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Vibrational and Electron Energy Spectrum of Double Wall Carbon Nanotubes ADITYA MOHITE, BRUCE ALPHENAAR, Dept. of Electrical and Computer Engineering, Univ. of Louisville, Louisville, KY, GAMINI SUMANASEKERA, Dept. of Physics, University of Louisville, Louisville, KY — Using Raman and photocurrent spectroscopy, we are able to distinguish between inner and outer tube features in both the vibrational and electron energy spectrums of double wall carbon nanotubes (DWNTs). DWNTs are synthesized using the "peapod" fabrication method. The inner hollow space of single wall nanotubes (SWNTs) is filled with C_{60} molecules by vapor phase reaction at 400^oC, creating nanotube peapods. Annealing the peapods at 1200^oC in high vacuum transforms the C_{60} molecules into the inner shell of the DWNT. Transmission electron microscopy measurements reveal that highly uniform DWNTs are formed with average outer and inner diameters of 1.4 nm and 0.9 nm, respectively. The Raman spectrum of the DWNTs contains a series of peaks not observed in the SWNTs or peapods. One of these peaks at 335 cm^{-1} can be attributed to the radial vibrational mode of the inner nanotube. The photocurrent spectrum of the DWNTs contains two extra peaks not observed in SWNTs. Based on the tube diameters, these are associated with the S11 and S22 transitions for the inner nanotube. *Supported by the NSF (ECS-0224114) and NASA (NCC5- 571).*

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