Philosophical Magazine, 2015
Vol. 95, No. 22, 2385–2402, http://dx.doi.org/10.1080/14786435.2015.1059518

Effect of ^{60}Co γ-irradiation on structural and optical properties of thin films of $Ga_{10}Se_{80}Hg_{10}$

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(*Received 21 March 2015; accepted 1 June 2015*)

Thin films of $Ga_{10}Se_{80}Hg_{10}$ have been deposited onto a chemically cleaned Al_2O_3 substrates by thermal evaporation technique under vacuum. The investigated thin films are irradiated by ^{60}Co γ-rays in the dose range of 50–150 kGy. X-ray diffraction patterns of the investigated thin films confirm the preferred crystallite growth occurs in the tetragonal phase structure. It also shows, the average crystallite size increases after γ-exposure, which indicates the crystallinity of the material increases after γ-irradiation. These results were further supported by surface morphological analysis carried out by scanning electron microscope and atomic force microscope which also shows the crystallinity of the material increases with increasing the γ-irradiation dose. The optical transmission spectra of the thin films at normal incidence were investigated in the spectral range from 190 to 1100 nm. Using the transmission spectra, the optical constants like refractive index (n) and extinction coefficient (k) were calculated based on Swanepoel's method. The optical band gap (E_g) was also estimated using Tauc's extrapolation procedure. The optical analysis shows: the value of optical band gap of investigated thin films decreases and the corresponding absorption coefficient increases continuously with increasing dose of γ-irradiation.

Keywords: thin films; γ-irradiation; structural properties; optical properties

1. Introduction

The study of new materials whose properties can be tailored made constituent, the core development of various device technologies. In the last several decades, compound semiconductor gains more interest of researchers because they have different properties than that of elemental semiconductors such as silicon and germanium. They thus end up covering a very wide range of fields, including displays, [1] sensors [2] microwave communication, [3] solar cells, [4] photodetectors, [5] laser diodes operating in the blue or ultraviolet spectral range, [6] infrared and visible LEDs [7] based on the photoemission characteristics and so on. However, the potential applications of compound semiconductors in the field of high-efficiency power devices, demonstrates their impact on energy and environment. Compound semiconductor based photovoltaic devices are emerging as an economical means of generating renewable energy through the use of concentrator technologies. Single crystalline silicon-based solar cells enhance the

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