Photoinduced Phenomena in Thermally Evaporated
a-Ge,Se$_{90-x}$ Sb$_{10}$ Thin Films
A.A.Othman$^1$, M.A.Osman$^1$, A.M.Aboschly$^2$, and K.A.Aly$^2$

1 Physics department, faculty of science, Assiut University, Assiut, Egypt, (aadho@yahoo.com).
2 Physics department, faculty of science, Al-Azhr University, Assiut, Egypt

ABSTRACT

Amorphous Ge,Se$_{90}$,Sb$_{10}$ thin films were prepared by thermal evaporation onto glass substrates. Reflectance and transmittance were measured in the wavelength range 190-900 nm. The optical properties of the as deposited and UV-irradiated films at different exposure times were reported. The compositional dependence of the optical constants (absorption coefficient, the non-direct optical gap $E_g$, refractive index ($n$)) were evaluated and discussed in terms of the Ge content.

Keywords: Thermal Evaporation / Photoduced / Optical Bandgap / Refractive Index /
Chemical by Ordered Network

INTRODUCTION

Chalcogenide glass Ge,Se$_{90}$,Sb$_{10}$ films are subjected to many systematic studies because of the changes of their optical, physical, and chemical properties, which occur in these materials after illumination or annealing. These photo and thermally induced effects may be either reversible or irreversible, and offer the possibility of using amorphous chalcogenide semiconductors for technological applications such as high-density information storage, a high resolution display devices and fabrication of diffractive elements [1].

Photo and thermally induced phenomena in amorphous Ge$_{30}$Se$_{70}$Sb$_{10}$ films were investigated by Vlcek et.al [2]. They found that, the changes of optical properties in these films are assigned to the change of homopolar bond densities. Group IV, V and VI (chalcogenide) network glasses, which allow the tuning of structural flexibility by composition display variety of both transient [3] and meta-stable photoduced phenomena including photoproduced darkening [4], photo-bleaching [5] and photo-structural change [6]. Recently photo-bleaching in Ge-Sn-Se thin film was observed by Florescu et.al. [7]. It should be noted that Ge containing chalcogenide glasses undergoes a variety of photoinduced effects. When the as-evaporated film is illuminated by band gap light, it exhibits an irreversible red or blue shift of the optical absorption edge [8].

The aim of the present work is to investigate the changes in the optical properties of Ge,Se$_{90}$,Sb$_{10}$ amorphous chalcogenide thin films, after illumination with above-band gap UV light.

EXPERIMENTAL DETAILS

Films of thickness 200-300 nm were deposited by thermal evaporation with an evaporation rate 10 A$^2$ sec$^{-1}$ in a vacuum of 10$^{-6}$ torr onto cleaned glass substrate. Optical transmittance and reflectance spectra in the visible region (400-900 nm) were measured using Shimadzu 2101 UV-Vis double beam