Fundamental and Applied NanoElectroMagnetics

FANEM'12

25th anniversary of the Research Institute for Nuclear Problems BSU

CONFERENCE PROCEEDINGS

May 22-25, 2012
Belarusian State University, Minsk, Belarus

Session «Perspectives of biomedical applications»

Surface enhanced spectroscopy in science and medicine

G. Dovbeshko
Institute of Physics of National Academy of Science of Ukraine, Ukraine

The enhancement of optical process by a factor 102..106 near rough surface of metal (Au, Ag, Cu, etc.) is known already for thirty years, for both optical transitions in adsorbed molecules (Raman scattering (RS) of light, luminescence, infra red (IR) absorption and the processes which do not depend on the presence of molecules on the metal surface (for example, second harmonics generation). The explanation of the effect is not simple and includes several mechanisms, such as: i) the increase of the electromagnetic field near rough metal surface or island metal films, ii) the increase of the dipole transition moment of the adsorbed molecules, etc. The energy is transferred from photon to local plasmon oscillations. The energy from plasmon vibrations is transferred to the adsorbed molecules, which causes increased molecular absorbance. The enhancement of infrared (IR) absorption by rough metallic surface is named as SEIRA (surface enhanced infra red absorption) and enhancement of RS is named as SERS (Surface enhanced Raman Scattering). Here we demonstrate and discussed different applications of SEIRA, SERS, enhanced fluorescent spectroscopy and imaging in nanotechnology, medicine, biology [1] as well new non-metallic substrates for it. We thank for financial assistance Project STCU 5525 (2012-2013), Ukrainian- German project № M366 (2011-2012). 1. G. Dovbeshko, O. Fesenko, O. Gnatyuk, Ya. Shtogun, L. Woods, S. Bertarione, A. Damin, D. Scarano, Adriano Zecchina, Nucleic acid interaction and interfaces with single-walled carbon nanotubes, "Carbon Nanotubes", 2010, Ed. By Jose Mauricio Marulanda, In-Tech., 2010. pp.697-719.

NOTES

Localized plasmon resonance in composite materials containing single-wall carbon nanotubes: theory and experiments

M. Shuba, A. Paddubskaya, A. Plushch, P. Kuzhir, G. Slepyan, S. Maksimenko, V. Ksenevich, P. Buka, D. Seliuta, I. Kasalynas, J. Macutkevic, G. Valusis, A. Lakhtakia
Research Institute for Nuclear Problems, Belarus

The origin of the broad THz conductivity peak (TCP) of thin single-wall carbon nanotube (SWNT) film is currently under debate. As was shown elsewhere [Slepyan, et al., Phys. Rev. B 81, 205423 (2010)], the main contribution to TCP formation at room temperature comes from the finite-length effect in SWNTs. We have now experimentally demonstrated the dependence of the TCP frequency on the SWNT length. A passive acid-cutting approach was developed to obtain SWNTs with different length distributions and weak sidewall degradation. Thin SWNTs films with different average SWNT lengths were prepared on silicon substrates. The far-infrared spectra of prepared samples demonstrate the TCP blue shift with decrease of SWNT length. The experimental results are well described by the theory of localized plasmon resonance in SWNTs.

NOTES