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Effect Orange G of Optical properties OF P3HT

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Abstract

In this papers , we studies measure the optical properties of the P3HT Poly(3-Hioxyl Thiophene) pure and doping with dyes Orange G (O.G) (1% -5%) and using casting method .The optical properties were characterized by 300 – 900 nm wavelength range measurement. The optical characteristics indicate that the P3HT doped with (Orange G) increases absorbance, decrease band gap and high n values where as the P3HT doped with (Orange G) in doping 5% (O.G),. The energy band-gap of P3HT was found to be 1.9 eV.

Key Word, P3HT,Orang G (O.G), the Optical properties,casting mothod .

INTRODUCTION

Semiconducting polymers have attracted much interest for potential applications in organic opto-electronic devices such as organic field-effect transistors (OFET), organic light-emitting diodes (OLED), and organic photovoltaic's (OPV). Regioregular poly(3-hexylthiophene) (RR-P3HT) has been widely studied, as reports of high field-effect mobilities1 show promise for such devices. Field-effect hole mobilities2 as high as 0.2 cm2/Vs, approaching the mobility of amorphous silicon, have been reported. The small bandgap3–6 (1.9 eV/653 nm) and corresponding absorption overlaps well with the strongest spectral[1,2] . Optical properties of a material change or affect the characteristics of light passing through it by modifying its propagation vector or intensity. Two of the most important optical properties are the refractive index *n* and the extinction coefficient *K*, which are generically called *optical constants*; There are available a number of experimental techniques for measuring n and K, some of which have been summarized by Simmons and Potter [3]. For example, ellipsometery measures changes in the polarization of light incident on a sample to sensitively characterize surfaces and thin films. The interaction of incident polarized light with the sample causes a polarization change in the light, which may then be measured by analysing the light reflected from the sample.[4,5]

MATERIALS AND METHODS

EXPRIMENTAL PROCEDURE

Pure P3HT (sigma Aldrich) (0.01% mol, 0.01 gm) was dissolved in 25 ml clorobenses the solution was filtered by filter paper, and used for the preparation of pure P3HT thin films[6]. The P3HT solution were deposited on a thoroughly cleaned glass substrates of dimensions of 27 mm, 25 mm and 1mm, to obtain thin films, by Casting method[6,7]. The evaporator temperature was taken to be 120oC to ensure the solvent evaporation. Samples thickness (d) were calculated using the relation, ((d =M2-M1/$S\rho$) ,where,M1 and , $M2$ is the mass of sample glass substrate before and after deposition respectively. S thin film are and, ρ is the density of the material[].The same procedure was used to prepare 1wt% and wt5% Orange G (O.G) and The electronic microscopy observations of the obtained pure and doped melanin thin films show uniformity and cracks or voids free. see Fig (1).

RESULTS AND DISCUSSION

Fig.2 shows the absorbance spectra of pure and doped P3HT thin films. The pure P3HT absorption spectrum with high absorbance of between visible wavelengths of 450 nm – 800 nm. Thiess absorbency material is favorable for electronic devices such as solar cells. Higher absorbance at higher energies may give high protection against the most damaging high energy photons to the humans. P3HT doped with 5% wt Orange G shows higher absorbance spectrum.
The absorption coefficient, α was calculated according to Beer-Lambert's law:
($\alpha = 2.303A/d$)……..(*)
where, A is the absorbance [8].

Fig. 3 shows the absorption coefficient spectra of P3HT pure and doped thin films. It is obvious that spectra of all films high absorbance in the in the visible range are due to P3HT doping because band gap properties.
The band-gap energy Eg which is associated with HOMO to LUMO electron transitions between the π and π^* molecular orbital's[9], were estimated using Talc's approach
$\alpha h\upsilon = A(h\upsilon - Eg)1/2$ ….(**) of direct band-gap energy

where, $h\upsilon$ is the incident photon energy) by extrapolating the linear curve to the photon energy axis, we found that the band-gap energies of pure P3HT as a function of thin films thickness are ~1.9 eV (Fig.4) .
The estimated energy gaps of pure and doped P3HT were shown in Fig.5. and Table.1. The decrease of the energy gap due to doping may be attributed to the amount of disorder in the material which probably plays an important role in the optical band gap [10], since the dopant deteriorate the structural properties, which in turn give rise to defect states and thus induce changes of absorption edge.
The extinction coefficient (k) and refractive index (n) were calculated according to the relations:-

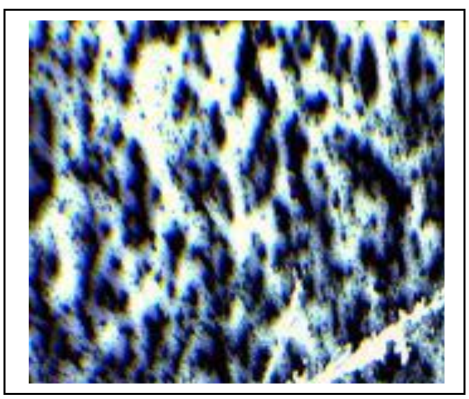
($k = \alpha \lambda / 4\pi$)…….(***) and

(n=1+R1/2/1-R1/2)…….(****) respectively[11,12].

Extinction coefficient (k) as a function of Wavelength .see fig(5,6)

CONCLUSION

The absorption in P3HT is broad and Visible rang . The pure P3HT has energy band gab of about 1.9 eV. Doping P3HT with (Orange G) broaden the band gap values decrease , where as doping .



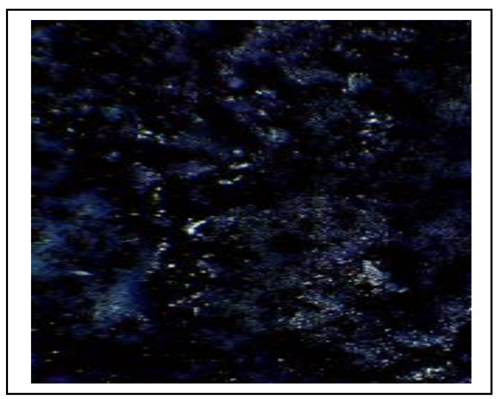


Fig (1) :- **Images of pure and doped P3HT thin films.**

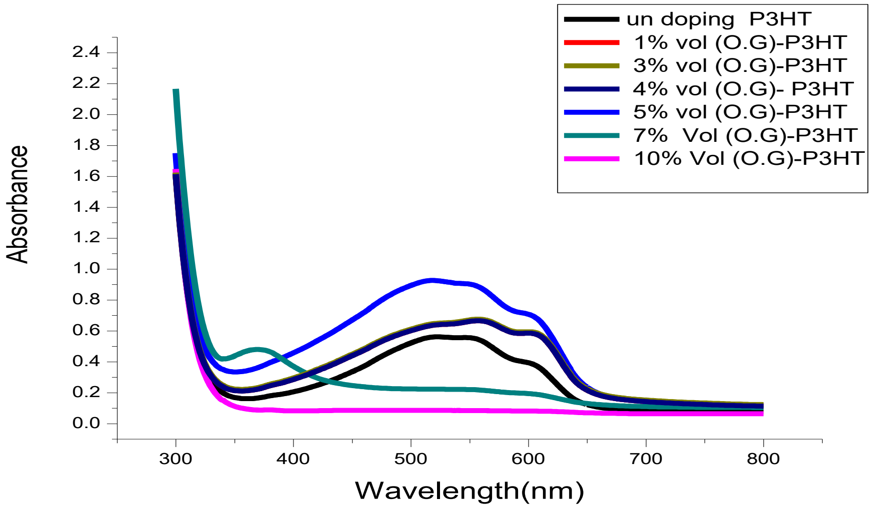


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Figure 2: The absorbance spectra of pure and doped P3HT thin films.

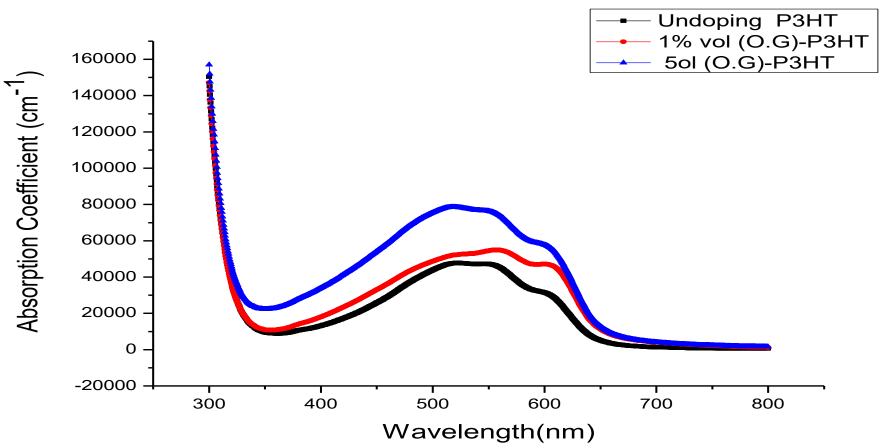

Figure 3: Absorption coefficient as a function of the Wavelength for the samples.

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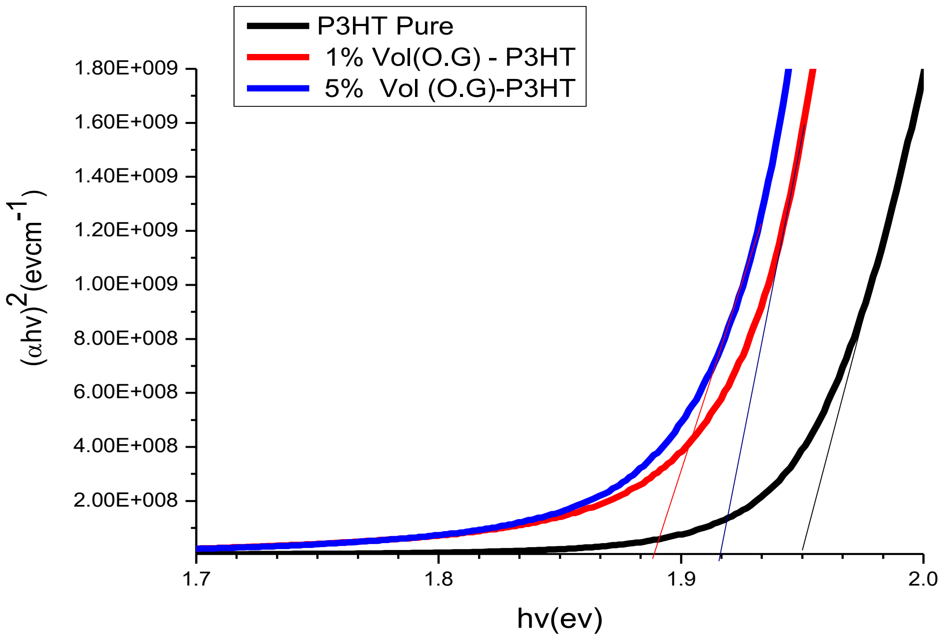

Figure 4: Optical band gap estimation of pure and doped P3HT with different wt% (O.G) thin films using Tauc's plot (α hʋ)2

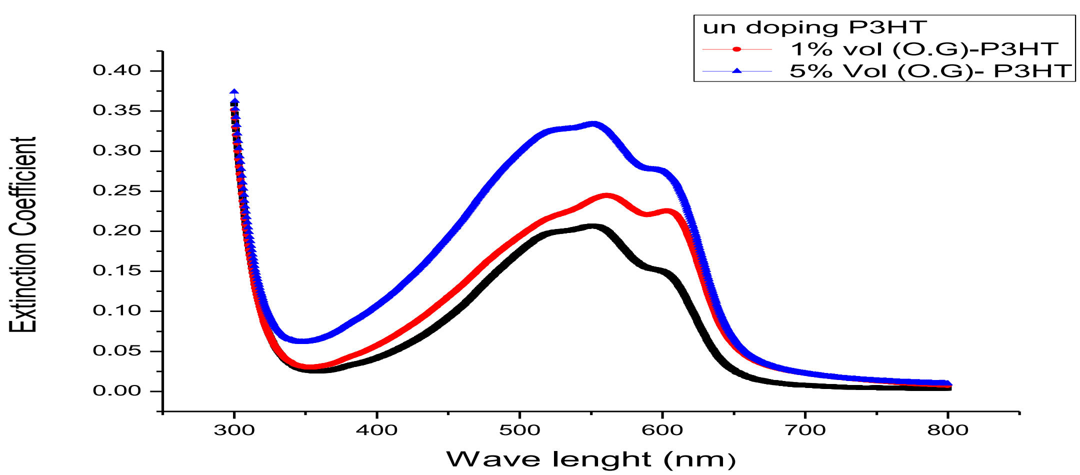

Figure 5: The extinction coefficient versus the energy of the incident Wavelength for pure and doped P3HT with different wt% (O.G) thin films.

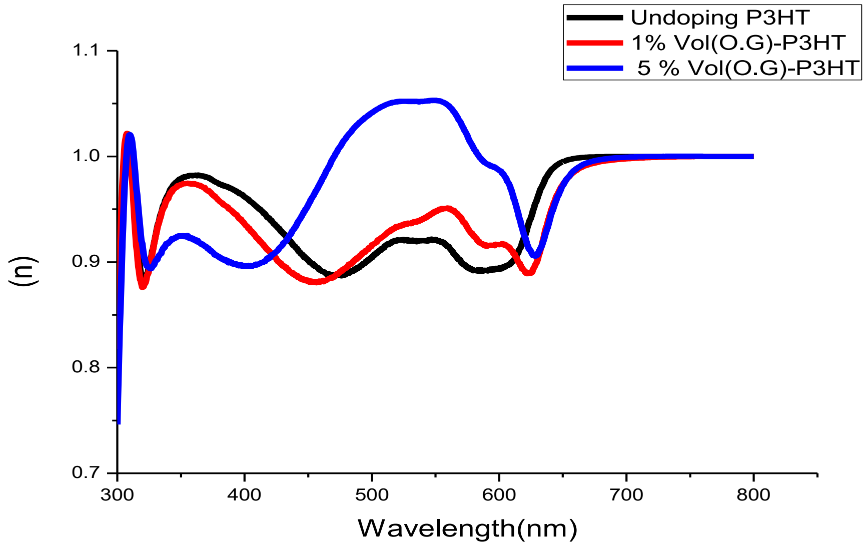

Figure 6: Refractive index as a function of the Wavelength for the samples.

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