ChemOnTubes, 1-5 April 2012, Arcachon, France

Functionalization of CNTS with Maleic Anhydride

R. Araújo[a], M. C. Paiva[b], M. F. Proença[a], C. J. Silva[a]

[a] Departamento de Química, Universidade do Minho, Campus de Gualtar, 4710-057 Braga, Portugal
[b] Instituto de Polímeros e Compósitos/I3N, Universidade do Minho, Campus de Azurem, 4800-058 Guimarães, Portugal
e-mail: mcpaiva@dep.uminho.pt

The outstanding properties of carbon nanotubes (CNTs) [1] are mainly related with their unique structural features. However, the high π-π staking between the tubes is a major drawback for their manipulation and interaction with other materials. Chemical functionalization has been used as a convenient tool to improve their performance in various applications [2].

The work reports the functionalization of multi-wall carbon nanotubes (MWCNTs) with maleic anhydride via a Diels-Alder addition reaction, performed in dimethyl sulfoxide (190 ºC) or 2-chorotoluene (150 ºC) for 24 hours. The product was characterized by thermogravimetric analysis (TGA) and the weight loss at 800 ºC was 11.9 and 3.7 % respectively. Potentiometric titration suggests that CNTs modified at 190 ºC remain predominantly in the anhydride form, while for CNTs modified at 150 ºC, the extent of hydrolysis is approximately 40 %. Maleic anhydride was also reacted with a model compound (anthracene) in dimethyl sulfoxide (190 ºC) and the hydrolysis of the product (0.025 mmol in 650 µL of DMSO-d6) was followed by 1H RMN upon addition of 0.166 mmol of DCl (40 % weight in D2O) (graphic in figure). The anhydride 1 was easily regenerated from the dicarboxylic acid 2 when this compound was heated at 185 ºC for 10 minutes. A similar behavior is expected for the modified CNTs.

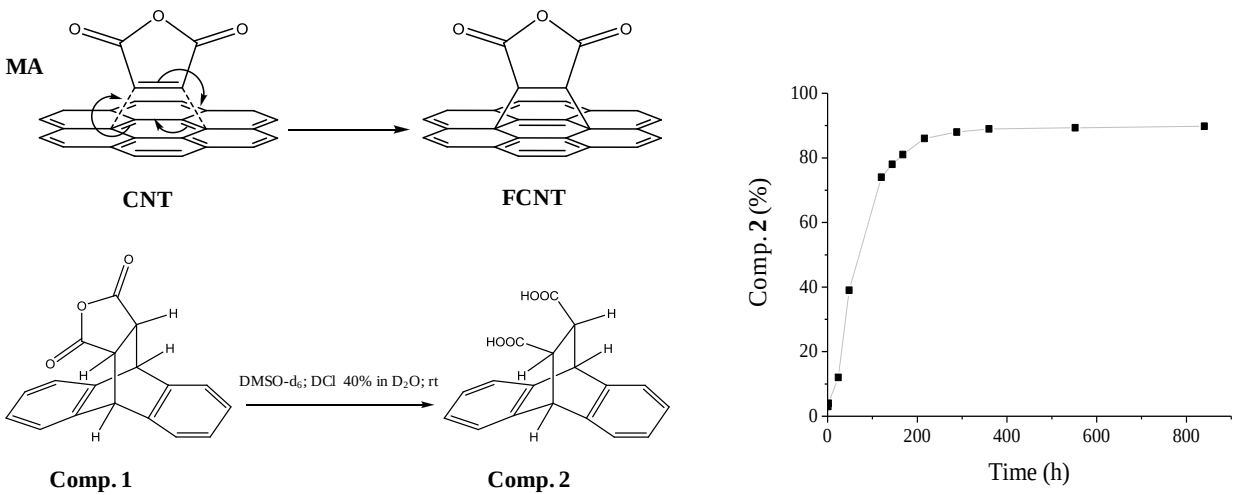

Figure: Reaction of maleic anhydride with the CNT surface and hydrolysis reaction of model compound 1.

References

[1] R. H. Baughman, A. A. Zakhidov, W. A. Heer, Science 2002, 297, 787.
[2] J. M. Schnorr, T. M. Swager, Chem. Mater. 2011, 23, 646.

Notes