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Microwave Plasma Polymerization of Polyaniline/MWCNT Composite Thin Films for Optoelectronic Applications

Ahmed S.Wasfi* andHadeelA.Ismail

Physics Dep., College of Science, University of Baghdad/Iraq.

Abstract: The nanocomposite films of polyaniline (PANI) and multi-walled carbon nanotubes (MWCNTs) were synthesized by in situ microwave plasma polymerization with a novel method that having coupled an atomizer head (automotive fuel injector) to inject the monomer and MWCNTs simultaneously in to the plasma reactor. The pristine MWCNTs were functionalized during its path to the substrate through plasma environment to obtain uniform dispersion within the PANI matrix. Scanning electron microscopy SEM, X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FT-IR) are employed to distinguish the pure PANI and the PANI-CNT nanocomposite. XRD and SEM reveal the homogeneous coating of PANI onto the CNT demonstrating that carbon nanotubes were well dispersed in polymer matrix. The overgrowth of CNTs particles by PANI governs all process and can easily be observed through the increasing films thicknesses with CNTs concentration. The interaction between the quinoid ring of PANI and the MWCNT causes PANI chains to be adsorbed at the surface of MWCNT, thus forming a hollow core surrounding the MWCNT was confirmed from FT-IR.

Nanocomposite film shows high electrical conductivity of 29.17 S/cm for film of 1.5 wt% MWCNTs compared to pure PANI film (10^{-8}) S/cm.The Incorporation of plasma functionalized CNTs into PANI matrix improved the transport properties of the nanocomposite.

Key words: Polyaniline composite, Carbon nanotubes, in situ plasma polymerization, Electrical conductivity.

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