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Effect of laser irradiation on structural and optical properties of thermally evaporated thin films of amorphous $Cd_5Se_{95-x}Zn_x$

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Thin films of $Cd_5Se_{95-x}Zn_x$ ($x = 0, 2, 4$) were deposited by a thermal evaporation technique on glass substrates. These films were irradiated by pulsed laser at different durations of time. Laser irradiation of $Cd_5Se_{95-x}Zn_x$ ($x = 0, 2, 4$) was accompanied structural changes which in turn leads to the change in optical properties of the material. The X-ray diffraction pattern of $Cd_5Se_{95-x}Zn_x$ ($x = 0, 2, 4$) shows that the grain size increases due to the addition of Zn and decreases after laser irradiation. It was also found that the value of dislocation density increases after laser irradiation. The surface morphology of laser-irradiated thin films of $Cd_5Se_{95-x}Zn_x$ ($x = 0, 2, 4$) shows that the disorderness or defects are produced due to laser irradiation. Energy dispersive X-ray spectroscopy confirms the elemental composition of the ternary alloy of $Cd_5Se_{95-x}Zn_x$ ($x = 0, 2, 4$). The optical constants of $Cd_5Se_{95-x}Zn_x$ ($x = 0, 2, 4$) were calculated from optical transmission spectra. The value of optical band gap increases after laser irradiation and decreases due to the addition of Zn.

Keywords: thin films of $Cd_5Se_{95-x}Zn_x$ ($x = 0, 2, 4$); laser irradiation; structural properties; optical properties

1. Introduction

Chalcogenide materials are basically amorphous compositions and derived from column six of the periodic table (*i.e.* S, Se and Te). In the last three decades, much interest has been paid for the development and characterization of these chalcogenide materials. Chalcogenide semiconductors are wide band gap semiconductors having wide band gap energy ranging from 1 to 3 eV and are promising materials for use in optical elements such as optical recording media (*1*), gratings (*2*), IR detector, IR emitter, tunable lasers, etc. (*3*–*7*). Among these chalcogenides semiconductors, Se-based and amorphous-based chalcogenides are preferred for many optical memory device applications because of their unique property of reversible transformation. Pure selenium has many disadvantages such as low photosensitivity and short life time. To overcome these disadvantages different additivities have been used. The addition of group (II) materials to Se (IV) has attracted considerable attention because of their potential applications in optoelectronics, thermoelectric and photoelectric diodes (*8*–*10*). The properties of these chalcogenide semiconductors are modified by using different techniques such as swift heavy ion irradiation (*11*), γ-ray irradiation (*12*), laser irradiation (*13*) and annealing (*14*) for

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