Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Archives of Applied Science Research, 2012, 4 (6):2499-2506
(http://scholarsresearchlibrary.com/archive.html)

ISSN 0975-508X
CODEN (USA) AASRC9

Nonlinear Optical Properties and Diffraction Ring Patterns of Acid black 1

Ketamm Abd AL-Adel and Hussain A. Badran

Department of Physics, College of Education, University of Basrah, Basrah, Iraq

---

ABSTRACT

The nonlinear optical properties of Acid black 1 in Chloroform solvent and polymer were studied using single beam Z-scan technique with a continuous-wave radiation at 635 nm of an output power of 40 mW. All the solution samples and polymer showed large nonlinear refractive indexice and absorption coefficient of the order of 10^{-7} cm^2/W and 10^{-3} cm/W, respectively. The concentration-dependent nonlinear refractive index was also investigated. We presents experimental evidences of observing diffraction pattern in Acid black1: chloroform solvent with the calculation of the refractive index change, Δn , the relative phase shift, $\Delta\Phi$, and effective nonlinear refractive index ,n_2. The solvent of spectroscopic grade and was used without further purification. All the solutions used for the study were freshly prepared.

Keywords*:* nonlinear refraction index , Z-scan, Acid black 1, cw laser.

INTRODUCTION

A very convenient and fast experimental method to determine the third-order nonlinear optical properties (NLO) of materials is the Z-scan experiment [1–4]. Z-Scan experiment, based on the beam-distortion effect in a nonlinear sample, is a technique for measuring both the value of n_2, the third-order nonlinear refractive index and the value of β, the effective nonlinear absorption coefficient [5,6]. In this method a single focused beam is used to illuminate the sample. The transmittance through an aperture placed some distance from the focal plane of the beam is monitored as the sample is scanned along the optic axis. This is called closed-aperture experiment. From this measurement both the sign and magnitude of n_2 can be determined. For materials with a negative n_2 (self-defocusing), the profile of the Z-scan transmittance curve consists of a peak followed by a valley as the sample is translated from –Z to +Z. For positive n_2 materials (self-focusing) the profile is reversed with a valley–peak sequence. In cases in which the material has a nonlinear absorption, the aperture of the Z-scan setup is removed. This is called open-aperture experiment. While the effective nonlinear absorption coefficient can be determined from the open-aperture experiment, the effective nonlinear refraction coefficient can be determined from closed/open-aperture curves for nonlinear absorptive materials [6].

In this work, we study the optical nonlinearities of a Acid black 1 at different concentration in Chloroform and thin film through Z-scan technique under laser excitation at 635 nm cw solid state laser with an output power of 40 mW and presents experimental evidences of observing diffraction pattern in Acid black 1: chloroform solvent with the