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RAMAN SCATTERING IN C₆₀@SWCNTS PEAPODS

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Raman spectroscopy is a powerful method that furnishes detailed information on various carbon allotropic forms, allowing ones materials to be distinguished from others via a set of vibrational lines, the so-called Raman “fingerprints” [1--4]. Depending on the rolling up of a graphene (2D carbon network system), one obtains a single-walled carbon nanotube (SWCNT, 1D network system) or a C₆₀ (0D) fullerene molecule, whose Raman spectra vary noticeably, enabling one to differentiate between these types of carbon materials.

SWCNTs can be filled with fullerene molecules, forming the so-called peapods, whose properties, such as flat conduction bands, are attractive in terms of a possible superconductivity by alkaline metal doping [5]. In this case, the Raman spectra of these systems contain the “signatures” of both SWCNTs and fullerenes, ensuring information on the type of encapsulating fullerene molecules, as well as on the diameter distribution of SWCNTs, receiving fullerenes.

In this respect, the present work aims the Raman spectroscopic characterization of a sample of C₆₀@SWCNTS peapods, prepared via the multistep method, in order to confirm the presence of fullerene molecules (C₆₀) inside the tubes, as well as to show the convenience of Raman spectroscopy for the non-destructive and rapid analysis of such combined-dimensionality systems. Peapods were scanned using two (514.5 and 325 nm) laser excitation wavelengths. The Raman responses of SWCNTs were distinguished from those of fullerene molecules. Furthermore, the Raman spectra of peapods, excited by a 325-nm laser beam, reveal the formation of bonds between the fullerene molecules in the nanotubes, presumably due to the laser heating (photopolymerization processes).

1. Dresselhaus MS, Eklund PC. Phonons in carbon nanotubes. *Advances in Physics*. 2000; 49(6):705-814.
2. Ferrari AC, Meyer JC, Scardaci V, Casiraghi C, Lazzeri M, Mauri F, Piscanec S, Jiang D, Novoselov KS, Roth S, Geim AK. Raman spectrum of graphene and graphene layers. *Physical Review Letters*. 2006;97:187401.
3. Milanez DH, Schiavi MT, do Amaral RM, de Faria LIL, Gregolin JAR. Development of carbon-based nanomaterials indicators using the analytical tools and data provided by the web of science database. *Mat. Res.* 2013;16(6):1282-1293.
4. Maultzsch J, Telg H, Thomsen C, Reich S. Radial Breathing Modes of Single-Walled Carbon Nanotubes: Optical Transition Energy and Chiral-Index Assignment. *Physical Review B*. 2005;72:205438-16.
5. Saito S, Okada S. Proc. Design of carbon-nanotube based materials. In: *Proceedings of the 3th Symposium on Atomic-Scale Surface and Interface Dynamics*; 1999 March 4-5; Fukuoka, Japan. p. 307-310.