Interaction of Carbon Nanotubes with Fatty Acids under high pressures

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ABSTRACT

Carbon nanotubes with simple walls were theoretically predicted in 1992 and then observed experimentally in 1993. These nanostructures have become an important material for scientific investigations due to their remarkable mechanical, electronic, transport, magnetic, optical and chemical properties. In this work, we report the preparation of SWCNTs samples in aqueous solutions of saturated fatty acids. These dispersions were characterized by the technique of Raman spectroscopy and fluorescence. The synthesized samples consist of aggregates containing nanotubes of different diameters, chiralities, lengths and electronic properties. Our results are consistent with an increase in the individualization of SWCNTs when suspensions are prepared with fatty acids with more than 12 carbon atoms. In order to further investigate the interaction of fatty acids with SWCNTs, we conducted Raman scattering experiments by subjecting these samples to high hydrostatic pressures in the range of 0.0 - 5.5 GPa. The previous compression results show us that the external tubes undergo some changes with pressure variation. The RBM band, in particular, shows a linear behavior with increasing pressure. During decompression, we observed a hysteresis of the G band with pressure, which has been shown to be a collapse with pressure.

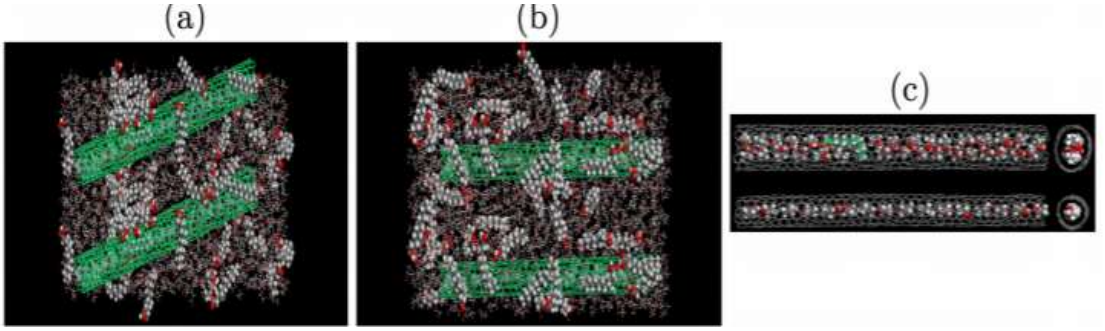

Figure - Supramolecular structures of SWCNT and C12 in ethanol from NPT molecular dynamics after 1.0 ns: (a) (10,6) nanotube and (b) (7,5) nanotube. Two unit cells are shown. The abrupt change in RBM frequency shifts for nanotube diameters over 1.0 nm in the fatty acid SWCNT composites could then be interpreted as being a consequence of nanotube filling.

REFERÊNCIAS

DRESSELHAUS, M. S. et al., Carbon fibers based on C60 and their symmetry, Phys. Rev. B **45**, 6234 (1992).

HAMATA, N., S.-i. Sawada, and A. Oshiyama, New one-dimensional conductors: Graphitic microtubules, Phys. Rev. Lett., 68, 1579 (1992).

IJIMA, S. Iijima and T. Ichihashi, Nature, London 363, 603 (1993).

BETHUNE, D. S. et al., Nature, London 363, 605 (1993).