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Title:Terahertz surface plasmon polaritons on freestanding multi-walled carbon nanotube aerogel sheets

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Abstract:We demonstrate that multi-walled carbon nanotubes (MWCNTs) are capable of supporting surface plasmon-polaritons (SPPs) at terahertz (THz) frequencies. To achieve this, we fabricated sub-100 μm -thick freestanding and highly oriented multi-walled carbon nanotube (MWCNT) aerogel sheets. Utilizing terahertz time-domain spectroscopy, we measured the complex index of refraction of the sheets for two orthogonal nanotube orientations. We found that the MWCNT sheets exhibit highly anisotropic THz polarization behavior. Based on the extracted dielectric properties of the medium, which show that it exhibits metallic behavior in the THz spectral range, we investigated the existence and propagation of SPPs by studying the resonantly enhanced transmission through periodic MWCNT hole arrays. We found that carbon nanotubes support SPP excitations that propagate along the tubes, but highly suppress these surface waves in the direction perpendicular to the nanotubes. \copyright 2012 Optical Society of America.

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