Structural and optical properties of gamma irradiated cugao2 thin film deposited by radio frequency (rf) sputtering

ABSTRACT

In space, semiconductor devices are vulnerable to various effect of high energy level of radiation causing single event upsets (SEU), damaging or altering the lattice structure. In this work, p-CuGaO2 was selected due to its relatively wide bandgap and a visibility transmittance up to 80% as a potential semiconductor material capable of withstanding harsh radiation environment. p-CuGaO2 thin films were deposited by RF powered sputtering on indium tin Oxide (ITO) substrates at 2500C deposition temperature and annealed at 300 oC. Structural morphology and optical properties of CuGaO2 thin film were investigated before and after irradiation. The samples were irradiated using Cobalt-60, gamma-ray with a dose ranging from 10 kGy-200 kGy. The structural properties reveal that the CuGaO2 films shows a diffraction peak at 2θ=38.0510 (012) before irradiation. The optical properties of deposited CuGaO2 thin film, exhibits approximately 75% optical transmittance in the invisible region at pre-irradiation and post-irradiation results shows a decrease of optical transmittance of 55%. At a dose of 200 kGy, the band gap of CuGaO2 is 3.62 eV which indicates that it is still within the acceptable range of a semiconductor properties. Early results of CuGaO2 shows good mitigation towards irradiation thus indicating that CuGaO2 thin film is capable of withstanding harsh radiation environment while retaining its semiconductor properties.