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TITLE

Carbon nanotube composites for photovoltaic and bolometric applications

I.A. Levitsky
Emitech, Inc., USA

Single-wall carbon nanotubes (SWNTs) are very attractive for solar cell design because of its ability to absorb light in the near-IR (NIR) spectral range, which is not possible for most organic compounds. SWNTs also possess high carrier mobility, and may have performance (conduction and transmission) properties competitive with conventional transparent conductors (e.g. indium tin oxide). Photovoltaic devices based on SWNTs and n-silicon heterojunctions have been fabricated by a spray-deposition process. The nanotubes serve as an active photosensing material involving directly in the photon absorption process as well as contributing to charge separation, transport and collection. The novel nanocomposite concept should provide the highest light entrapping, charge separation, and high charge mobility, which could demonstrate superior photovoltaic properties exceeding 10% conversion efficiency with respect to other organic/hybrid photovoltaic materials.

Another topic discussed in this talk is anisotropic SWNT-polymer composite for bolometric application in the mid-IR spectral range (2.5-20μm). Composite alignment in conjunction with non-uniform distribution of SWNTs in the polymer matrix allows a significant enhancement of the temperature coefficient of resistance (0.82%) with respect to uniform composite (0.24%). As a result a responsivity of ~ 500 V/W is reached which is the highest among SWNT based bolometers reported so far. Such remarkable optical and thermal characteristics are explained in terms of fluctuation tunneling theory taking into account the composite anisotropy and the gradient of SWNT concentration. Flatness of the photoresponse in the broad spectral mid-IR range and enhanced responsivity provide a great potential for employment of such novel composite for various applications in IR spectroscopy and thermal imaging.

Biography

Dr. Levitsky has a Ph.D. in Physics (1989), from the Institute for Low Temperature Physics and Engineering, Kharkov, USSR, and an M.S. in Physical Optics in 1979 from, Kharkov State University, Ukraine. Dr. Levitsky worked as a postdoctoral associate at MIT and research scientist at Brown University. Since 2002 he serves as a principal scientist at Emitech, Inc being at the same time adjunct faculty of the Chemical Department of the University of Rhode Island. Levitsky's research interests are primarily focused on the study of chemical, physical and optoelectronic properties of nanomaterials which include carbon nanotubes (CNT), CNT-polymer composites, mesoporous silicon and organic-inorganic nanocomposites. Dr. Levitsky has more than 50 publications in peer reviewed journals and ten patents (three pending).