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Characterizing optical and morphological properties of Eriochrome Black T doped polyvinyl alcohol film

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Abstract

Eriochrome Black T doped polyvinyl alcohol film was prepared on a glass substrate via the casting method. Optical microscope image of the film was taken by an optical microscope and analyzed by an Image J and origin 2008 software where it was proved that the film was free of defects and holes and uniformly distributed over entire area of the substrate. The optical constants of the film were calculated via the optical absorbance and transmittance in the wavelength range 350–900 nm via the use of a set of known mathematical formulas together with Wemple and DiDomenico model. The optical conductivity and the electrical conductivity of the prepared film in response to external electric filed are obtained using two more equations where it was found that the prepared film have high optical conductivity of the order of 10^{12} s^{-1} and an electrical conductivity of the order of 10^{4} (S cm^{-1}).

Keywords: Eriochrome Black T, surface morphology, optical constants, nonlinear refractive index

(Some figures may appear in colour only in the online journal)

1. Introduction

There has been a continuous interest and search for the development of new nonlinear optical (NLO) materials for the use in optical devices, viz., photonic integrated circuitry [1], optical limiting [2–10], optical phase conjugation [11], all optical switching [12, 13], optical data storage [14–17] etc. NLO organic materials are superior compare to other inorganic materials from the point of view of synthesisation, fast optical nonlinear response, architectural flexibility and crystal fabrication.

Any material thought to be used in the upper mentioned applications many parameters such as the nonlinear optical third-order susceptibility, $\chi^{(3)}$, and the nonlinear index of is considered the best because its requirements are simple compared to other methods that require difficult requirements [21, 22], its results are very accurate and it has the ability to calculate the real and imaginary parts of the nonlinear optical third-order susceptibility separately. This technique has been used during the last three decades by many researchers to calculate the n_2 and $\chi^{(3)}$ of vast number of materials [23–33]. In the indirect measurements the use of the results of the absorption and transmission spectra of the material and theoretical formulas for calculating the nonlinear optical third-order susceptibility and nonlinear index of refraction, also this method was used by researchers in recent years [34–43].

We hope, through the current study, to complete our