OPTICAL PROPERTIES OF POLYVINYL CHLORIDE FILMS DOPED WITH MWCNT

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Due to the specific physical features of polyvinyl chloride (PVC), which include high-performance production, high stiffness, high chemical resistance and low cost of production, major applications in various fields have also emerged. For instance, cable electrical insulation, vehicles, medical, and packaging. Furthermore, the optical properties of PVC can be modified by addition of small amount of nanoparticles into the polymer matrix and can be used in optical fibers and other different optical applications. Recently, the big attention is paid to carbon nanotubes (CNT) due to their remarkable properties. They are widely used in various applications as individual material or as a filler in nanocomposite material. Polymer nanocomposites based on CNT are of great interest in several applications, such as energy storage, chemical sensors, electromagnetic interference shielding and electronics. The goal of this work is to study the impact of small amounts of CNT on the structure and optical properties of the PVC matrix.

Polyvinyl chloride (PVC) films loaded by different concentration of multi-walled carbon nanotubes (MWCNT) are prepared through a solution casting method. The change in polymer structure is investigated using X-ray diffraction (XRD) using a SHIMADZU diffractometer with Cu-K_α radiation (λ= 1.5418 Å). The morphology and the dispersion of the MWCNT in the polymer matrix were studied by a scanning electron microscope (model-JEOL, JAPAN)). The optical properties of the polymer films were analyzed using double beam Spectrometer model-Cary 5000 UV-Vis -NIR, Agilent Technologies-U.S., was used to investigate the optical properties (wavelength range 200 to 800 nm).

It is found that, the optical band gap decreases with increasing the MWCNT content in the PVC matrix. The refractive index, optical dielectric parameters, and optical conductivity of the polymer films are investigated using the optical absorption data. These parameters are enhanced with the increase in the MWCNT concentration in the PVC matrix. The nonlinear optical susceptibility $\chi^{(3)}$ and nonlinear refractive index n_2 are calculated using the Wemple–Di Domenico single oscillator model. The $\chi^{(3)}$ and n_2 values are enhanced with the increase of Ni nanoparticles concentration in polymer films. The prepared PVC-MWCNT films are more promising and extend their usability in different fields like; thermal solar collectors and nonlinear optical devices.