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Synthesis, Structural and Electrical Properties of SWCNT Thin Film Electrodes - First Results

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Due to growing demands for minituarization and small electronic devices, the production of novel composite material enhanced by the incorporation of nanomaterial fillers such as multiwall (MWCNT) and single-wall carbon nanotubes (SWCNT) is the subject of widespread research today. The investigations also shown that SWCNT explore better performance compared to MWCNT structures. One of the most promising aspects of SWCNTs applications, due their optical and electrical properties, are transparent conductive thin films or electrodes. The thin film electrodes were prepared on Pt substrates using very simple Layer-by-layer (LbL) technique, by alternate deposition of polyethileneimine (PEI) and carboxylic single walled nanotubes (SWCNT-COOH). This attractive technique allows deposition of polyelectrolytes with opposite charges using electrostatic interaction forming a multilayered films in nanometer range. In this work we present the results of preparation of the samples on Pt with 4 and 10 bilayers (PEI+SWCNT-COOH) using layer-by-layer technique.

Raman measurements of synthetized samples were performed using confocal DXR Raman Microscope with CCD camera as a detector. Excitation is provided by diode pumped solid state (DPSS) laser $\lambda = 532nm$. The obtained results enabled structural characterization and study of interface interactions. Due to the presence of sp2 carbon in the nanotubes structure two G bands were noticed in Raman spectra of both samples. Their shape and ratio gives information about semiconductor type of SWCNTs.

In order to get the insight into the fundamental charge transport through single nanostructures, the electrical properties of SWCNT were characterized using current-voltage and Hall effect measurements. The I-V characteristics of both samples are linear, thus exhibiting the ohmic behavior. The lower resistance of the sample with 10 layers is also noticed. The Hall effect measurements revealed the higher values of mobility, sheet resistance, sheet concentration and conductivity of the sample with higher number of layers.

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