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M. Mbarek, F. Abbassi, K. Alimi

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New polymer-matrix nanocomposites based on SWCNTs and PVK-PPV copolymer: synthesis, functionalization and characterization

M. Mbarek, F. Abbassi and K. Alimi*

Unité de Recherche : Matériaux nouveaux et Dispositifs Electroniques Organiques (UR 11ES55) Faculté des Sciences de Monastir, Université de Monastir-Tunisie.

***Corresponding author: E-mail: kamel.alimi@fsm.rnu.tn**

Abstract

An original nanocomposite material was prepared by in-situ grafting of a PVK-PPV copolymer onto SWCNTs. The new composites were elaborated with various SWCNTs weight concentrations into homemade PVK-PPV copolymer. Different experimental analyses were performed to investigate their morphological features and their optical and vibrational spectroscopy behaviours as a function of the concentration of carbon nanotubes. Π-staking and covalent interactions and functionalization process between copolymer and SWCNT undergo dramatic effect in vibrational and photoemissives properties of copolymer matrix. Transmission (TEM) and scanning electron microscopy (SEM) were used. Then, resonant Raman scattering and steady-state and time-resolved photoluminescence (PL) and (TRPL) measurements were used to study the evolution of the spectroscopic characteristics and optical properties of PVK-PPV/SWCNTs composites. As results, we have observed PL quenching effect and a decrease of average life time. These indicated the processing of a charge transfer that leads to exciton dissociations to the SWCNTs matrix. Such results, also supported by modelling based on DFT method, have given a strong evidence of the functionalization and the charge transfer between the SWCNTs and the PVK-PPV copolymer and predicted a structure-properties correlation.

Keywords: Copolymer; SWCNTs; Raman; PLRT; charge transfer.

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