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ORIGINAL PAPER

Dispersion parameters of cadmium chloride doped PVA-PVP blend films

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Abstract Solution cast films of poly vinylalcohol (PVA) – poly vinylpyrrolidone (PVP) polymer blend, doped with different concentrations (from 0.5 wt% up to 40 wt%) of cadmium chloride ($CdCl_2$) have been studied by analysing the data recorded using optical (UV-Vis) spectrometry. The modified band structure of PVA -PVP blends doped with $CdCl_2$ has been studied using Moss model and Wemple - DiDomenco model. Optical parameters such as transmittance (T), reflectance (R), refractive index (n), average oscillator energy (E_0), oscillator dispersion energy (E_d), real and imaginary part of dielectric constant (ε_r and ε_i) have been determined. The ratio of charge carrier concentration to effective mass (N/m^*), plasma frequency (ω_p), average oscillator wavelength (λ_o), oscillator strength (S_o), optical conductivity (σ) and optical momenta of spectra (M_{-1} and M_{-3}) have been estimated for the PVA-PVP blend films doped with $CdCl_2$.

Keywords Dielectric constant · Optical parameters · $CdCl_2$ · PVA-PVP blend · Moss model · Wemple and DiDomenco model

Introduction

Solid polymeric electrolytes (SPEs) are attracting the attention of researchers due to their potential applications in manufacture of batteries, super capacitors, gas sensors, display devices and fuel cells [1, 2]. Optical characterisation is important for applications in various fields [3]. To characterise the electrical and optical properties of the sample, UV-Visible (optical) spectrometry is a basic tool. After optical characterisation, these polymeric materials can be used in designing electronic and optoelectronic devices, which are gaining attention of researchers because of their implementation in switching, modulation and optical waveguide structures [4].

For the last several years, poly vinylalcohol (PVA) has gained the special attention of researchers due to its semi-crystalline nature, biodegradability, good solubility in water, biological/medical applications and easy film formation. To modify its optical, electrical and mechanical properties, researchers are essentially working on the doping of inorganic salts in PVA. Thus, PVA doped with iodine/potassium iodide, titanium chloride, barium chloride, cuprous sulphate, thorium nitrate, cadmium chloride and magnesium chloride have been studied extensively [5–11]. The hydroxyl (OH) group in PVA interacts with the ions of the dopant; it is actively involved in the formation of cross-links and charge transfer complexes in the polymer matrix. Poly vinylpyrrolidone (PVP) is an amorphous material which is hygroscopic in nature, has moderate electrical properties and easy processability. Interactions of PVP takes place via carbonyl (C = O) group. Many researchers have rigorously studied PVP by incorporating different additives like potassium bromide, lithium perchlorate, potassium perchlorate [12–15] and other inorganic salts. After studying the morphology and optical properties of PVA and PVP doped with inorganic salts, the information obtained is useful for fabrication of devices like super capacitors and sensors. PVA and PVP have also been studied after incorporation of gold and silver nano-particles [16, 17]. Since PVA and PVP are water soluble and have ability to crosslink, they form a compatible blend. Several research groups have studied the properties of PVA-PVP blend after doping the polymeric

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