Journal of Education for Pure Science- University of Thi-Qar
Vol.9, No.2 (June, 2019)
Website: jceps.utq.edu.iq Email: jceps@eps.utq.edu.iq

DOI: http://doi.org/10.32792/utq.jceps.09.02.24

Diffraction Ring Patterns And Z-Scan Measurements Of The Nonlinear Refraction Index Of 5W20 Oil

H. Bakr[1], Qusay M. A. Hassan[2], H. A. Sultan[3], C. A. Emshary[4]

[1,2,3,4] College of Education for Pure Sciences, University of Basrah, Basrah, Iraq.

Received 12/03/2018, Accepted 10/05/2018, Published 02/06/2019

Abstract:
Nonlinear properties of 5W20 oil have been investigated using the diffraction ring pattern and Z-scan techniques. The nonlinear refractive index was measured by the use of a solid state laser in the CW regime at wavelength 473 nm. Experimental results show that such a sample has a large, negative, nonlinear refractive index ($n_2 = 4.22 \times 10^{-7}$ cm^2/W). The optical power limiting performances for 5W20 oil have been investigated. These results proved that 5W20 oil has significant nonlinear properties and it could be used for photonic and nonlinear optical devices.

***Keywords*:** Self-phase modulation, Diffraction ring pattern, Z-scan technique.

1. Introduction

The race for obtaining new materials with fast response time and large nonlinear refractive index is an ongoing matter for the last thirty years [1-6]. These materials have been extensively used in all optical applications such as high density optical data storage, optical phase conjugation, all optical switches and optical limiting devices [7-10]. Vegetable oils are the new comer to be used for the same proposes owe to the new work of Sultan et al. [11] and Hassan et al. [12]. Very little attention have been paid to oils [13,14]. These oils shows large nonlinear refractive index in the visible region viz. oils in the 660 nm wavelength [13] and SAE 70 oil in the 473 nm wavelength. In this work the results of two experiments on 5W20 oil viz. diffraction ring and Z-scan is presented to estimate its nonlinear refractive index. The experiments were performed using a continuous wave (CW) solid state laser (SDL) emitting light at wavelength of 473 nm.

2. Experimental

2.1 sample and uv-visible spectroscopic results

The absorption property of the 5W20 oil used in the experiment which was characterized at room temperature in the (350-900) nm range using a double UV-visible spectrophotometer type 6800 Jeneway, England. The absorbance (A) of 5W20 oil in a glass cell, 1 mm thick against wavelength is shown in Fig.(1). The absorption coefficient ,α, is calculated using Fig.(1) and the relation [15]