Abstract

In this thesis, the research was divided into two sections. The first section includes the synthesis of TiO_2–PMMA nanocomposites films by using solution casting method and then studying the effect of (1, 2, 3)wt% of titania concentration with thicknesses of (125, 195, 290, and 420) μm on the linear optical properties , nonlinear optical properties, and optical limiting properties of the nanocomposites. The second section includes the addition of ZnO nanoparticles at different concentrations (0.2, 0.3, and 0.4) wt% to the TiO_2–PMMA nanocomposite and studying its effect on the linear , nonlinear optical properties, and optical limiting properties of the material.

The optical properties of TiO_2- PMMA nanocomposites films showed shifting of the absorption edges towards longer wavelength and decreasing in band gap energy as the TiO_2 concentration increased, the addition of ZnO nanoparticles caused the band gap energy to decrease from its bulk value.

The nonlinear optical properties of TiO_2- PMMA nanocomposites samples revealed the dependency of optical nonlinearity on TiO_2 concentration, the degree of crystallinity of the samples, and the sample thicknesses where β reaches its maximum value of (β=7.43×10^{-6} cm/W) when the TiO_2 concentration was 2wt% and sample thickness was125μm.

The addition of ZnO nanoparticles shows enhancement in the nonlinear optical behavior of these samples and increasing in the optical nonlinearity as the ZnO nanoparticles concentration increased. The results also show decreasing in optical nonlinearity as the sample thicknesses increased.

The optical limiting threshold of the nanocomposites was found to depend on the nonlinear absorption coefficient, where the minimum power threshold (10 mW) was obtained at the highest value of nonlinear absorption coefficient (β=1.24×10^{-5} cm/W).