Effects of laser irradiation on optical properties of amorphous and annealed Ga$_{15}$Se$_{81}$In$_4$ and Ga$_{15}$Se$_{79}$In$_6$ chalcogenide thin films

A.A. Al-Ghamdi$^a$, Shamshad A. Khan$^{a,*}$, S. Al-Heniti$^a$, F.A. Al-Agela$^a$, T. Al-Harbi$^a$, M. Zulfequarb$^b$

$^a$ Department of Physics, Faculty of Science, King Abdul Aziz University, Jeddah 21589, Saudi Arabia
$^b$ Department of Physics, Jamia Millia Islamia, New Delhi 110025, India

**ABSTRACT**

Amorphous thin films of Ga$_{15}$Se$_{81}$In$_4$ and Ga$_{15}$Se$_{79}$In$_6$ glassy alloys with thickness 3000 Å were prepared by thermal evaporation onto chemically cleaned glass substrates. The changes in optical properties due to the influence of laser radiation on amorphous and thermally annealed thin films of Ga$_{15}$Se$_{81}$In$_4$ and Ga$_{15}$Se$_{79}$In$_6$ were calculated from absorbance and reflectance spectra as a function of photon energy in the wave length region 400–1000 nm. Analysis of the optical absorption data shows that the rule of non-direct transitions predominates. The optical band gaps observed to decrease with the increase of annealing temperatures. Furthermore, exposing thin films to laser irradiation leads to a decrease in optical band gap, absorption coefficient, refractive index and extinction coefficient for both as-prepared and annealed films. The decrease in the optical band gap is explained on the basis of change in nature of films, from amorphous to polycrystalline state, with the increase of annealing temperature and by laser irradiation for 10 min exposure time. Outcomes of our study confirm that this system may be used for photovoltaic devices.