Physical Properties of the Organic Polymeric Blend (PVA/PAM) Modified with MgO Nanofillers

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Abstract

Magnesium oxide/Polyvinyl alcohol/Polyacrylamide (MgO/PVA/PAM) nanocomposite films were prepared via a solution chemical method. The effect of PVA and MgO nanoparticles (NPs) loading on the physical properties of PAM is discussed. XRD reveals that the average MgO crystallite size in the NPs is ~ 25 nm while adding PVA increases PAM crystallinity. FTIR spectra confirm the interaction between blend chains and MgO NPs. DSC thermograms illustrate the miscibility between the PVA and PAM. The melting temperature, the glass transition, as well as the equilibrium swelling ratio, are depending on the films' composition. PAM showed a transmittance of 87%, increased to 90% after PVA addition, but decreased to 74% after MgO loading. Meaningful changes are observed in the extinction coefficient and indirect/direct band gap of PAM due to PVA blending and MgO addition. The influence of MgO NPs on the dielectric constant (ε') of the blend film is reported. The maximum value of AC conductivity of the blend is 4.77 x 10^{-3} Sm^{-1}, increased to 8.07 x 10^{-3} Sm^{-1} with increasing the MgO loading to 5.0 *wt.%*. The conduction mechanism changed from the correlated barrier hopping, in the blend, to the large Polaron tunneling with MgO loading. The observed improvements in optical properties and AC conductivity encourage the use of these nanocomposite films in the semiconductors industry.

Keywords: Nanocomposite; MgO nanoparticles; Band gap; PVA/PAM; Dielectrics.