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Role of Ag additives on light induced metastable defects in Se-In glassy system

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ABSTRACT

Present communication reports the role of Ag additives on light induced metastable defects in Se-In glassy alloys, well known thermally stimulated current (TSC) technique have been used for the present measurements. Amorphous thin films of $Se_{90}In_{10-x}Ag_x$ (x = 0, 2, 4, 8) have been prepared by well known thermal evaporation technique. Measurements have been made in given thin films prior and after exposing amorphous thin films to white light at different exposure times (0 to 1.5 hrs). It is found that the density of light induced metastable defects increases with the exposure time and fractional increase in light induced metastable defect density decreases as Ag concentration increases.

Keywords: Thin films; light induced metastable defects; thermally stimulated current

1. Introduction

Chalcogenide materials are intrinsically metastable because attaining no long rang order and the structure can be changed easily from one metastable to other due to structural flexibility. The most interesting property of these materials is their affectability of light illumination and therefore these materials show variety of light induced effects during light illumination [1, 2]. These light induced effects may be due to change in the volume, optical constants, optical band gap, refractive index, optical absorption coefficient and density. These effects are mainly, photo induced anisotropy [3], photo crystallization [4], photo contraction [5], photo expansion [6], photo volumetric changes [7] and photo induced amorphization [8], photo vaporisation [9], photo diffusion [10] and photo polymerisation [11], photo darkening [12], photo bleaching [13], change in elastic constants [14], photodecomposition [15]. Some of these light induced effects are due to light induced metastable defects. Therefore the study of these defects is a very interesting problem in the case of chalcogenide glassy semiconductors.

Recently Se based chalcogenide glasses are important from research and application point of view. Many researchers [16-18] have also found that Se based glasses are more useful as compare to pure Se due to their higher photosensitivity, greater hardness, higher crystallization temperature and lower aging effect. Matsushita et al. [18] have observed that Se-In binary glassy system has great interest as their potential applications in solar cells. It has been also reported by various workers that in Ge-Se and Se-In glassy systems, some metallic additives are found to change conduction from p-type to n-type [19]. Therefore the study of above mentioned glassy systems are of great importance.

Frumar and Wagner [20] have reported that Ag containing chalcogenide glasses change the electrical conductivity of the glasses by several orders of magnitude. The electrical,