Infrared transmittance of free-standing single-wall carbon nanotube films

K. Kamarás

Research Institute for Solid State Physics and Optics, Hungarian Academy of Sciences, P. O. Box 49, Budapest, Hungary, H 1525

M. Nikolou, Z. Chen, A.G. Rinzler, and D.B. Tanner

Department of Physics, University of Florida, Gainesville, FL 32611-8440, USA

The infrared transmittance of free-standing single-wall carbon nanotube films has been studied over 30–30,000 cm^{-1} (4 meV–4 eV) at temperatures between 20 and 300 K. The optical constants were calculated by Kramers-Kronig analysis of the transmittance. Results for the conductivity and the low energy spectral weights show that there is a significant fraction of metallic tubes, but also show evidence of a pseudogap around 10–15 meV. Conductivity peaks corresponding to transitions between density-of-states peaks of semiconducting as well as metallic tubes are seen in the near-IR–visible region. Their energy locations are consistent with electronic structure calculations for 1.4 nm diameter tubes

The far-IR data suggest a dc conductivity of around 500–1000 S/cm. The low-energy conductivity has an overall width of around 200 cm^{-1}. With decreasing temperature, the conductivity increases, but only by about 30% between 300 K and 20 K.

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