American Journal of Applied Sciences 9 (2): 250-253, 2012
ISSN 1546-9239

Study on Optical Constants and Refractive Index Dispersion of Neutral red Doped Polymer Film

Hussain A. Badran
Department of Physics, College of Education, University of Basrah, Basrah, Iraq

Abstract: Problem statement: The some optical constants polymer thin film with red dye 3-amino-7-dimethylamino-2-methyl phenazine (NR) as the guest material and Polyvinylpyrrolidone (PVP) as the host material were prepared by adulteration and spin-coating methods. **Approach:** The values of some important parameters (refractive index n, extinction coefficient K and dielectric constant ε_∞) of polymer thin film are determined from these spectra. **Results:** It has been found that the dispersion data obey the single oscillator relation of the Wemple-DiDomenico model, from which the dispersion parameters and high-frequency dielectric constant were determined. The estimation of the E_0, E_d and ε_∞ are 1.27, 3.175 and 3.5 eV respectively. **Conclusion:** The single oscillator model was used to calculate their optical constants from the transmittance and reflectance spectra. The dispersion of the refractive index in film follow the single electronic oscillator mode relation. The UV-Visible spectroscopic studies showed that, the NR film have high refractive index and high dielectric constant. The variation of the dielectric constant with the wavelength indicates that some interactions between photon and electrons in the films are produced in this wavelength range. These interactions are observed on the shapes of the real and imaginary parts of the dielectric constant and they cause the formation of peaks in the dielectric spectra which depends on the material type.

Key words: Optical properties, Thin film, azo dye, Polyvinylpyrrolidone (PVP), Neutral Red (NR), phenazine doped, extinction coefficient, dielectric constant, polymer thin film, dispersion parameters

INTRODUCTION

The process of thin film deposition involves the deposition of material atom-by-atom, molecule-by-molecule, ion-by-ion or cluster of species by cluster of species condensation (Preoneanu *et al*., 1995; Koksbang *et al*., 1994). This methodology is applied extensively in the manufacture of photocells and is being used in optical coating, microelectronics, surface science engineering and other technologies (Krunks and Mellikov, 1995; Susilawati and Doyan, 2009; Supa'at *et al*., 2008).

The investigation of the optical constants such as refractive index, extinction coefficient and dielectric constant of the 3- amino-7-dimethylamino-2-methyl phenazine doped polymer film are important for designing of new materials. Optical constants include the valuable information for technological applications. Furthermore, the changes in refractive index are important for controlling optical properties of thin polymer. Optical properties of any organic thin films are important for optical applications, because optical properties are directly related to their structural and electronic properties. The main aim of this study is to investigate the optical properties of polymer thin film with 3- amino-7-dimethylamino-2-methyl phenazine using the optical spectra.

MATERIALS AND METHODS

The molecular structure of 3- amino-7-dimethylamino-2-methyl phenazine (Neutral Red) is shown in Fig. l. In our experiment, the host material is Polyvinylpyrrolidone (PVP) and the ratio of Neutral Red in PVP by weight is 0.6%. The NR-doped PVP films were prepared as follows: Neutral Red and PVP are dissolved separately in distilled water and then the solution of Neutral Red (NR) and that of PVP are mixed, heated (up to 50°C) and stirred for 2 h; thus the mixed sols of NR and PVP were obtained. After the sols were filtrated, the films were prepared on a clean glass slide by the repeat-spin-coating method and dried at room temperature for 48 h. The thickness of the film is about 0.7 μm and the film samples have good purity and uniform thickens.

The absorption spectrum of the film sample is shown in Fig. 2, where the peak of absorption is located at 533 nm. In addition, our experimental results show that 3- amino-7-dimethylamino-2-methyl phenazine doped. Polymers have a stronger photo-induced birefringence effect (El-Nahass *et al*., 2010).