Photophysical and Electronic Properties of Congo Red Dye Embedded in Polyvinyl Alcohol as an Efficient Laser Optical Limiter: Enhancement the Electrical Conductivity and Dielectric Properties

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Abstract

High-quality polymeric composite films containing Congo red dye and PVA were prepared using the casting technique. The proposed Cr-doped PVA composites were examined using XRD, UV–visible optical, dielectric, and optical limiting effect techniques. The XRD patterns of CR-doped PVA composite films display diffraction peaks, which belong to CR organic dye. There was a broadening and reduction of the initial peak intensity in polymer composite films at higher doping concentrations. The band edge of CR: PVA composites reduced with a massive shift from 4.63 eV to 1.86 e, were Congo red controls the energy bandgap of the PVA polymer. Dielectric permittivity diminishes with increasing the frequency and achieves constant values at higher frequencies through the relation between the electric dipole and the electric field differences. Increasing the percentage ratio of the CR doping enhances the electrical conductivity and dielectric permittivities due to the large size of the CR molecules. The strong optical limiting of the CR-doped PVA composites is determined using different laser sources of 632.8 and 532 nm wavelengths. The amazing obtained results imply that CR: PVA composite films are very significant for applying large-scale CUT-OFF laser filters for medical optical and electronic device systems.

Full Text

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