Structural and optical properties of Te doped Ge-Se phase-change thin films: A material for optical storage

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Abstract

Amorphous Ge25Se75-xTex chalcogenide thin films of thickness 400 nm were prepared by thermal evaporation technique. Thin films were crystallized by transversely-excited atmospheric-pressure nitrogen laser for different time intervals. As-prepared and laser-irradiated thin films were characterized by X-ray diffraction, field emission scanning electron microscopy and UV/VIS/NIR spectroscopy. X-ray diffraction results show that the as-deposited films are of amorphous nature while the laser-irradiated films are of polycrystalline nature. The optical absorption spectra of these films were measured in the wavelength range of 400-1100 nm in order to drive the extinction and absorption coefficient of these films. It was found that the mechanism of the optical absorption follows the rule of the allowed non-direct transition. The optical band gap is found to decrease by increasing the laser-irradiation time. It is due to the crystallization of amorphous films. As the phase of the films changes from amorphous to crystalline, a non sharp change of the band gap is observed. The decrease in optical band gap by laser-irradiation is an interesting behavior for a material to be used in optical storage. The optical gap has been observed to increase with the increase of Te content in Ge-Se system. (C) 2013 Elsevier Ltd. All rights reserved.

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