Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 8894 - 8900
Received 25 April 2021; Accepted 08 May 2021.

Study Effect of Magnetic Field in Improving the Optical Properties of PMMA-PS Doped Fe2O3 Nanoparticles in Medical Applications

[1]Hussein Ali Hussein Salman,[2] Zaid A. Hasan

Department of physics, College of Education for Pure Sciences, University of Babylon, Iraq

hussein442519@gmail .com& zaid.shimary@yahoo.com

Abstract :

The effect of the magnetic field on the (PMMA-PS) films doped with $Fe_2 O_3$ nanoparticles has been studied with variable weight ratios on their optical properties. The films were prepared at room temperature using a solution molding technique. It was observed that the magnetic field gave an improvement in the optical properties because the magnetic field induced the PMMA-PS / Fe2O3 film particles to arrange their crystal structure in the direction of the applied magnetic field, which caused an increase in the permeability value and a decrease in the values of (absorbance, absorption coefficient, extinction coefficient, refractive index, etc.) The real and imaginary isolation constants

Key words: Methyl Metha Acrylate, Optical properties , polystyrene.

Introduction:

Interested researchers in nanotechnology and was the focus of widespread interest and made a great leap in various medical and engineering sciences ... etc. [1]
Nanocomposites are the product of adding nanoparticles to other ordinary materials to produce new materials with distinctive physical properties that are used in various applications, especially medical ones [2]. PMMA is a colorless, transparent thermoplastic that is technically classified as the preferred type of amorphous glass due to its moderate properties, ease of handling and low cost [3]
In this study, membranes of PMMA-PS polymer compounds were prepared by casting technique with the addition of Fe2O3 of nanoparticles in different weight ratios to improve their mechanical and optical properties for use in medical applications, especially the dental industry, and to improve contrast in the magnetic resonance device.

Materials and Methods:

Use PMMA / PS doped with Fe2O3 nanoparticles (size: 30-40 nm) The prepared films with solution molding technology. The mixture (PMMA-PS / Fe2O3) was dissolved. In proportions (0.2, 0.4, 0.6 wt%) in (40 mL) chloroform alcohol using a magnetic stirrer and the samples are dried. Emphasis on a magnetic field on the prepared membranes because the system consists of a diode laser operating in the basic Gaussian modeAt wavelength (540nm), an abeam capacitor consisting of two glass lenses in a confocal configuration is used to allow a very narrow laser point of about (2 mm) in diameter as the laser radiation is polarized along the direction of propagation at an angle of 45 ° with the direction of the cell, and through a wire mesh polarizer we get this Polarization Figure (1) illustrates this where .

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 8894 - 8900
Received 25 April 2021; Accepted 08 May 2021.

The beam passes through the cell (PMMA-PS-Fe2O3 nano). The film is positioned inside a coil when operating the laser device, the laser beam is filled with the cell perpendicular to the instrument vector of the incident laser radiation.

First, the intensity(Io) measurement of the laser beam was taken before the effect of the magnetic field, and then the intensity of the laser beam was measured after the effect of the magnetic field on the prepared films PMMA_PS / Fe2O3nano and for several times the measurements were repeated and between each measurement and the last 12 minutes.

. The optical measurements included measurement of absorbance, absorption coefficient, transmittance, refractive index, real and imaginary insulation constant, and all measurements were made at room temperature.

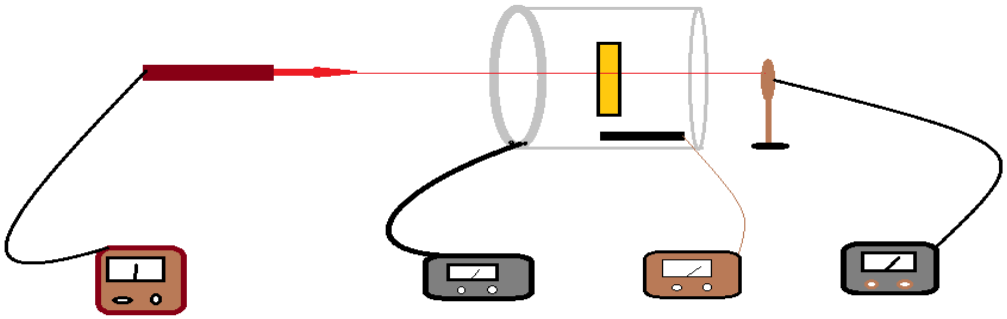

Fig (1) Magneto optical system set up

Results and Discussion:

The Absorptance value can be obtain from equation

$$A = \text{Log}_{10} T \qquad (1)$$

By observing the permeability values from this equation (1), found the indirect correlation between absorption (A) and permeability (T), where Fig. (2) shows the correlation between absorption (A) with concentration (C)

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 8894 - 8900
Received 25 April 2021; Accepted 08 May 2021.

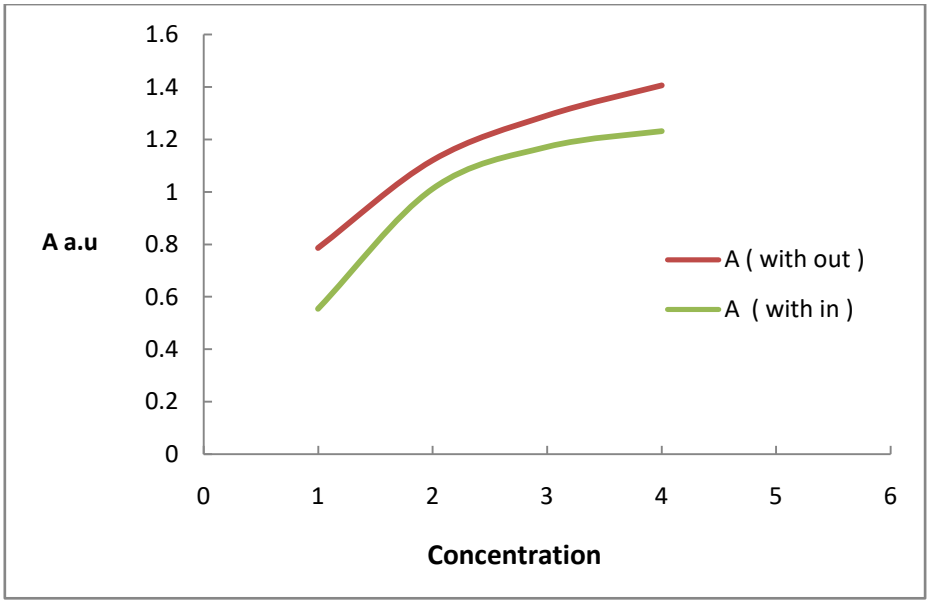

Fig (2):Note the proportionality between the absorption (A) and the focus in the magnetic field (450 mT) and wavelength (540 nm).

The absorption coefficient is directly related to the concentration, as it increases with the increase in the concentration and this is evident from Figure (3) as the magnetic field affecting the films produces better alignment of the magnetic dipoles, and this affects the values of the absorption coefficient, which decreases because of that

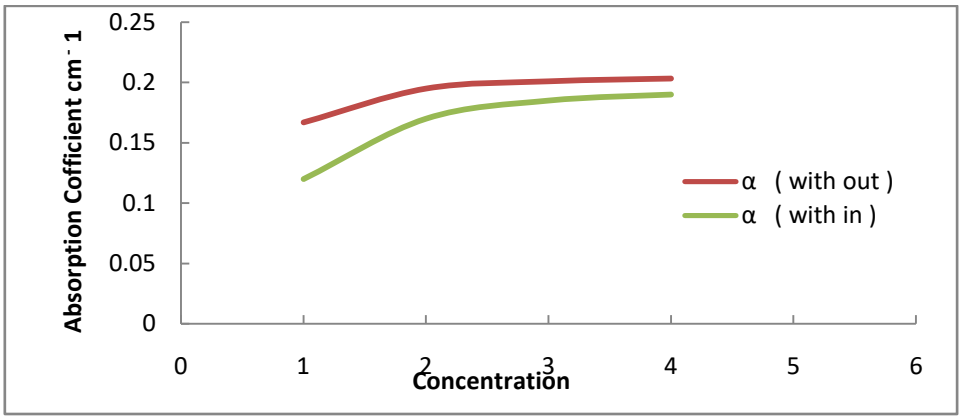

Fig (3): The Absorption Coefficient (α) Shown with respect to magnetic field concentration (450 mT) and wavelength (540 nm)

The transmittance of the film is measured directly, which is the amount of rays reflected from the [film to the amount of rays that fell on it according to the equation[13]

T = IT /IO

The transmittance value increases as the magnetic field applied ,therefore the molecules are affected by the magnetic field and polarized toward it, this means that the wave vector (k) takes the same direction of the field.[14]

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 8894 - 8900
Received 25 April 2021; Accepted 08 May 2021.

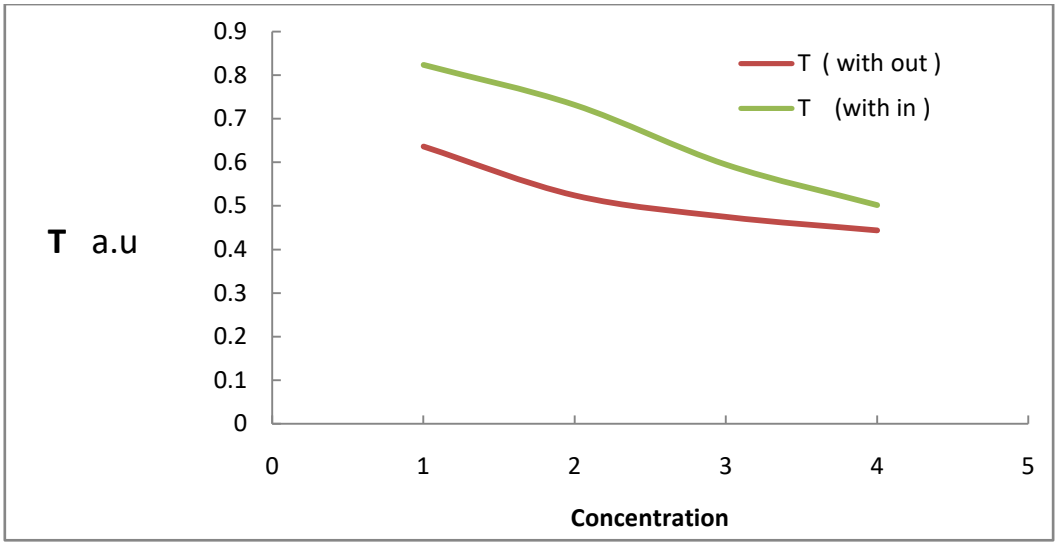

Fig. (4) : between transmittance (T) and the concentration at magnetic field(B) (450 mT)and wavelength(540 nm)

By use the equation ($K_0 = \alpha\lambda /4\pi$)calculate the coefficient of extinction (k),Note that the extinction coefficient is proportional to the wavelength. In Fig. 5, the k value is lower at the lower concentration of nanoparticles and this causes an increase in the absorption coefficient with an increase in the doping ratios of the added nanoparticles. The extinction coefficient is high at longest wavelength and high concentration. (7)

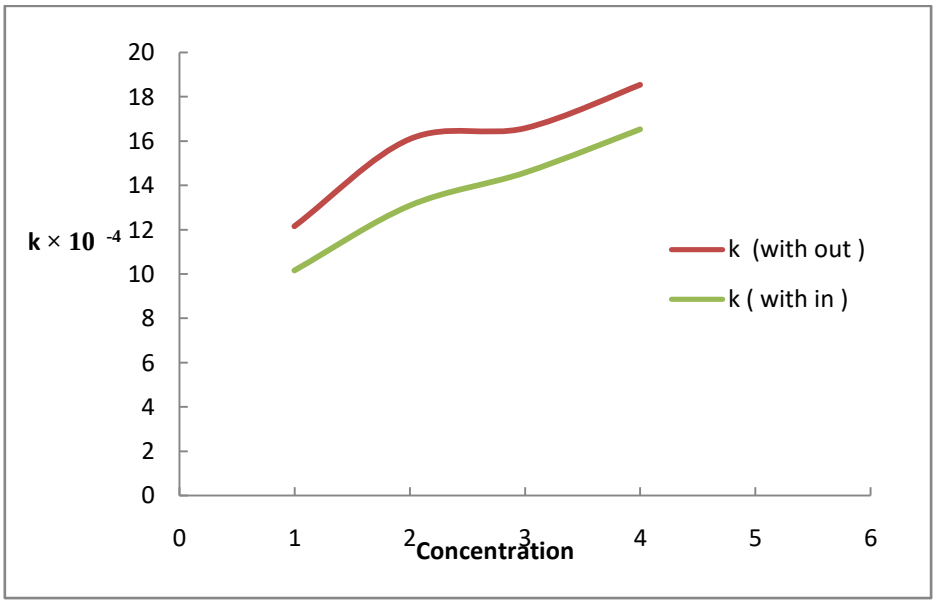

Fig (5) : Note the proportionality between the extinction coefficient (k) and the concentration (c) in the magnetic field (450 mT) and the wavelength (540 nm).

Figure (6) describes the change by the refractive index as a function of the wavelength with an increase in the deflection ratios.Because it's pure PMMAIt is an amorphous crystalline substance with a low density that increases with increasing the concentration of Fe2O3 nanoparticles, so we

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 8894 - 8900
Received 25 April 2021; Accepted 08 May 2021.

notice that the refractive index decreases with the larger wavelength and increases at the maximum concentration of the drug, because the longer wavelength transmission is more. , Whose behavior corresponds to. Zaid Hassan, Maryam Obais (2018) [8].

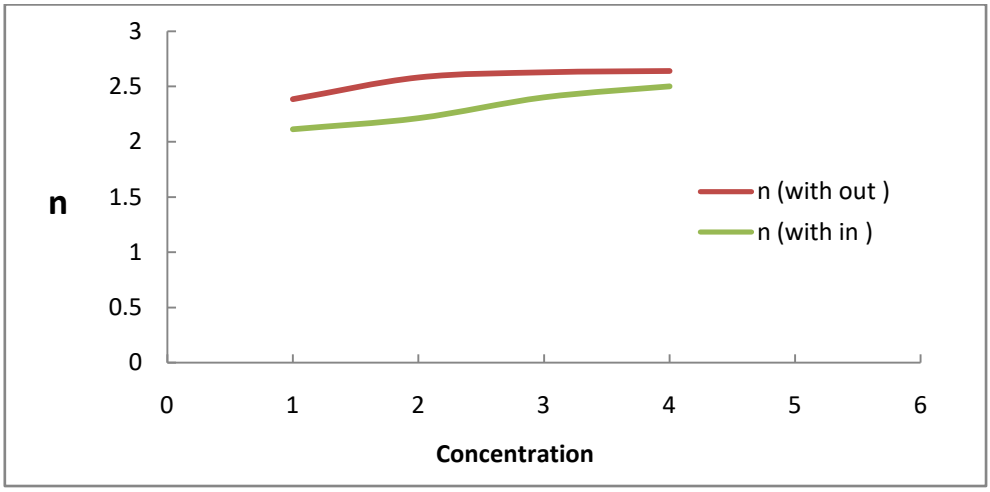

Fig (6): Note the proportionality refractive index (n) and the concentration (c) in the magnetic field .((450 mT) and wavelength (540 nm

Thedielectric constant (Ɛ) ,it is defined as the polarization of charges due to the interaction of radiation and the charges of the medium, and is calculated by relations ($Ɛ=Ɛ_1+Ɛ_2$) ,($Ɛ_1=n_0^2-k_0^2$) , ($Ɛ_2=2n_0k_0$) [9].

Where the true dielectric constant is related to the scattering and for the purpose of a comprehensive interpretation of the scattering, the actual motion with which the electrons move within the optical medium through which the light passes must be observed while

The imaginary part of the dielectric constant represents the rate at which the scattered electromagnetic anomalies propagate in the medium. We note that the real and imaginary parts depend on the photon energy of the prepared samples in addition to the refractive index, where the magnetic field decreases in (n), and this leads to a reduction in the real and imaginary dielectric constant. As shown in Figures (7) and (8) [12]

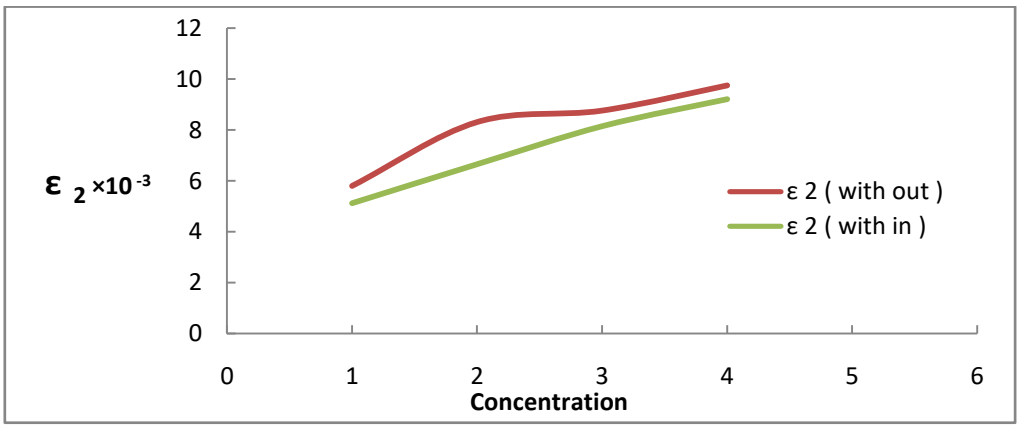

Fig (7) : Note the proportionality between The imaginary dielectric (ε_2) and the concentration(c) at magnetic field (450 mT)and wavelength(540 nm)

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 8894 - 8900
Received 25 April 2021; Accepted 08 May 2021.

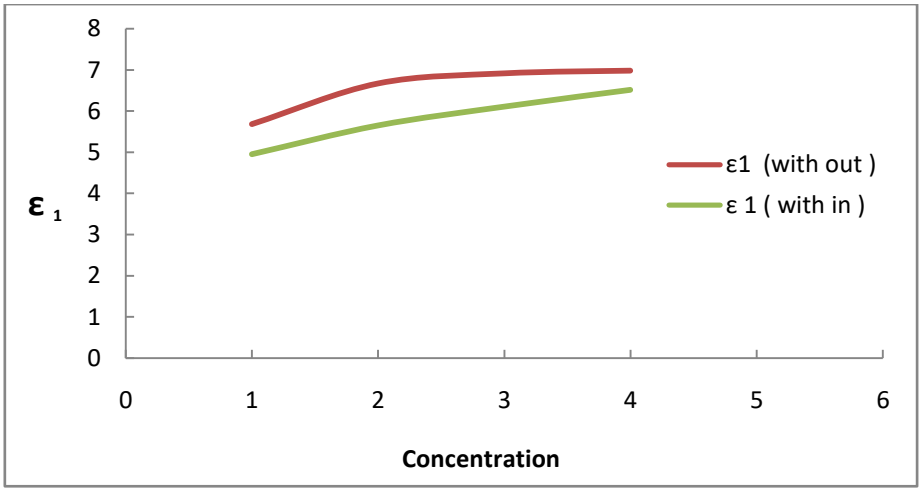

Fig (8) : Note the proportionality between The real dielectric constant (ε_1) and the concentration(c) at magnetic field (450 mT)and wavelength(540 nm)

Conclusions

The study showed that the effect of the magnetic field on PMMA-PS / Fe2O3 membranes led to an improvement in the optical properties and we obtained a bound and coherent polymeric compound with a greater impact force for use in various applications, especially medical ones. As the permeability of the prepared films increased and decreased (absorption, absorption coefficient, real and imaginary dielectric constant, refractive index)

References:

[1]-Pippek, J. C. , "Semiconductor Optoelectronic Devices", University of California, (2006).
[2]-French, R. H., Mullejans, H. and Jones, D. J., "Optical Properties of AluminumOxide: Determined from Vacuum Ultraviolet and Electron Energy-LossSpectroscopies", Journal of the American Ceramic Society, Vol. 81, No. 10, pp.2549-2557.(1998).
[3]- Yahya N .al-Jamal, 1990, “Solid State Physics”, Mosul University Press.
[4]- Echcrtova, L., 2002, "Physics of Thin Films", Plenum Press, New York and London,
[5]. Saba S.Nemah, Zaid A.Hasan, Journal of Global Pharma Technology, Vol.11,Issue 07,(suppl.), 325-330,(2019).
[6]- B.A. Hasan ,J.ofcolloge of Education**,** No.5,P.(449-465),(2000).
[7]- G. Kumar, R. Chandramani, Investigation on Fe3þ doped PVA polymer films with andwithout gamma irradiation,Appl. Surf. Sci. 255 (2009) .
[8]. Zaid A Hasan, Maryam F Obayes,"Study of the Effect Magnetic Field on theOptical Properties of Poly(Methyl MethaAcrylate) Doped with CopperNanoparticles" , J. Eng. Applied Sci., 13 (13): 10551-10554,(2018).
[9]. Zaid A. Hasan " Influence theTemperature on Optical Properties for(5PCH) Liquid Crystal ", Research J.Pharm. And Tech., Marh, 11: 3,(2018).
[10]-Chopra, K. L., and Kaur, I., "Thin Film Device Applications" Plenum Press, New York, (1983).
[11] Ndukwe IC1996 Solar Energy Materials and Solar Cells 40 P123
[12] F. W. Billmeyer, Jr. ,"Textbook of Polymer Science". John Wiley and Sons, New York, (1984).

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 6, 2021, Pages. 8894 - 8900
Received 25 April 2021; Accepted 08 May 2021.

[13] Jalil, Abduladheem Turki, and Aleksandr Karevskiy. "The Cervical Cancer (CC) Epidemiology and Human Papillomavirus (HPV) in the Middle East." *International Journal of Environment, Engineering & Education* 2, no. 2 (2020): 7-12.

[14] Zelner, M., Minti, H., Reisfeld, R., Cohen, H., & Tenne, R. Preparation and Characterization of CdS Films Synthesized in Situ in Zirconia Sol− Gel Matrix. Chemistry of materials, 9(11), 2541-2543.) (1997).

[15] Jaleel, Abduladheem Turki. "SURVEY THE PREVALENCE OF VIRAL HEPATITIS A, B, C INFECTION IN DHI-QAR PROVINCE (IRAQ)." *ББК 20.1 А43 Редакционнаяколлегия: ИБ Заводник (отв. ред.), АЕ Каревский, ОВ Янчуревич, ОВ Павлова* (2018): 95.

[15] G.Marti,T.Pongraz ,Rapid Commun ,VOL .4,(1983).