**Using Z-scan technique to measure the nonlinear optical properties of PMMA/ZnO nanocomposites**


ABSTRACT

The study of nonlinear optical properties of polymer nanocomposites has been given increasing attention due its application in laser, communication and data storage technology. There is a need to enhance the understanding of all photonics technologies. In the current work, PMMA-ZnO nanocomposites as foils and as thin films have been successfully prepared. Casting method and spin coating were used to prepare them respectively. Nanocomposites were prepared by mixing ZnO nanoparticles with polymethyl methacrylate (PMMA) as the polymer matrix. Different contents of ZnO nanoparticles were used as the filler in the nanocomposites. The absorbance spectra of the samples were obtained. The linear absorption coefficient was calculated. The nonlinear refractive index and nonlinear absorption coefficient were investigated using a single beam Z-scan technique. A Q-switched Nd-YAG pulsed laser (532 nm, 7 ns, 5 Hz) was used as a light source. Both thin filmôs and foilôs samples showed peak absorption at 375 nm and increasing absorption with ZnO nanoparticles concentration. The nonlinear refractive index was in the order of 10-11 cm2/W for thin film samples and 10-12 cm2 /W for foilôs samples with a negative sign. In contrast, the nonlinear absorption coefficient is in the order of 10-6 cm/W and 10-7 cm /W for thin film and foil respectively. The figures of merit W and T were calculated in order to evaluate the suitability of the samples as optical switching device .However; they unsatisfied the requirements of optical switching devices but they can be considered as an excellent candidate for optical limiting.



**Keyword:** Nanocomposite; Nonlinear absorption coefficient; Nonlinear refractive index; PMMA/ ZnO