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Title

Terahertz characterization of single-walled carbon nanotube and graphene on-substrate thin films

Source

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Abstract

In this paper, single-walled carbon nanotube (SWNT) thin films with thicknesses on the order of hundreds nanometers on glass substrates and a graphene thin film (2-3 layers) on a glass substrate are characterized via terahertz time-domain spectroscopy. The substrate permittivity is first characterized. The thin film is then treated as a surface boundary condition between the substrate and air. Using the uniform field approximation, the surface conductivities of these films are extracted. To improve accuracy, precise thickness of the sample substrate is calculated through an iteration process in both dielectric constant extraction and surface conductivity extraction. Uncertainty analysis of the measured thin-film properties is performed. The SWNT results show consistent surface conductivities for samples on different substrates and with different film thicknesses. The measured graphene terahertz conductivity is comparable to the values reported in the literature at dc and optical frequency. This characterization method has been successfully applied as a means to evaluate metallic content of SWNT samples to verify a metallic SWNT removing process using high-power microwave irradiation. (26 References).