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Synthesis, optical, thermal, electric properties and impedance spectroscopy studies on P(VC-MMA) of optimized thickness and reinforced with MWCNTs

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Abstract:

The synthesis of polymeric blends and nanocomposites with improved physical properties has attracted increasing attention worldwide, for its practical and technological applications. The present study aims to tune the physical properties of thermoplastic polyvinyl chloride (PVC) and polymethyl methacrylate (PMMA) blends by adjusting the film thickness and loading with multiwall carbon nanotubes (MWCNTs). To this end, P(VC/MMA) films of thickness in the range 36.4–204 μm and P(VC/MMA)/MWCNTs films were prepared using solution casting. A scanning electron microscope (SEM) and Fourier transform infrared spectroscopy (FTIR) were used to investigate the films morphology and cross-sectional area and the vibrational properties, respectively. UV-vis measurements demonstrated that the transmittance spectra and absorption index were significantly affected by the film thickness and fillers content ratio. Moreover, both the direct and indirect optical bandgap increased with increasing thickness and decreased with increasing MWCNTs content inside P(VC/MMA) films. Further, thermogravimetric analysis (TGA) and differential scanning calorimetric (DSC) showed that the films exhibit thermal stability in the temperature range of 179–230 ^{o}C, and the melting temperature and degree of crystallinity increased with increasing thickness and decreased after doping with MWCNTs. The influences of film thickness and MWCNTs on the refractive index, dielectric constant, dielectric modulus, ac conductivity, impedance, and Nyquist plots have been discussed, along with the induced capacitance nature of the samples. Consequently, it was ascertained that the observed improvement in the optical properties and ac conductivity make these blends and nanocomposites suitable for optical devices and dielectric applications.

Adel M. El Sayed	**Designed the idea of the work, sample preparation, methodology, characterization, writing the original draft, reviewing and editing the final draft.**