

Characterization of (Palm fronds- Polystyrene) Composites

Falah Ali Jasim¹, Farhan Lafta^{1*}, Ahmed. Hashim^{2*}, Majeed Ali², Angham.G.Hadi²

1.Ministry of Science and Technology, Iraq

2.Babylon University, Iraq

*E-Mail: engfarhan71@gmail.com

*E-Mail: ahmed_taay@yahoo.com

Abstract

In this work, samples of pure polystyrene and polystyrene (PS) doped with palm frond (PF) were prepared using casting method. The effect of addition of palm frond (PF) concentration on optical properties of polystyrene have been studied in the wavelength range (200-800)nm. The absorption coefficient, energy gap, refractive index and extinction coefficient have been determined. The results show that the optical constants change with increase of PF concentration.

Key words; polymer, PS, palm frond, Optical properties, absorbance.

1.Introduction

In the recent years, studies on the electrical and optical properties of polymers have attracted much attention in view of their application in electronic and optical devices. Polymer composites can be fabricated into different shapes using known

polymer melt processing parameters, such as, films, wires, and bulk materials, which is dependent on the rheological melt behavior of the polymer [1-6].

Polymers are considered a good choice as host materials, because they can be designed to yield a variety of bulk physical properties, and they normally exhibit long-term stability and possess flexible re process ability. This new class of organic inorganic composites or hybrid materials may afford potential applications in molecular electronics, optics, photo electrochemical cells, solvent-free coatings, etc.[7]. Interesting properties such as fluorescence, electro-luminescence, and optical nonlinearity have already been observed. [8-12] Nonlinear optical materials are expected to be important in future high-speed communication networks as all-optical switching, wave-length manipulation, and signal processing devices.[13]

The aim of this work was prepared samples of polystyrene (PS) and polystyrene (PS) doped with (PF) by using casting method and studied the optical properties of them.

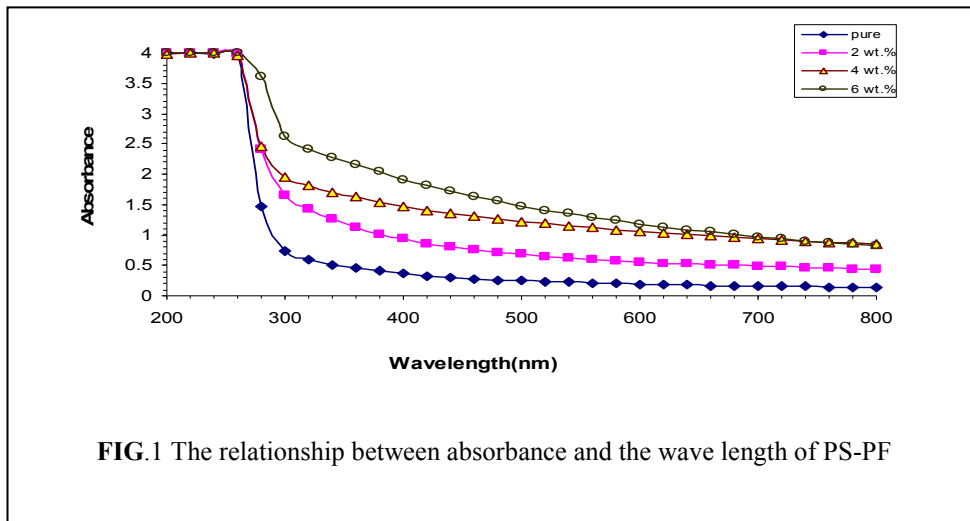
2.Experimental Part

The polymer was dissolved in chloroform by using magnetic stirrer in mixing process to get homogeneous solution. The weight of PF are (2, 4, 6 wt%) were added and mixed for 10 minute to get more homogenous solution, after which solution was transferred to clean glass Petri dish of (5.5cm) in diameter placed on plate form. The dried film was then removed easily by using tweezers clamp. The polymer systems were evaluated spectra photo metrically by using UV/160/Shimadzu spectrophotometer.

3.Results & Discussion

3.1 The absorbance of composites

Fig(1) shows the relationship between absorbance of PS-PF composite with wave length, from the figure it was appeared that the absorbance tends to decrease with the wavelength increasing.



Fig(2) shows the optical absorption spectrum of composite for different impurities quantities, it was found that the composite have a low absorption coefficient at a small photon energy then increase at different rates dependence on the composite structure. The pure sample had low absorption coefficient this may be as a result of low crystallinity.

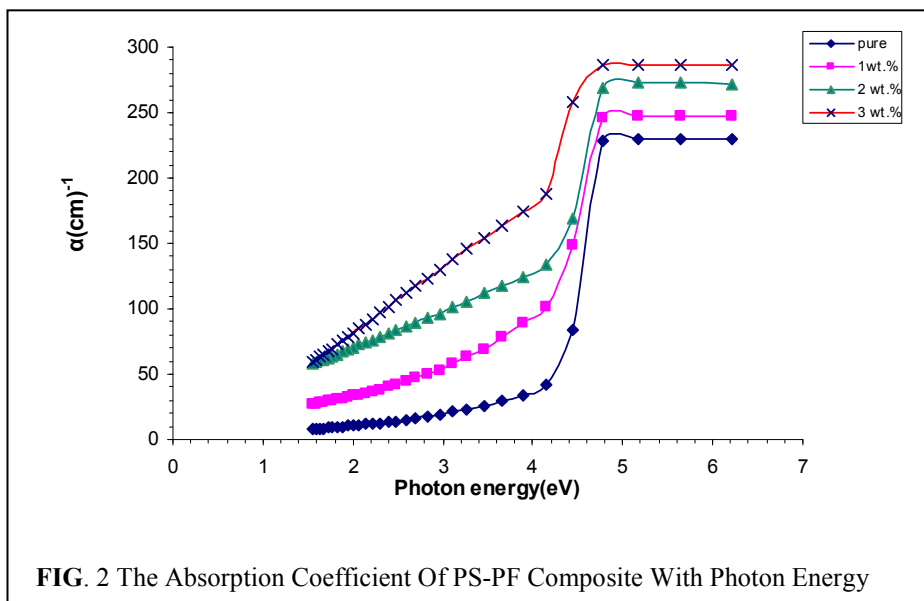
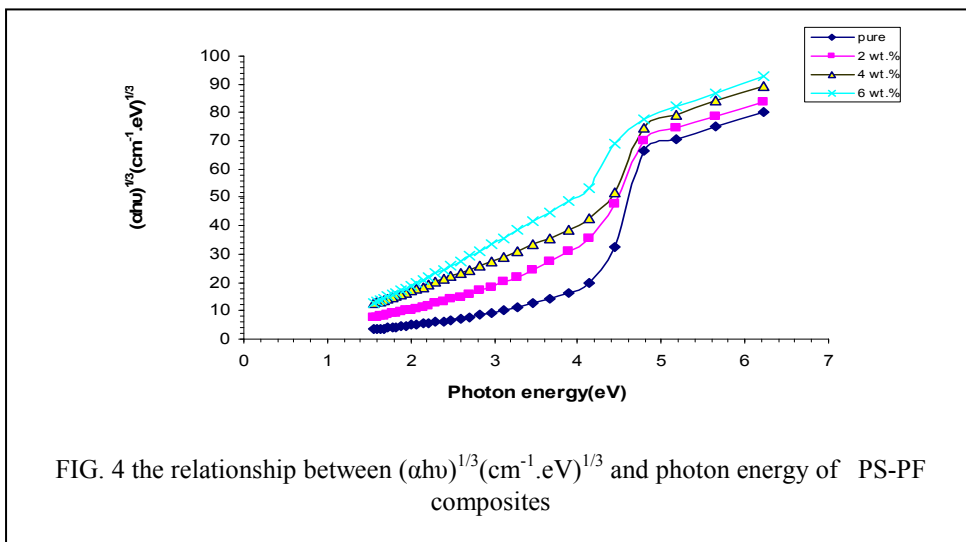
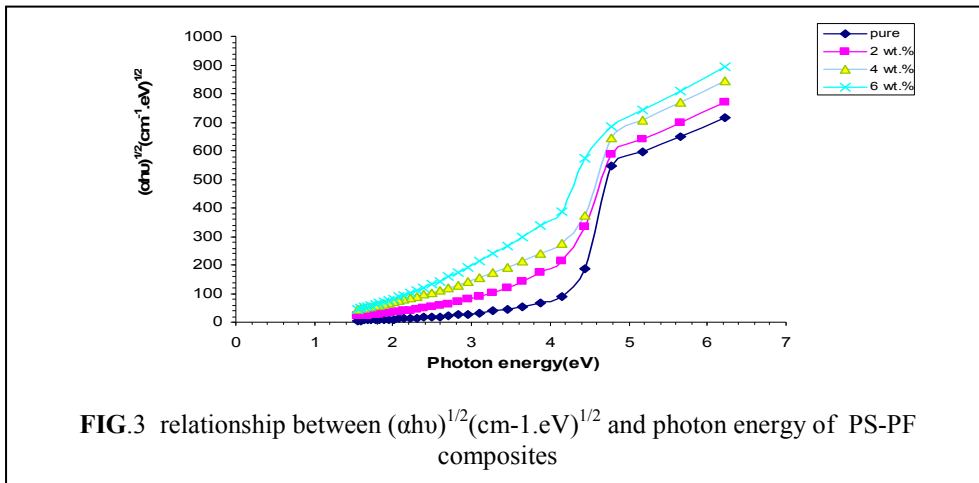


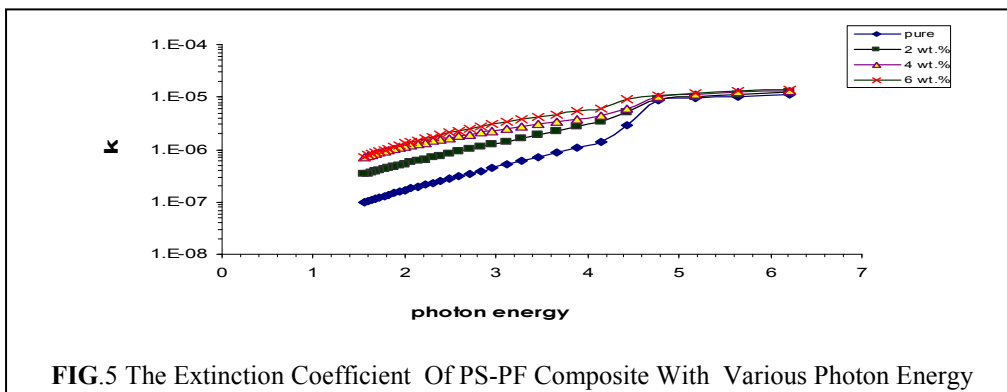
Fig (3) and Fig(4) represented the direct transition , the energy gab values dependence in general on the crystal structure of the composites and on the arrangement and distribution way of atoms in the crystal lattice .

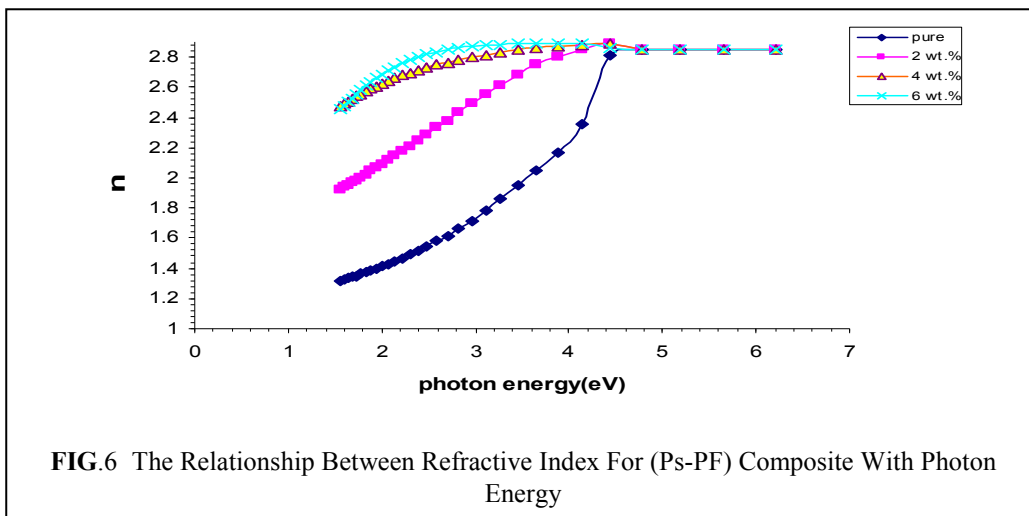


3.3 Refractive Index and Extinction Coefficient

Fig. (5) shows the variation of refractive index(n) with of the composite with a given photon energy the values increase exponentially with increasing photon energy. This increase indicates that the electromagnetic radiation passing through the material is faster in the low photon energy.

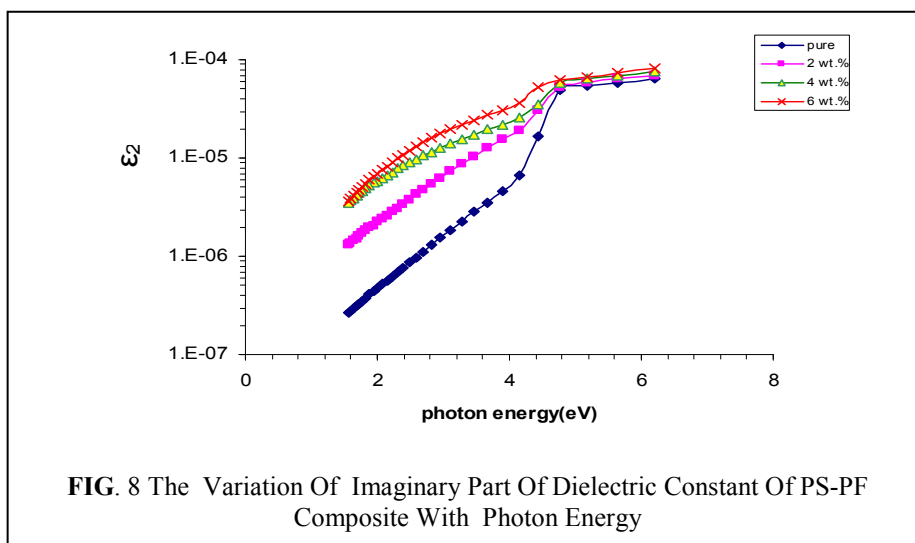
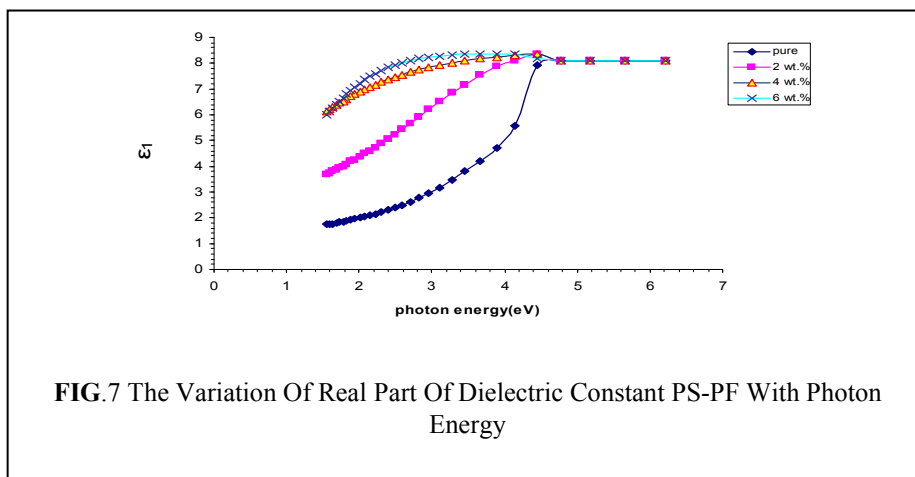
Fig. (6) represent the variation of the extinction coefficient(k) with the incident photon energy in this figure the variation is simple in the low energy region while the variation increased in the high photon energy region this behavior may be as a result to the variation of the absorption coefficient which leads to spectral deviation in the location of the charge polarization at the attenuation coefficient due to the loses in the energy of the electron transition between the energy bands.





3.4 dielectric constant

Fig.(7) & (8) represent the real and imaginary parts of the dielectric constant respectively in the real part the variation is very clear spatially in the high impurities concentration this may be due to the no resonance between the frequencies of the incident photon energy (electromagnetic and the induced dipoles in the composite), while in the imaginary part there is an absorption to the energy of the incident photon energy, so the variation nearly constant until it reaches to the high photon energy. The pure composite shows the smaller variation



Conclusion

Prepared films samples of pure and doped PS with PF with different concentrations have been investigated for their optical properties such as optical band gap, refractive index and extinction coefficient through transmittance and reflectance spectra. The optical constants such as the real (n) and imaginary (k) are parts of the complex refractive index, the real and imaginary parts of the dielectric constant were also determined.

References

- [1] R. B. H. Tahar, T. Ban, Y. Ohya, and Y. Takahashi, 1997 "Optical, structural, and electrical properties of indium oxide thin films prepared by the sol-gel method," *Journal of Applied Physics*, vol. 82, pp. 865-870.
- [2] C. Capozzi, S. Shackelford, R. Ou, and R. Gerhardt, 2004, Study of Percolation in PMMA/Indium Tin Oxide Composites, in Materials Research Society. meeting, symp. N3.13, pp. 303-308.
- [3] S. Gupta, R. Q. Ou, and R. A. Gerhardt, 2006, "Effect of the fabrication method on the electrical properties of poly(acrylonitrile-co-butadiene-co-styrene)/carbon black composites," *Journal of Electronic Materials*, vol. 35, pp. 224-229.
- [4] R. H. Baughman, A. A. Zakhidov, and W. A. de Heer, 2002 "Carbon nanotubes--the route toward applications," *Science*, vol. 297, pp. 787-792 .
- [5] A. K. Kota, B. H. Cipriano, M. K. Dueterberg, A. L. Gershon, D. Powell, S. R. Raghavan, and H. A. Bruck, 2007, "Electrical and Rheological Percolation in Polystyrene/MWCNT Nanocomposites," *Macromolecules*, vol. 40, pp. 7400-7406.
- [6] A. Greco and A. Maffezzoli, 2003, "Polymer melting and polymer powder sintering by thermal analysis," *Journal of Thermal Analysis and Calorimetry*, vol. 72, pp.1167-1174.
- [7] Antonietti, M.; Goltner, C.; *Angew. Chem., Int. Ed. Engl.* 1997,36, 910.
- [8] Winiarz, J. G.; Zhang, L. M.; Lal, M.; Friend, C. S.; Prasad, P.N. *J. Am. Chem. Soc.* 1999, 121, 5287.
- [9] Dabbousi, B. O.; Bawendi, M. G.; Onitsuka, O.; Rubner, M. F. *Appl. Phys. Lett.* 1995, 66, 1316.
- [10] Huynh, W. U.; Peng, X.; Alivisatos, A. P. *Adv. Mater.* 1999, 11,923.
- [11] Woggon, U.; Bogdanov, S. V.; Wind, O.; Schlaad, K. H.; Pier, H.; Klingshirn, C.; Chatziagorastou, P.; Fritz, H. P. *Phys. Rev. B* 1993,48, 11979.
- [12] Schwerzel, R. E.; Spahr, K. B.; Kurmer, J. P.; Wood, V. E.; Jenkins, J. A. *J. Phys. Chem. A* 1998, 102, 5622.
- [13] Cotter, D.; Manning, R. J.; Blow, K. J.; Ellis, A. D.; Kelly, A.E.; Nasset, D.; Phillips, I. D.; Poustie, A. J.; Rogers, D. C. *Science* 1999,286, 1523.

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