Contribution ID: **93** Type: **POSTER**

Structural and electrical properties of polycrystalline CdTe films for direct X-ray imaging detectors

Thursday 6 September 2012 15:10 (1 hour)

In recent years, direct conversion flat-panel X-ray imaging detectors have been researched and used in various medical applications such as chest radiography, mammography and fluoroscopy imaging. In direct detection method, an X-ray photoconductor is used as a conversion material to transform the absorbed X-ray photons to electrical charge, which carries the corresponding signal. In addition to amorphous selenium, the various photoconductor materials such as lead iodide (PbI2), mercury iodide (HgI2), lead oxide (PbO) and cadmium telluride (CdTe) or cadmium zinc telluride (CdZnTe) have reported the significant potential. Among many photoconductors mentioned, CdTe direct-conversion material has been considered as very an attractive candidate for high energy X-ray imaging application.

In this work, polycrystalline CdTe films were fabricated on ITO/glass substrate by both physical vapor deposition (PVD) with slow deposition rate and pressure of 10-6 torr and closed space sublimation (CSS) method with high deposition rate and low vacuum pressure(10-3 torr). The various polycrystalline CdTe films were grown by different deposition rate, substrate temperature, annealing condition. Physical properties such as microstructures, crystal structure of the polycrystalline samples were investigated by SEM and XRD pattern respectively. The microstructures with columnar shape and more uniform surface were observed in PVD method. On the other hand, the microstructures with many larger grains and less uniform surface were shown in CSS method. The films were polycrystalline structure with preferential (111) direction. The electrical properties such as the dark current as a function of applied bias, X-ray sensitivity and signal-to-noise ratio (SNR) of the fabricated films were measured and investigated under X-ray exposure condition. The obtained experimental results will be presented in detail.

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Session Classification: Poster session

Track Classification: X-ray imaging applications - Medicine