various applications. Particularly, INASMET is researching the functionalization of carbon nanotubes for its union with polylactic acid in applications of bone implants.

References:

¹ B. Zheng, Y.Li, J.Liu, *Applied Physics A* (74), 345-348, (2002).

² I.W.Chiang, B.E.Brinson, A.Y.Huang, P.A.Willis, M.J.Bronikowski, J.L.Margrave, R.E.Smalley and R.H.Hauge, *J. Phys. Chem. B* 2001 (105) 8297-8301.