

Preparation, characterization, and study of the nonlinear optical properties of a new prepared nanoparticles copolymer

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The nonlinear optical properties of a nanoparticle polyaniline/polyacrylonitrile (PAN/PANr) copolymer newly prepared via experimental and theoretical findings are reported. Diffraction ring patterns result in the far field when a CW, visible, 473 nm, low power laser beam traverses the solution of PAN/PANr in the solvent ethanol. The diffraction ring patterns are usually used to estimate the nonlinear refractive index while the Z-scan is used to measure both nonlinear refractive index and its sign and nonlinear absorption coefficient. The experimentally observed ring patterns are numerically reproduced via the use of the Fresnel-Kirchhoff procedure. Good agreement between experimental findings and the numerical ones are obtained. The obtained diffraction ring patterns suffer modification in the vertical direction due to convection current as a result of local heating of the sample and the presence of gravity.

Keywords: Nanoparticles; copolymer; self-phase modulation; nonlinear refractive index; diffraction ring pattern; Z-scan technique.

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1. Introduction

Nonlinear optical materials are essential for various applications, viz., optical limiting, optical computing, optical communications, optical switching, modulation, data storage and phase conjugation.¹⁻¹² The refractive indexes of such materials are function of the input intensity, such as focusing¹³ or defocusing.¹⁴ The nonlinear refractive index is an important parameter in the design of optical devices.

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