Abstract

Organic/inorganic nanoparticles have received great interest in linear and nonlinear optical properties because of their promising applications in the field of optical switches, solar cells and optical limiter devices. In this work, nanocomposite samples composed of an inorganic and organic nanomaterial were prepared by the casting method. Samples of the epoxy resin polymer with zinc oxide nanoparticles were prepared in different concentrations ($1*10^{-5}$, $5*10^{-5}$, $1*10^{-4}$ and $5*10^{-4}$) mol/L. ZnO nanoparticles properties (polycrystalline nature, high purity, particle size and morphology) have been identified by using wide range of techniques; XRD, XRF, FTIR, AFM, and SEM respectively. The UV-Vis absorption spectrum shows that optical absorption peak located at 377nm for ZnO-NPs. Nonlinear optical properties such as nonlinear absorption coefficient and nonlinear refractive index of the prepared samples were measured by using two techniques; diffraction pattern rings scan and single-beam Z-scan. The second harmonic generation Nd-YAG laser with 532 nm was used for two techniques. Nanocomposite samples, in close aperture z-scan data, show positive nonlinear refractive index, self-focusing behavior and the nonlinear refractive index (n_2) was in the order of 10^{-9} cm^2/W. An open aperture z-scan data demonstrated that the nonlinear absorption coefficient is a saturable absorption and the nonlinear absorption coefficient (β) was in the order of 10^{-3} cm/W. The D-scan technique was used to calculate the nonlinear refractive index, and the results showed that the number of rings increases with the increasing of laser power and the concentration of zinc oxide nanoparticles. Also, the real part, imaginary and the absolute value of the third-order nonlinear optical susceptibility $\chi^{(3)}$ were calculated. The $\chi^{(3)}$ was in the order of 10^{-10} V^2/m^2. Finally, the optical limiting property of the nanocomposite samples was studied, and the results gave us a good indication that these samples can be considered as an excellent candidate for optical limiter devices.