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RESEARCH

Electrical, Thermal Lens and Optical Study of Fluorescein Film for Application As Organic Photovoltaic Devices

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Abstract

This article is devoted to the study of various dielectric and optoelectrical parameters nonlinear optic behaviors, thermal lens and self-diffraction parameters of Fluorescein (FLs) doped polymethyl methacrylate (PMMA) films. The films were prepared with 60 mM. These studies are based on the calculated values of refractive, absorption coefficient, energy gap, extinction coefficient and nonlinear Refraction index (n_2). The polymer films were prepared using the casting technique. All samples were previously investigated by UV–Vis–NIR spectrophotometric measurements and Optical microscopy SEM and ATM. Utilizing thermal lens spectrometry, an investigation of the thermo-optical characteristics as well as the nonlinear refractive index was carried out. In this method, a pump beam and a probe beam were brought into collinear alignment with one another. To determination the nonlinear Refraction index (n_2). High values of nonlinear refractive index predict a bright future for materials in optical applications. These results indicate that the new dye is a promising candidate for applications in nonlinear optical devices. Investigations were carried out on organic photovoltaic devices in addition to devices consisting of active layers with conducting polymer of PHPP:P3HT film and PHPP:P3HT/Fls. The methods of polymer and dyes synthesis are presented and their physical properties are given.

Keyword Polymer films · Active layers · Laser · Thermal lens · Solar sell

Introduction

In recent years, scientists have used a variety of dyes and their derivatives in colorimetric detection of dangerous chemicals. This technique has shown to be quite successful [1]. Xanthine dyes (Xan) (dibenzo + pyrans) are tricyclic molecules connected to each other, containing two benzene rings in the middle of which is a heterogeneous central ring of pyran. Xan don't have a permanent dipole moment parallel to the length of the axis of the molecule in the stable and excited state, and it has a transmission moment for most absorption bands that lies between (450–600) nm, it belongs to a class of fluorescent dyes. Xan show high stability under the influence of visible and ultraviolet rays, and they are generally efficient. Most dye lasers use solutions belonging to one of the dyes of Xan family [1, 2]. They have exceptional properties as brilliant photoluminescence, high absorption capacity, exceptional photosensitivity and little toxicity in vivo, so Xan are pioneers as optical materials and as organic materials for medical diagnostic studies. FLs dye is one of the most famous Xan, FLs appears as a dark red–orange powder, soluble in water and alcohol [3–5], with a density of 1.602, and a molecular weight of 332.311gm.mol^{-1} [6–9]. Since FLs discovery in the last century, it was played an effective role in many scientific, military, industrial and medical applications due to its inertness, high brilliance, light weight, Commercial availability and low cost, ease of formation and preparation of devices at the microscopic level, its high absorption and ease of handling. FLs was still used as a probe in medical detection analytics and optical imaging applications [10–13], and the wonderful optical properties of FLs was exploited to apply it as a light-emitting diode [14]. The antibacterial activity of FLs is greatly enhanced by light [15–18]. The fluorescence produced by FLs has a poor quantum yield due to its absorption in the visible range. The polarity of an environment has a significant impact on the emission qualities of an

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