Journal of Engineering and Applied Sciences 8 (5): 140-142, 2013
ISSN: 1816-949X

Characterization of Palm Fronds-Polystyrene Composites

[1]Falah Ali Jasim, [1]Farhan Lafta, [2]Ahmed Hashim, [2]Majeed Ali and [2]Angham G. Hadi
[1]Ministry of Science and Technology, Iraq
[2]Babylon University, Hillah, Babylon Province, Iraq

Abstract: In this research, 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 poly styrene 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

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 (Tahar *et al*., 1997; Capozzi *et al*., 2004; Gupta *et al*., 2006; Baughman *et al*., 2002; Kota *et al*., 2007; Greco and Maffezzoli, 2003).

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. Interesting properties, such as fluorescence, electro-luminescence and optical nonlinearity have already been observed (Winiarz *et al*., 1999; Dabbousi *et al*., 1995; Huynh *et al*., 1999; Woggon *et al*., 1993; Schwerzel *et al*., 1998).

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 (Cotter *et al*., 1999).

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

MATERIALS AND METHODS

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 and 6 wt.%) were added and mixed for 10 min to get more homogenous solution, after which solution was transferred to clean glass petri dish of 5.5 cm 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.

RESULTS AND DISCUSSION

The absorbance of composites: Figure 1 shows the relationship between absorbance of PS-PF composite with wave length from Fig. 1, it was appeared that the absorbance tends to decrease with the wavelength increasing.

Figure 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

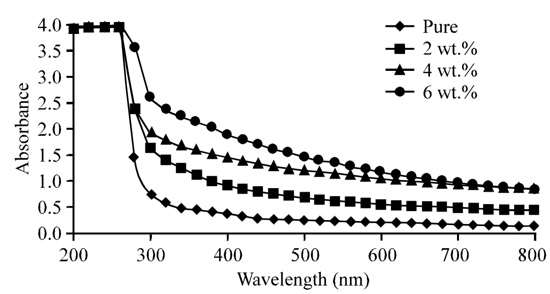

Fig. 1: The relationship between absorbance and the wave length of PS-PF

Corresponding Author: Falah Ali Jasim, Ministry of Science and Technology, Iraq

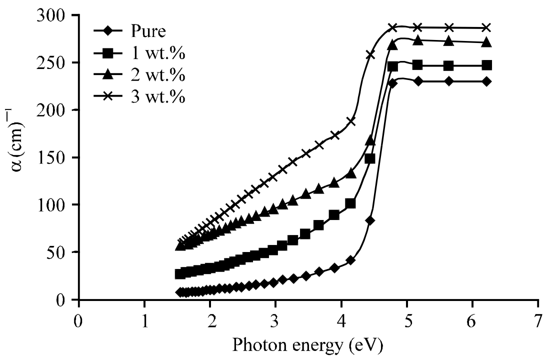

Fig. 2: The absorption coefficient of PS-PF composite with photon energy

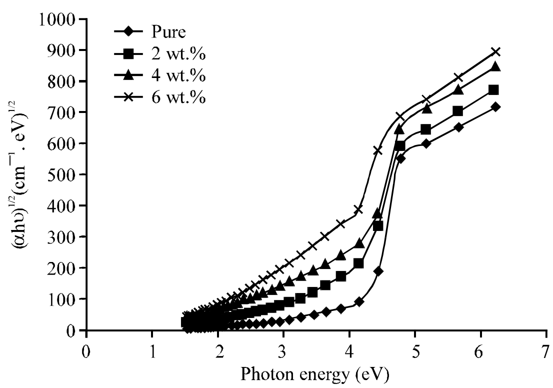

Fig. 3: Relationship between (αhυ)$^{1/2}$ (cm^{-1}.eV)$^{1/2}$ and photon energy of PS-PF composites

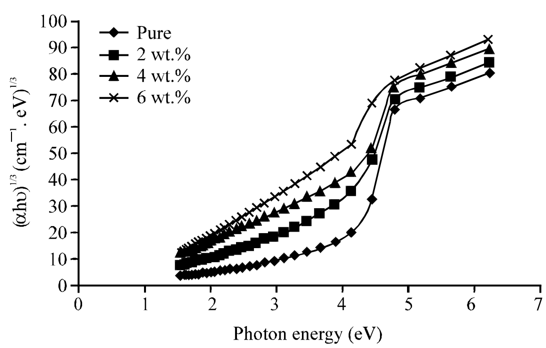

Fig. 4: The relationship between (αhυ)$^{1/3}$ (cm^{-1}.eV)$^{1/3}$ and photon energy of PS-PF composites

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 crystalinity.

Figure 3 and 4 represented the direct transition, the energy gab values dependence in general on the crystal structure of the composites and on the 6 arrangement and distribution way of atoms in the crystal lattice.

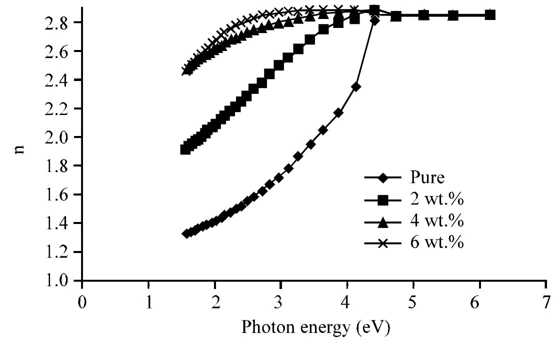

Fig. 5: The relationship between refractive index for (PS-PF) composite with photon energy

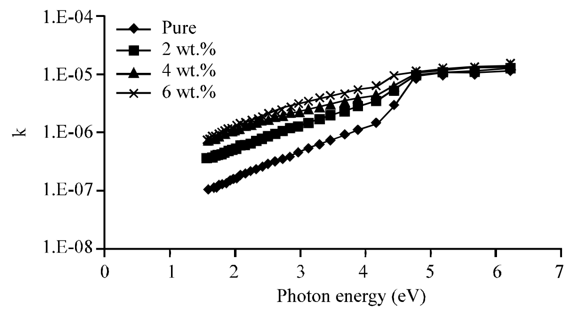

Fig. 6: The extinction coefficient of PS-PF composite with various photon energy

Refractive index and extinction coefficient: Figure 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.

Figure 6 represent the variation of the extinction coefficient (k) with the incident photon energy. In Fig. 6, 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.

Dielectric constant: Figure 7 and 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,

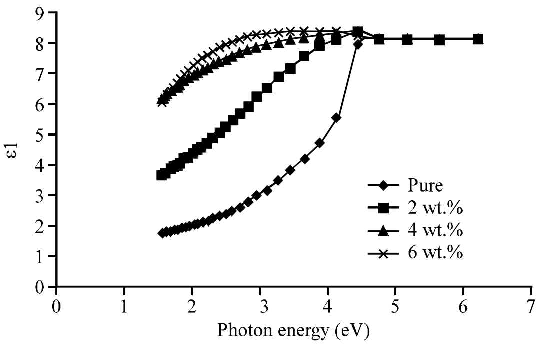

Fig. 7: The variation of real part of dielectric constant PS-PF with photon energy

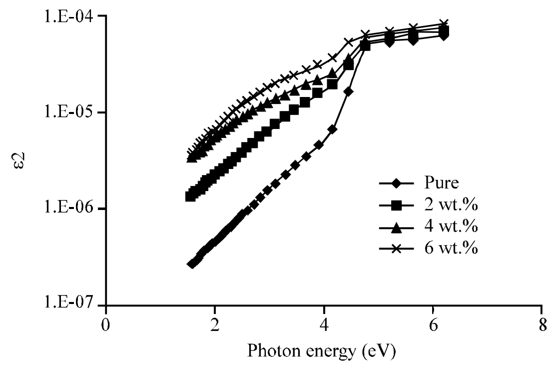

Fig. 8: The variation of imaginary part of dielectric constant of PS-PF composite with photon energy

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

Baughman, R.H., A.A. Zakhidov and W.A. de Heer, 2002. Carbon nanotubes--the route toward applications. Science, 297: 787-792.

Capozzi, C.J., S. Shackelford, R. Ou and R.A. Gerhardt, 2004. Study of percolation in PMMA/Indium tin oxide composites. Proceedings of the Symposium on Materials Research Society, Volume 819, April 13-16, 2004, Warrendale, PA., USA., pp: 303-308.

Cotter, D., R.J. Manning, K.J. Blow, A.D. Ellis and A.E. Kelly *et al*., 1999. Nonlinear optics for high-speed digital information processing. Science, 286: 1523-1528.

Dabbousi, B.O., M.G. Bawendi, O. Onitsuka and M.F. Rubner, 1995. Electroluminescence from CdSe quantum-dot/polymer composites. Applied Phys. Lett., 66: 1316-1318.

Greco, A. and A. Maffezzoli, 2003. Polymer melting and polymer powder sintering by thermal analysis. J. Therm. Anal. Calorim., 72: 1167-1174.

Gupta, S., R. 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. J. Electron. Mater., 35: 224-229.

Huynh, W.U., X. Peng and A.P. Alivisatos, 1999. CdSe nanocrystal rods/poly(3- hexylthiophene) composite photovoltaic devices. Adv. Mater., 11: 923-928.

Kota, A.K., B.H. Cipriano, M.K. Duesterberg, A.L. Gershon, D. Powell, S.R. Raghavan and H.A. Bruck, 2007. Electrical and rheological percolation in polystyrene/MWCNT nano composites.Macromolecules, 40: 7400-7406.

Schwerzel, R.E., K.B. Spahr, J.P. Kurmer, V.E. Wood and J.A. Jenkins, 1998. Nanocomposite photonic polymers. 1. third-order nonlinear optical properties of capped cadmium sulfide nanocrystals in an ordered polydiacetylene host. J. Phys. Chem. A, 102: 5622-5626.

Tahar, R.B.H., T. Ban, Y. Ohya and Y. Takahashi, 1997. Optical, structural, and electrical properties of indium oxide thin films prepared by the sol-gel method. J. Applied Phys., 82: 865-870.

Winiarz, J.G., L. Zhang, M. Lal, C.S. Friend and P.N. Prasad, 1999. Observation of the photorefractive effect in a hybrid organic-inorganic nanocomposite. J. Am. Chem. Soc., 121: 5287-5295.

Woggon, U., S.V. Bogdanov, O. Wind, K.H. Schlaad and H. Pier *et al*., 1993. Electro-optic properties of CDs embedded in a polymer. Phys. Rev. B, 48: 11979-11986.