Research Paper

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Optical properties of PMMA Composite with ZnO Polymer Films

Physics

KEYWORDS : FESEM, FTIR, particle size, Polymer composite films, Raman spectra.

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ABSTRACT

The polymer films of PMMA composite with ZnO with various weight percentages are prepared by solution casting method. The films of PMMA and its composites are used for optical absorption studies using UV-vis Spectrometer over the range 200-900 nm. The samples are characterized by using Raman Spectroscopy. The variation of the Raman intensity of composite films of PMMA with ZnO at different weight percentages such as 10-40 weight percentages are studied. The morphological studies of these films have been made by using FESEM.

INTRODUCTION

Developments of Polymer composites and extensive utilization of polymer materials in technology have led to importance in the field of polymer composites and also it is well known that the composites of polymer films exhibit enhanced properties than that of the constituent materials (1-3). The composite materials of polymers are important to the electronic industry for its optical properties and as well for dielectric properties in the use of capacitors (4). The development of polymer based composites which exhibit various optical functionalities such as high/low refractive index, tailored absorption/transmission properties, a strong optical non linearity attracts great interest because of the potential opto-electronic applications. The polymer composites are typically obtained by the incorporation of functional inorganic particles into a transparent polymer matrix. The particle shape and sizes (5) are also obtained in PMMA films and its composites.

EXPERIMENT MEASUREMENTS

The substance of Polymethylmethacrylate (PMMA), ZnO are obtained from S.d. Fine Chem. Ltd, Mumbai, India. The composite films of PMMA with ZnO at different weight percentages such as 10-40 are obtained by mixing of ZnO with the PMMA solution, where the PMMA solution is obtained by dissolving substance of PMMA in acetone. The composite films of PMMA with ZnO are prepared by solution casting method. The studies of optical absorbance and for determination of particle size.

RESULTS AND DISCUSSION

OPTICAL SPECTRA

The optical absorbance for PMMA composite films with ZnO are studied for various weight percentages using UV-vis spectrometer (PC2000 ISA). it is observed that as weight percentage increases the absorbance is also increases. . the maximum absorbance occurred at wavelength of around 600-750 nm. The optical observation curve for mono-dispersed particles should be narrow, while the optical absorption curve of wide size distribution is broad. The single peak absorbance spectra indicates presence of spherical size of the particles.[8] but in Figs 2 we observed the double-peak absorption spectra that lie between 600-800 nm indicate the shape of the particles may be elliptical or cylindrical in PMMA and its composite films. It confirmed through the surface studies using FESEM images and are given in Fig.4.

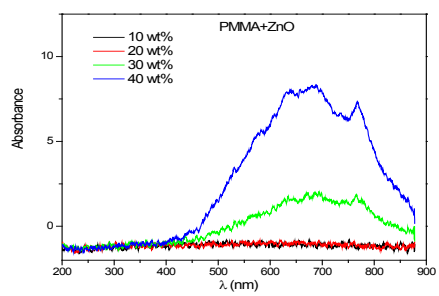


Fig. 2 UV-absorbance spectra of composite films of PMMA with ZnO

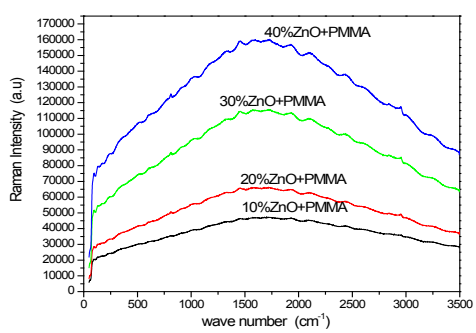


Fig.3.Raman spectra of PMMA film and its composite with ZnO.

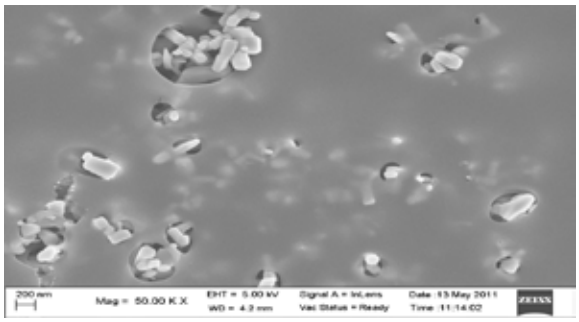
RAMAN SPECTRA

The Raman Spectra for PMMA composite films with ZnO for various weight percentages over the range 0-4000 cm^{-1} are studied using Raman Spectrometer (model spex 14018). Here it is observed that the maximum intensity occurs at around 2800 cm^{-1} PMMA composite with ZnO. . Investigations are carried out on the variation of FWHM of the Raman peak at 2953 cm^{-1} .The Raman bands in PMMA with composite films of Raman bands, the one at 2953 cm^{-1} is the most prominent which is due to the C-H stretching vibration .

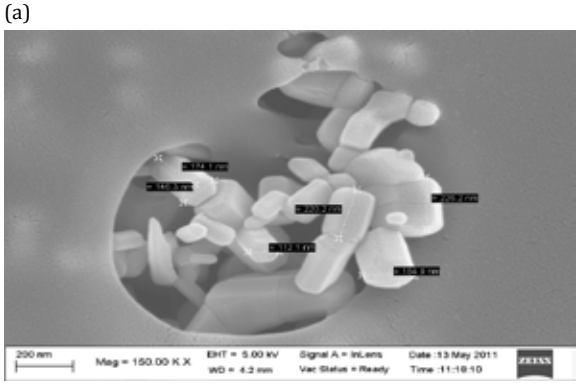
MORPHOLOGY USING FESEM

The morphological studies have been made using the Field Emission Scanning Electron Microscope (FESEM-Hitachi, SU6600) to determine the size of the particles in PMMA composite films with ZnO. The micrographs for PMMA composites for ZnO are given in Fig.4. The composite film of PMMA with

ZnO are 112.1, 146.3, 174.1, 184.9, 220.2, 226.2 at 150 k x magnifications. It also suggests that polymer films of particles formed are non spherical in shape it confirmed by the UV-vis absorbance spectra..



(a)



(b)

Fig. 4.The micrographs for particle sizes in PMMA+ZnO at (a) 50 and (b) 150 k x magnifications

CONCLUSION

The UV-vis spectra shows maxim mum absorbance at 650 nm for all the concentrations and as weight percentage increases the absorbance is also increases. The Raman intensity of composite films increases.. The sizes of the particles obtained by FESEM in PMMA its composites are shown in nano-particle size.

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