Resonant Raman spectroscopy of single wall carbon nanotubes under pressure

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Due to their unique one dimensional structure carbon nanotubes are expected to stand up, through pressure application, strong geometrical changes that preserve their nanostructured character. This has motivated an important number of experimental investigations including compressibility[1], X-ray[2] and neutron diffraction[3], Raman spectroscopy[4], as well as an important number of theoretical works predicting pressure induced polygonization or ovalisation, including or not sp^3 bonding between the tubes. In spite of these efforts, we are far from having a clear image of the exact nature of phase transitions taking place under pressure on carbon SWNT and of the shape changes associated. Motivated by these considerations, we take profit of the resonant selectivity of Raman spectroscopy to separately study the high pressure evolution of bundles of metallic and semiconducting carbon nanotubes of 1.3±0.2 nm in diameter, by working at two different excitation wavelengths. We perform Raman experiments on metallic (excitation wavelength 632.8 nm) and semiconducting (excitation wavelength 514.5 nm) single-wall carbon nanotubes up to 40 GPa[6] using Argon as pressure transmitting media. The effects of high pressure on Raman response of SWNT are discussed in the poster.

[1] S. Chesnokov, V. Nalimova, A. Rinzler, R. Smalley, and J. Fischer, *Phys. Rev. Lett.* 1999, *82*, 343.

[2] S. Sharma, S. Karmakar, S. Sikka, P. Teredesai, A. Sood, A. Govindaraj, and C. Rao, *Phys. Rev. B* 2000, *63*, 205417.

[3] S. Rols, I. N. Goncharenko, R. Almairac, J.-L. Sauvajol, and I. Mirebeau, *Phys. Rev. B* 2001, *64*, 153401.

[4] I. Loa, *J. Raman Spectroscopy*, 2003, *34*, 611.