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Dielectric function of carbon nanotube coatings on thermal detectors*

John Lehman
National Institute of Standards and Technology, Boulder, Colorado 80305
lehman@boulder.nist.gov

The absolute responsivity of a thermal detector depends on its absorption efficiency as a function of wavelength. We present experiments and document the results for carbon nanotube (CNT) based coatings for thermal detectors. The results indicate that the spectral absorption properties of bulk carbon single wall nanotubes (applied by airbrush) and carbon multiwall nanotubes (in situ) depend on the CNT type (metallic or semiconductor), topology and purity. Unlike conventional spectroscopic methods, our technique allows determination of optical properties from a specular absorptivity at normal incidence rather than a small diffuse reflectivity (< 5 %). The experimental results are correlated with the calculated theoretical coating spectral variation. The advantage of knowing specular absorptivity at normal incidence simplifies the derivation of the coating's dielectric function based on an effective medium approximation [1], however the process may be tedious to calculate on a case by case basis. In this work we present areas of opportunity to apply computational methods that may be correlated with experimental results thus reducing the time and expense required to identify CNT type.

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[1] **Lehman**, J. H., Engtrakul, C., Gennett, T., Dillon, A. C., "Single-wall carbon nanotube coating on a pyroelectric detector," Appl. Opt. **44**, 483-488 (2005).