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Spectral Features of Carbon Nanotube Films Changeable With Increasing Thickness JOHN H. LEHMAN, The National Institute of Standards and Technology, KATALIN KAMARÁS, ÁRON PEKKER, Hungarian Academy of Sciences, KATHERINE E. HURST, The National Institute of Standards and Technology, D.B. TANNER, University of Florida — We have investigated an apparent contradiction with respect to optical spectroscopy of carbon nanotube films. The measured absorbance shows "inverted" features: local maxima for dilute suspensions correspond to local minima for thick films. The inversion is reconciled by taking into account the saturation of absorption in thick films, when all the light is absorbed in the sample. In this case, the measured direct absorption is (1-R), and independent of thickness. Kramers-Kronig analysis of transmittance data, which provides a means to model absorbance for material ranging from nearly transparent to almost completely opaque, provides values of refractive index for a film of nanotubes. (Borondics et al., PRB 74, 045431 (2006)). From these values, we determined (1-R- T) at many values of the film thickness. This calculation is corroborated with measurements based on the spectral responsivity of a pyroelectric detector and the absolute absorbance of the films. These results are consistent with data on nanotube suspensions by Zhang et. al. (J. Phys. Chem B, 108, 8136 (2004)), representing the limiting case of transparent samples, as well as films by Lehman et. al. (J. Phys. Chem. C, 112, 11776–11778 (2008)) representing the other limiting case of completely opaque samples.

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