

Preparation and Characterization of (PVA-FeNO₃) Composites

⁽¹⁾Ghaidaa Abdul Hafidh, ⁽²⁾Galib A. Ali ⁽³⁾Majeed Ali, and ⁽⁴⁾Ahmed Hashim

⁽¹⁾Babylon University, College of Science, Department of physics, Iraq.

⁽²⁾Babylon University, College of Science of women, Department of physics, Iraq.

^(3,4)Babylon University, College of Education, Department of physics, Iraq.

E-Mail: ahmed_taay@yahoo.com

Abstract

This work investigates the effects of addition of FeNO₃ on the optical properties of poly-vinyl alcohol (PVA). The specimens were prepared by adding FeNO₃ to the solution of poly-vinyl alcohol with weight percentages from FeNO₃ are (0,1,2,3)wt.%. The experimental results show that the absorbance of (PVA-FeNO₃) composites increases with an increase in the weight percentages of FeNO₃. The refractive index, real part of dielectric constant, Brewster angle and coefficient of finesses are increasing with an increase in weight percentages of FeNO₃.

keywords: poly-vinyl alcohol, optical properties, Composites.

Introduction

Polymer materials are often filled with inorganic compounds in order to improve their properties [1]. The enhanced properties of composite materials depend on the compatibility of polymer and its filler. Because of the strength of interfacial bonding between the filler and the polymer matrix would have influences upon the overall mechanical properties of the composites [2]. To the separation scientists, the combination of solubilizing properties of the water-soluble polymer molecules and inorganic salts is an interesting area in the field of extraction and fractionation. Several liquid phase extraction technologies employing phase-forming polymers in aqueous solution have the potential to replace volatile organic compounds in classical solvent extraction technologies [3]. Polyvinyl alcohol (PVA) is a polymer with several interesting physical properties, which are very useful in technical applications. PVA, as a semicrystalline material, exhibits certain physical properties resulting from the crystal-amorphous interfacial effect [4]. This study deals with results of the effect of FeNO₃ on the optical properties of polyvinyl alcohol.

Materials and Methods

The materials used in this work are polyvinyl alcohol and FeNO₃. The weight percentages of FeNO₃ are (0,1,2 and 3)wt.%. The samples were prepared by dissolving FeNO₃ in 30 mL of a 3% solution of PVA. The transmission and absorption spectra of PVA-FeNO₃ composites have been recorded in the length range (190-850) nm using a double-beam spectrophotometer (UV-210°A Shimadzu).

Results and Discussion

Figure(1) shows the behavior of optical absorbance of (PVA-FeNO₃) composites with wavelength. The figure shows that the absorbance increases with an increase in the weight percentages of FeNO₃, this attribute to the absorbance of FeNO₃.

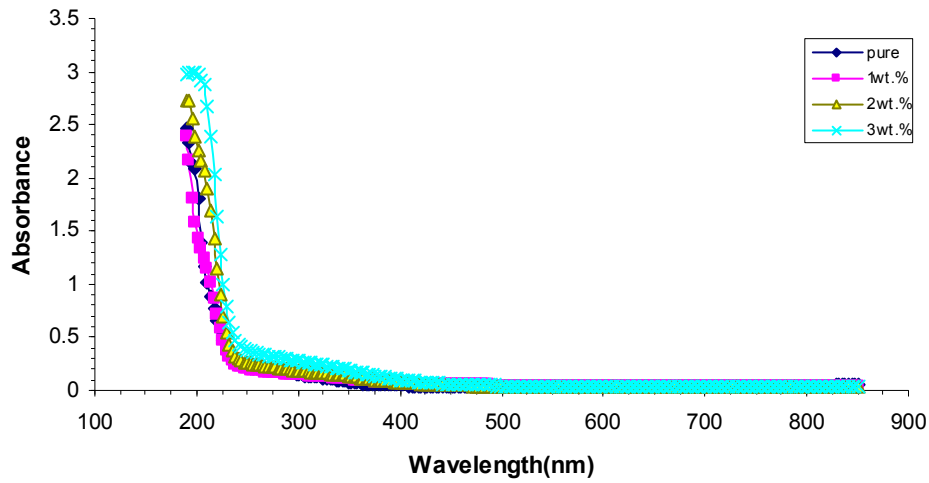


FIG.1
 Effect of FeNO₃ concentration on Optical absorbance for (PVA-FeNO₃) composite

The relationship between refractive index of composites and photon energy of different weight percentages of FeNO₃ is shown in figure(2). The refractive index of composites increases with increase the FeNO₃ concentrations, this behavior relate to increase of the density with increase the concentration of FeNO₃ [5].

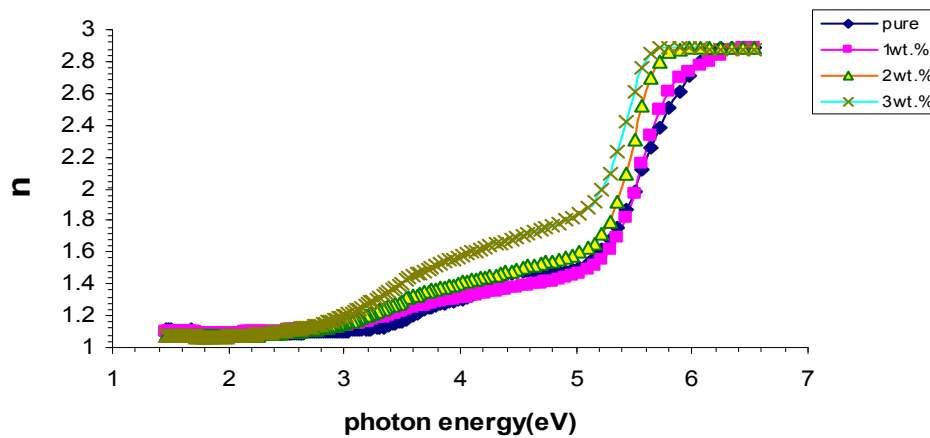


FIG.2
 Effect of FeNO₃ concentration on refractive index for (PVA-FeNO₃) composite.

The relationship between real part of dielectric constant ($\epsilon_1 = n^2$)[8] and energy photon of (PVA-FeNO₃) composites are shown in figure(3).

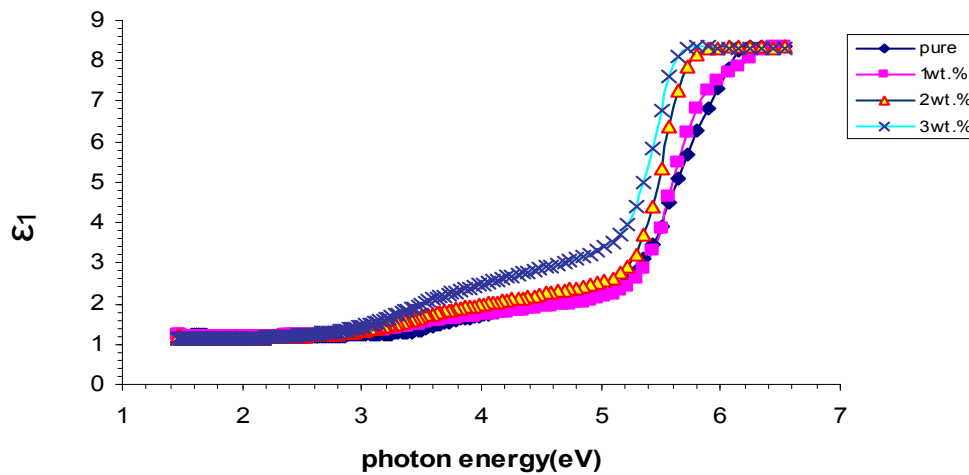


FIG.3
 Effect of FeNO₃ concentration on real part of dielectric constant (PVA-FeNO₃) composite.

The real part of dielectric constant of composites increased with increase the FeNO₃ concentration, this attribute to increase the refractive index of composites with increase the weight percentages of FeNO₃ [6].

The variation of Berwster angle ($\theta_B = \tan^{-1}(n)$) [7] with photon energy is shown in figure(4). The Berwster angle of composites increased with increase weight percentages of FeNO₃. The increase of Berwster angle with concentration of FeNO₃ related to increase refractive index with increase the weight percentages of FeNO₃.

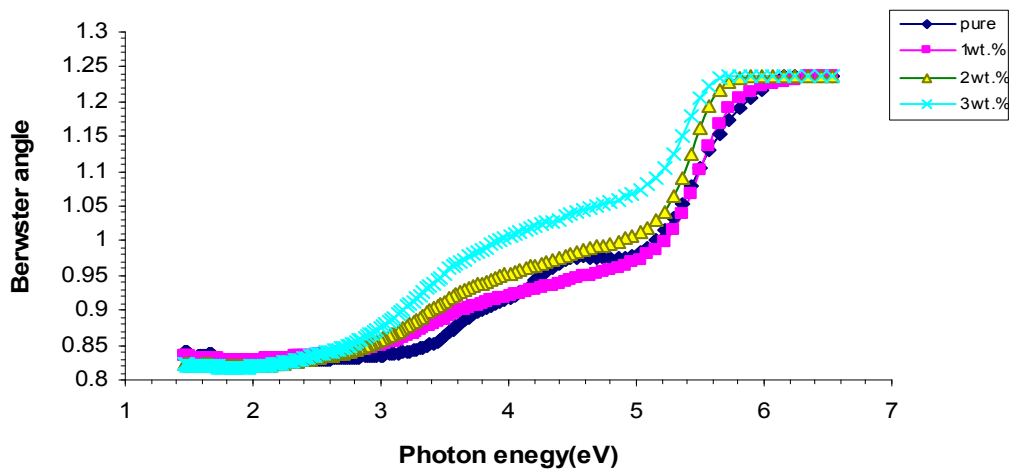


FIG.4
 Effect of FeNO₃ concentration on Berwster angle (PVA-FeNO₃) composite.

The behavior of coefficient of finesses ($F = \frac{4R}{(1-R)^2}$) where R is reflectance [8] with photon energy of different FeNO₃ concentrations. The figure shows that the coefficient of finesses increased with increase FeNO₃ concentration. This behavior attribute to increase refractive index with increase the FeNO₃ concentration.

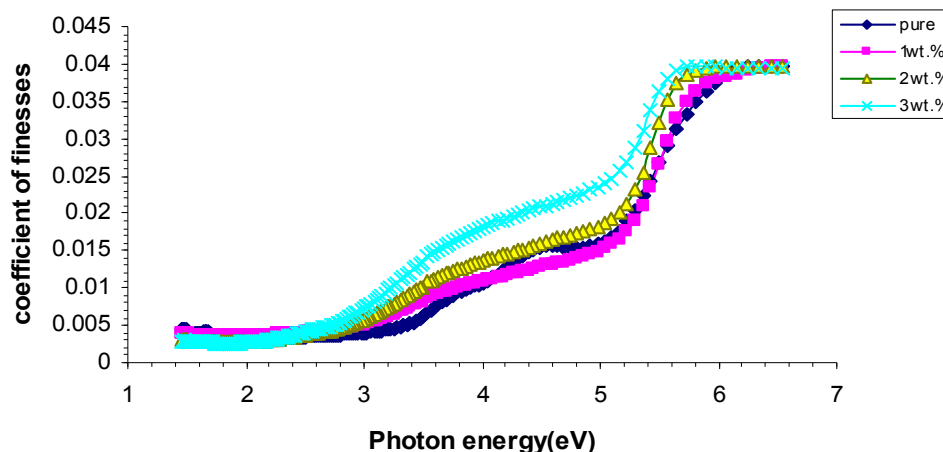


FIG.5
Effect of FeNO₃ concentration on coefficient of finesse (PVA-FeNO₃) composite.

Conclusions

- 1- The absorbance of (PVA-FeNO₃) composites increases with increase of weight percentages of FeNO₃.
- 2- The refractive index, real part of dielectric constant, Brewster angle and coefficient of finesse of (PVA-FeNO₃) composites are increasing with increase concentration of FeNO₃.

References

- [1] Hellen Papananou, Sapfo Fotiadou, Kiriaki Chrissopoulou and Spiros H. Anastasiadis, 2011, "CRYSTALLINITY AND CRYSTALLIZATION KINETICS IN POLY(ETHYLENE OXIDE) / LAYERED SILICATE NANOCOMPOSITES", Proceedings of the Conference of Multiphase Polymers and Polymer Composites: From Nanoscale to Macro Composites", Paris-Est, Creteil University, June, France
- [2] Wittawut Wimonsong, Poonsub Threepopnatkul and Chanin Kulsetthanchalee, 2011, "THERMAL CONDUCTIVITY AND MECHANICAL PROPERTIES OF WOOD SAWDUST/ POLYCARBONATE COMPOSITES", Proceedings of the Conference of Multiphase Polymers and Polymer Composites: From Nanoscale to Macro Composites", Paris-Est, Creteil University, June, France
- [3] A. Bhattacharya, P. Ray, 2004, "Studies on Surface Tension of Poly(Vinyl Alcohol): Effect of Concentration, Temperature, and Addition of Chaotropic Agents", J. of Applied Polymer Science, Vol. 93, 122-130 .
- [4] M. Abdelaziz, E.M. Abdelrazek, 2006, "Effect of dopant mixture on structural, optical and electron spin resonance properties of polyvinyl alcohol", J. of Physica B, PP.(1-9).
- [5] Ahmad A.H., Awatif A.M. and Zeid Abdul-Majied N., 2007, " Dopping Effect On Optical Constants of Polymethylmethacrylate (PMMA), J. of Eng. & Technology, Vol.25, No.4, 558-568.
- [6] M. Muhsien, A. Hashim, K. Mahdy, 2010, " Doping Effect On Constants of poly- vinyl alcohol", Proceedings of the First Scientific Conference of physics/ Al- Kufa University, Iraq.
- [7] Danial and Alberty, (1975) "Physical Chemistry", 4th Edition, John, W. and Sons, Inc, 44-94.
- [8] Garl zesis. (1985) "Operating Instruction Abbe-Refractometer". West Germany oberkochen, 3-25.

This academic article was published by The International Institute for Science, Technology and Education (IISTE). The IISTE is a pioneer in the Open Access Publishing service based in the U.S. and Europe. The aim of the institute is Accelerating Global Knowledge Sharing.

More information about the publisher can be found in the IISTE's homepage:

<http://www.iiste.org>

CALL FOR PAPERS

The IISTE is currently hosting more than 30 peer-reviewed academic journals and collaborating with academic institutions around the world. There's no deadline for submission. **Prospective authors of IISTE journals can find the submission instruction on the following page:** <http://www.iiste.org/Journals/>

The IISTE editorial team promises to review and publish all the qualified submissions in a **fast** manner. All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Printed version of the journals is also available upon request of readers and authors.

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

