Refractive index, band gap and Optical conductivity of PVP doped $K_2Cr_2O_7$ thin films

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1- Introduction

Chalcogenide glasses are good candidates for applications in the infrared (IR) region [1,2].Chalcogenide glasses are vitreous materials having one or more of the chalcogen elements (Group VI): sulfur (S), selenium (Se), and tellurium (Te). The addition of the network formers (Group IV and V) such as silicon (Si), germanium (Ge), tin (Sn), phosphorus (P), arsenic (As), and antimony (Sb) establishes cross-linking between the tetrahedral and pyramidal units which facilitates stable glass formation [3,4]. Depending on the composition, the chalcogenide glasses are stable against crystallization and are chemically inert. They have excellent thermal stability, and are relatively easy to fabricate. In our present work we have taken the SeO_2 powder and then solvent (DMF),put on stirrer for 30 min. The mixed deposited on glass substrate by casting method. The optical properties of the thin films of the prepared samples are calculated using the Absorbance spectrum in the range 250-600nm.

Modern electronic devices, such as thin film transistors, solar cells, active matrix displays and image sensors, possess thin semiconductor layers of hydrogenated amorphous silicon (a-Si:H). For most electronic applications, the optical properties and the thickness d of these films play an important role, in the sense that they govern the device performance. For that aim, ellipsometry is the most appropriate tool [5] due to the fact that it is not influenced by the adopted substrate. Alternatively, for the exist analysis of samples grown on top of transparent substrates like glass, the use of optical transmittance is the most attractive method because optical transmission is a very easy, accurate and nondestructive measure.

The interest in the optical properties of some material compounds containing metal atoms has been established by their optical transmission media, as well as by their use as passivating materials for integrated circuits. It is well known that the optical gap strongly depends on the structure of the compounds [6].

In this paper will be focused on prepared Inorganic thin films on glass, substrates at room temperature using the casting method also will be analysis of physical and optical properties of (SeO_2) inorganic thin films.

2- EXPERIMENTAL

(Se_2) powder , obtained from Merck company. Seo_2 dissolve in (DMF) in concentration (10mg/ml). Structure of the (Seo_2) is shown in Fig. 1.

glass substrate was washer with deionizer water for ten minutes period and then were cleaned in Aston and Ethanol. The thin layers of the (Se2) were deposed by casting method on the glass. To avoid a contamination and defects in thin stratum this process was carried out at room temperature in atmosphere of under atmospheric pressure. beam spectrophotometer (mark CE-7200) was used to measure optical properties of the thin (Seo_2) layer. The absorption (A), measurements was performed at room temperature.

3- Results and discussion

Figure 2 shows the linear absorption spectrum of (Seo_2) at room temperature, from which we can get linear absorption coefficient α_o. The absorption band edge E_g is determined by

$\alpha h\nu = A\ (h\nu - E_g)^{1/2,}$ .... (1)

where $h\nu$ is the incident photon energy, and A is a constant. Nonlinear absorption is a phenomenon that absorption coefficient changes with high intensity. The peak appear at wavelength (320 nm), which is more suitable for spectrum of selenium dioxide (Seo_2) thin films.

For many glassy and amorphous non-metallic materials, the absorption edge can be divided into two regions depending on the value of absorption coefficient a (I) In case of a < 10^4 cm^{-1}, there is usually an Urbach tail [7] in which a depends exponentially on photon energy,

$\alpha = \alpha_o \exp\ (hv\ /\ E_e)$ .... (2)

where α_o is a constant and E_e is the width of the band tail of the localized states in the band gap also called Urbach slope. Fig. 3 shows the variation of In (α) with photon energy In (α) Variations in the width of the exponential region Ee, provide information bout the relative changes of the structural disorder induced by an additive.

Fig. 3 shows the variations of (αhv)1/2 vs. hv The values of indirect band gaps calculated from the graphs and the variation with incident photon energy hv is shown in same figure. The indirect band gap decreased (3.77 eV).

4- Conclusions

The dependence of the absorption coefficient α on photon energy hν was determined in the spectral (3.77 eV) for selenium dioxide (Seo_2) films deposited on glass substrates. The variation of the absorption coefficient and the optical gap Eg on substrate glass are reported. The optical gap is highly dependence on Absorption of (Seo_2) that deposited on substrate. The allowed direct transitions were found to be responsible for inter band transitions. The experimental results indicated that the absorption coefficient for (Seo_2) films deposited on glass substrates exhibits an exponential dependence on photon energy, obeying Urbach rule in the absorption edge[8].

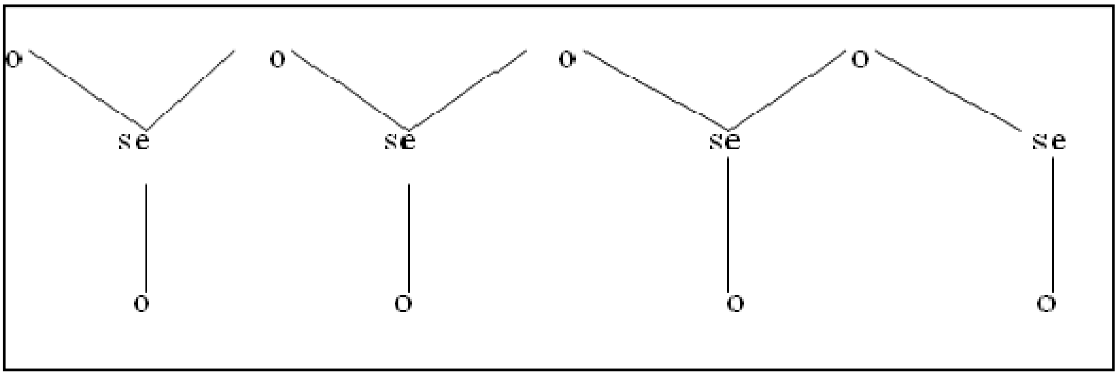

Fig. 1 Structure of the selenium dioxide (SeO_2).

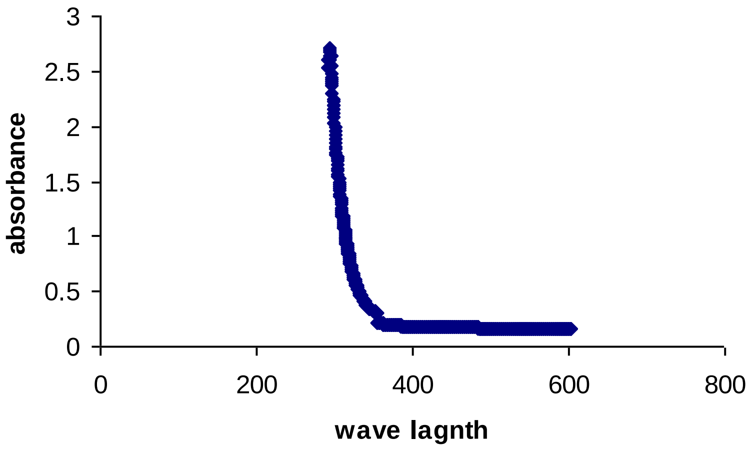

Fig.2 The absorption spectra for not irradiated and irradiated SeO_2 thin films

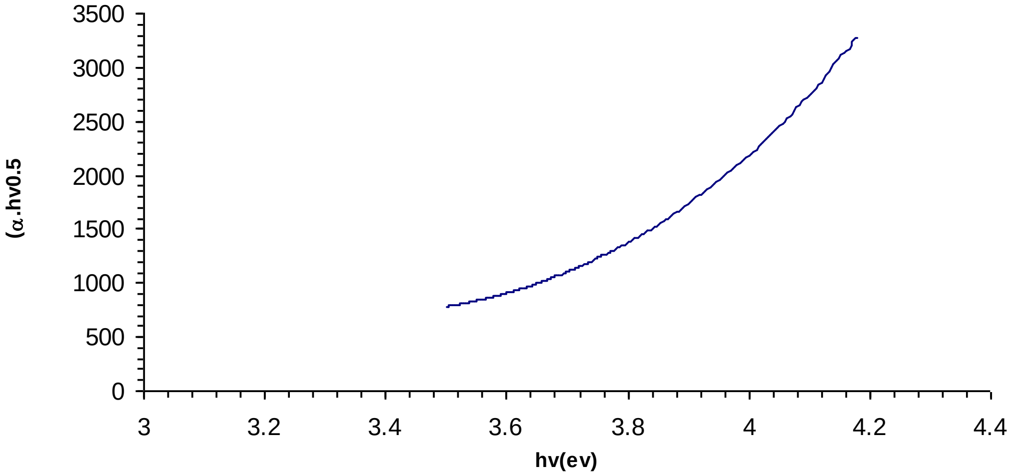

Fig.3 plot of $(\alpha hv)^2$ vs. photon energy near the absorption edge of seo2 thin films.

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