# Vibrational properties of carbon nanotubes interacting with saturated fatty acids

**Katiane Pereira da Silva[1]; Sousa, M. E. S[1], Araujo, Paulo T.[2], Reis, M. A. L.[1], Alves da Cunha, J. R.[1]; Barbosa Neto, N. M.[1]**

[1]Departamento de Física, Universidade Federal do Pará (UFPA), Belém, PA, Brasil
[2] Department of Physics and Astronomy, University of Alabama, Tuscaloosa, Alabama 35401, USA

E-mail: katianeperei@gmail.com ; kps@ufpa.com.

**Abstract**

We report on the preparation of stable suspensions of SWCNT in aqueous solutions of saturated fatty acids and sodium dodecyl sulfate. These dispersions were characterized by PL and RRS techniques, and the supramolecular structures formed by SDS and C18 adsorbed on SWCNTs in water were studied by Molecular Dynamics simulations (MD). Our results are consistent with an enhanced individualization of SWCNTs when the suspensions are prepared with Cn's having more than 18 carbon atoms. We further investigate the interaction of Cn's with SWCNTs by mixing SWCNT bundles and Cn's in ethanol. After evaporation of the solvent, the resulting solids were characterized by RRS. The measured RBM frequencies are blue-shifted with respect to the values observed for pristine nanotube powders, indicating a strong interaction between nanotubes and the fatty acid layer. The blue-shifts exhibit an unexpected dependence on nanotube diameter: there is a sharp increase of blue shifts for nanotube diameters larger than 1.0 nm, suggesting the emergence of a second mechanism by which fatty acids interact with nanotubes. MD results on open-ended nanotubes demonstrate that nanotubes are filled with ethanol molecules and, for nanotubes whose diameters are larger than 1.0 nm, fatty acids also enter the nanotube cavity. Pressure-dependent Raman spectra were obtained with a Jobin-Ybon T64000 spectrometer equipped with a charge-coupled device detection system. The employed excitation source, for the Raman experiments, was the 514.5 nm radiation delivered by a continuum argon ion laser with a 2 $cm^{-1}$ spectral resolution. High-pressure was achieved using a diamond anvil cell loaded with nujol mineral oil as the pressure transmitter fluid. The results were studied by Raman pectroscopy with pressure varying from 0.0 to 5.5 GPa. In particular, the RBM band shows a linear behavior with increasing pressure during decompression.

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