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Structural, Opto-Physical, Photoluminescence, and Optical Limiting Properties of Polyvinyl (Pyrrolidone and Alcohol) Blend Film Doped with Co-Metal

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The optical properties of polyvinyl (pyrrolidine and alcohol) and PV(P/A) blend polymer have been improved using Co-metal as a filler for optoelectronic and optical shielding applications. The casting technique of solutions was used in order to prepare composite films with different Co-ratios (x: 0−18.5). XRD, FT-IR, SEM, and UV−visible spectrophotometry were operated to study the structure, morphology, and optical features of the flexible plain blend and composite films. The semi-crystalline nature of the films was influenced by the filler ratio of nanoparticles. Homogenous dispersion with some agglomeration of Co-particles has been observed in the host blend matrix. Then again, a successful interaction between the host matrix and particles was ensured by the FT-IR spectroscopic and XRD measurements. The cut-off absorbance edge of composite films is red-shifted from 200 nm (host blend) to 228 nm. The indirect transition optical band gap was confirmed from the Tauc's and optical dielectric loss calculations. Its value goes back from 5.15 eV (plain blend) to 4.43 eV for 18.5 wt% Co-blend composite film. An improvement in the extinction coefficient, optical conductivity, and refractive index of the composite films was achieved compared with the plain blend. The non-linear parameters of the composites were also enhanced. Photoluminescence (PL) emission spectra of PV(P/A) blend films doped with various weight percentages of Co-metal were examined at a wavelength of 750 nm. The optical shielding performance of the prepared composites is recommended for laser cut-off. Furthermore, the ability to tailor the optical properties of blend film makes it more effective for various applications including optical devices, non-linear optoelectronics, and reflective coating.

Keywords: extinction coefficient, PV(P/A) polymer blend, transition band gap, photoluminescence, NL optical parameters, optical shielding.