Method of vacuum deposition of carbon nanotube thin film nanocomposites

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Carbon nanotubes (CNT) nanocomposites are one of the most attractive near-term means to exploit the unique properties of carbon nanotubes. This is particularly true for composites aimed at electronics, electromagnetics and photonics, where a number of possible promising applications have already been demonstrated [1]. The main method for producing of CNT nanocomposite films is deposition from CNTs liquid-phase suspension. This technology limits the range of materials suitable for forming the composite matrix. We have demonstrated the possibility of vacuum sublimation (10-4 Pa) of few-wall CNT (FWNT) short fraction (100 ÷ 500 nm) with a diameter of 2 ÷ 10 nm, which makes it possible to obtain nanocomposite films by vacuum co-deposition of thermally sublimed FWNTs with thermally sublimed matrix composite material. Vacuum formation technology of nanocomposite films may be used as a template, except for organic matter, metals and metal oxides, which opens up new opportunities for their applications in electronics and electromagnetism. Studies using scanning and transmission electron microscopy in conjunction with Raman spectroscopy showed that the vacuum deposited FWNT thin films on substrate had been formed, consisting of individual FWNT and not fully ordered transition forms of carbon. The processes for obtaining the fraction of short FWNTs using chemical treatments, laser cutting and mechanical degradation as well as the relationship between macroparameters of vacuum sublimation process and the parameters of the FWNTs thin film will be discussed. The direction and criteria for the FWNT-cut and vacuum deposition process optimization to create on their basis thin film nanocomposites will be discussed.

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Ag Displacement Deposition on Porous Silicon for SERS Substrate Fabrication

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Displacement technique was applied to deposit Ag on porous silicon (PS) template that provided a metal film nanoroughness. Morphology and strycture of the obtained samples were studied with scanning electron microscopy. The Ag layer on the PS surface presented quasi-continuous film consisted of the particles of the 70-150 nm diameter. An average distance between such nanoparticles (NPs) varied in the range 100-200 nm and the gaps between them were filled with NPs of the 15-25 nm diameter almost touched each other. The connection of NPs should promote plasmon's coupling that cause the strong local field enhancement areas (so-called “hot spots”) emergence. The enhancement of Raman signal was estimated at 441,6 nm laser excitation from the intensity of the 1366 cm–1 line in the spectrum of water-soluble cationic copper porphyrin (CuTMPyP4) adsorbed on the Ag/PS substrates.The level of the signal was found strongly dependent on PS morphology, composition of the solution for metal deposition and regimes of the Ag films fabrication. The present research was funded under the followed projects: F11MC-019, T10M-089 and T11OB-057.

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