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Investigation of CdCl2 treatment effect on polycrystalline CdTe films for large area medical X-ray imaging detectors

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In recent years, direct detection X-ray imaging detectors using a photoconductor and an array of storage capacitors (TFT) have been researched and used in various medical applications such as chest radiography, mammography and fluoroscopy imaging. As an alternative to amorphous selenium (a-Se) material with low atomic number and high ionization energy, the various heavy photoconductor materials such as lead iodide (PbI2), mercury iodide (HgI2), lead oxide (PbO) and cadmium telluride (CdTe) or cadmium zinc telluride (CdZnTe) have been researched for the possible medical application. Among many photoconductors, CdTe/CZT direct-conversion material has been considered and developed as an attractive candidate for high energy X-ray imaging application requirements. In this work, a large effort has been implanted in order to improve the previous experimental result and performances. Different polycrystalline CdTe films on ITO/glass substrate were fabricated by physical vapor deposition (PVD), closed space sublimation (CSS) method and vapor transport deposition (VTD). The various polycrystalline CdTe films were grown by using optimal process conditions such as deposition rate, substrate temperature and post heat-treatment. Physical properties such as microstructures, surface morphology and crystal structure of the polycrystalline samples were characterized by SEM, AFM and XRD pattern respectively. In addition, CdCl2 post-treatment was in order to investigate the effects of structural and electrical properties of polycrystalline CdTe films. The polycrystalline CdTe films were immersed in a saturated solution of CdCl2 and then treated at 400℃ for 30 minute in the furnace under ambient N2 condition. The morphology of surface and grain boundary of the CdTe films with and without post CdCl2 heat-treatment were characterized. Furthermore, the electrical properties such as the dark current as a function of applied voltage, X-ray sensitivity were measured and investigated through practical X-ray exposure. The physical and electrical results of the fabricated CdTe films will be presented in detail.

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