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Structural and Optical Properties of Flexible Polymer Nanocomposites Films for Optoelectronics Applications

In this study, we address the the effects of low energy hydrogen ion beam irradiation on the optical characteristics of polymeric nanocomposite films for used in optoelectronics devices. The composite films are irradiated using broad beam cold cathode ion source with hydrogen ion energy ranging from 1 to 6 keV. The techniques of X-ray diffraction, Fourier transform infrared spectrum, as well as scanning electron microscopy are all used to investigate the untreated and irradiated films and determine their properties. Both the optical energy band tails and the optical energy bandgap of untreated as well as modified films were determined. The FTIR peaks are indicative of inorganic nanoparticles bound to the polymer chains, and XRD validated the successful synthesis of the polymeric composite films. Scanning electron microscopy (SEM) pictures have shown that the nanofiller is loaded and distributed uniformly throughout the polymeric layer. Moreover, the refractive index, extinction coefficients, and dispersion properties were also established for the pure and treated films. On the other hand, the ion penetration depths, the electronic stooping, nuclear energy loss and distributions of scattered atoms are recorded using SRIM Monte Carlo simulation programs. In light of these findings, the irradiated flexible composite films with low energy hydrogen ion beam can be used in a variety of fields, including those dealing with batteries, super-capacitors, detectors, as well as optoelectronics.

Keywords: Polymer nanocomposite, Ion irradiation, surface characterization, Optical properties, Optoelectronics Applications.

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