



Available online at: www.basra-science-journal.org



ISSN -1817 -2695

Experimental and Theoretical Study of the Laser Induced Diffraction Pattern in the Acid Orange 10 Dye: Polyacrylamide Gel

Hassan A. Sultan, Hussain A. Badran ,Alaa, Y. Al-Ahmad* and Chassib A. Emshary

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

* Corresponding author

e-mail: alaa_ta2005@yahoo.com, Phone: +00 9647703291910

Received 19-11-2012 , Accepted 29-4-2013

Abstract:

We observed and studied diffraction rings generated in an Acid Orange 10 dye doped Polyacrylamide gel (AO10: PAA gel) using cw visible laser beam. The number of rings increases almost exponentially with increasing input power and concentration of the samples. The refractive index change, Δn , effective nonlinear refractive index, n_2 , variation of thermo-optic coefficient, dn/dT , figure of merit, W , and thermal figure of merit, H , are found to be 0.004788, $10^{-5} \text{ cm}^2/\text{Watt}$, $1.01 \times 10^{-4} \text{ 1}^\circ\text{C}$, 13.7 and 0.45×10^{-4} respectively. The effective nonlinear refractive index, n_2 , was determined based on the observed number of rings. This large nonlinearity is attributed to a thermal effect. Theoretical diffraction patterns that agree well with experimental one are generated using a wave theory.

Keywords: Nonlinearity; Thermal effect; Wave theory.

1. Introduction

Self-induced index changes in optical media have been investigated extensively in the past in connection with Q-switching and mode locking of lasers and self-focusing or defocusing of laser beams. The mechanisms behind self-induced changes fall into two categories. In the first category, there are several non-resonant mechanisms which have been studied quite extensively in the past in connection with

self-focusing. In the second category, we have near-resonant effects, the most important of which is associated with the saturation of a more-or-less homogeneously broadened absorption line [1]. A Fréedericksz transition caused by the electric field of wave was first observed by Zolot'ko and colleagues [1]. He and his colleagues published series of articles concerning the appearance of aberration