Laminate structure detectors for low dark current with photoconductors in digital X-ray imaging

Kyungmin Oh1, Minwoo Kim1, Seunguk Heo1, Minseok Yun1, Chol Kwon1, Chiwon Choi2, Sungho Cho1, Sanghee Nam1

Radiation Image Lab., Inje University, Gimhae 621-748, Korea1
Radiation Vatech&E-Woo Technology Co.,LTD. 473-4, Bora-Dong, Gihung-Gu, Youngin-Si, Gyeonggi-Do 446-904, Korea2

INTRODUCTION

Digital radiography with detector offers the potential of high efficiency as well as providing improved image quality in medical management. Flat panel x-ray detectors fabricated by Particle-In-Binder (PIB) process have been recently researched in medical x-ray imaging applications. Although Detectors for digital radiography coated by Particle-In-Binder (PIB) process provide high sensitivity in x-ray exposure, the dark current is a quite high for practical use in medical devices. To decrease the dark current and improve the efficiency of detectors, we investigated the potential for flat panel X-ray detector with a laminate structure including a plurality of metal halide films. The experiment was progressed by laminating hexagonal lattice matched metal halide photoconductive layers and adjusting Fermi level to have a different band gap. Also characteristics of film samples with laminate structure like dark current, sensitivity, signal to noise ratio(SNR) and signal lag are investigated.

Experimental Method

1. Fabrication of film sample

2. Measurement of Morphological & Electrical properties

Morphological properties | Electrical properties
---|---
SEM, XRD, Surface uniformity | Dark current, Sensitivity, Signal to noise ratio, Signal lag

CONCLUSION

- The possibility of reduction of dark current was ensured using a lamination structure of photoconductor used as direct method in Digital radiography.
- Due to the reduction of dark current, SNR(signal to noise ratio) improved. Also the possibility of using a digital radiation detector for vivid medical image was ensured.
- For future work, the various electrodes which have hexagonal FCC, BCC structure will be deposited as top electrode by considering lattice parameters.

Results

- Structural and morphological properties of fabricated films were measured by Scanning Electron microscopy(SEM). Also using X-ray diffraction(XRD), the orientation of grain and material properties were evaluated.

Figure. 4 SEM micrographs of top view and cross section of the double layer

Figure. 5 XRD results of double layer detector fabricated with PIB method

- Electrical properties of fabricated films were evaluated by measuring Dark current, sensitivity, signal to noise ratio and signal lag at the range of operation voltage.

Figure. 6 The dark current, sensitivity, SNR(signal to noise ratio) and signal lag as a function of applied voltage