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SYNTHESIS, CHARACTERIZATION, AND STUDY OF PHYSICAL PROPERTIES OF PVC / $BaTiO_3$ NANOCOMPOSITES.

By

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Abstract

An attempt has been made to study the effects of Barium Titanate ($BaTiO_3$) nanoparticles addition on physical properties of polyvinyl chloride (PVC). To improve these properties, $(BaTiO_3)_x(PVC)_{100-x}$ composite samples were prepared and investigated. The structural changes of the nanocomposite $(BaTiO_3)_x(PVC)_{100-x}$ were studied as a function of BT content using FTIR, XRD and DSC measurements.

It was found that the hindrance to the PVC crystallization becomes less and less serious with the increase of BT ratio in the composite. The FTIR spectra indicate a clear interaction between PVC and $BaTiO_3$ particles as is concluded from XRD results.

The Scherrer formula was used to estimate the grain size for the included BT in the $(BaTiO_3)_x(PVC)_{100-x}$ composite samples. The average particle size values obtained are ~50 nm. Also, the atomic force microscope was used to confirm the mean radius of BT particle and gave 24nm which agree well with XRD data. It was fond that the BT addition to PVC results in a decrease of the composite samples tetragonalities ($c/a < 1$). The DSC results reveal the increase of crystallization with the increase of BT content in the composite. The prepared samples were also, investigated by using scanning electron microscopy. SEM image showed that the nanocomposite films were homogenous. For dielectric properties the measurements were carried out using an RLC bridge in the frequency range from 80 kHz up to 4 MHz and temperature range 300 up to 428 K. The results showed that; the dielectric constant was decreased by adding BT nanoparticles to PVC. Based on the temperature dependence of M``; α -relaxation process in pure and doped-PVC films was observed. Both frequency dependence and temperature dependence of AC conductivity were also studied and indicated that charge carriers are transported by hopping through defect sites along the chains. For optical properties, the

absorbance A (λ) and transmittance T (λ) spectra of the films were measured at normal incidence in the spectral range of (200-800) nm.

The effect of doping on absorbance and transmittance, direct optical energy band gap, and optical constants (refractive index, extinction coefficient, dielectric constants, and optical conductivity) were also investigated. The direct optical energy band gap was decreased with increasing BT content. The refractive index was increased significantly. There was an agreement between the dielectric and optical measurements.