University of Victoria | Graduate Studies

Notice of the Final Oral Examination for the Degree of Master of Applied Science

of

NILOOFAR SADEGHI

BSc (University of Tehran, 2012)

"The Effect of Crystal Defects on the Performance of High-flux CZT X-Ray Detectors"

Department of Electrical and Computer Engineering

Tuesday, September 22, 2015
2:00 P.M.
Engineering Office Wing
Room 430

Supervisory Committee:
Dr. Tao Lu, Department of Electrical and Computer Engineering, University of Victoria (Supervisor)
Dr. Chris Papadopoulos, Department of Electrical and Computer Engineering, UVic (Member)

External Examiner:
Dr. Alexandre G. Brolo, Department of Chemistry, UVic

Chair of Oral Examination:
Dr. Justin Albert, Department of Physics and Astronomy, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Cadmium Zinc Telluride (CZT) has been the most promising semiconductor material and an important research topic for many years. Due to its high atomic number, suitable band-gap energy and ability to function at room temperature, CdZnTe has become the material of choice to be used as a room temperature radiation detector for many applications in the fields of medical imaging, process monitoring and national security.

The high demands and specifications set by each of the applications require that these detectors can operate well at the extreme conditions while maintaining good resolution, high detection efficiency, good reliability and high throughput.

In most applications, detectors are exposed to high flux of X-ray radiation. One of the most common issues is the degradation of these detectors and the poor performance due to the presence of extended and point defects, which can act as traps for the charge carriers. This charge trapping causes the build-up of space charge and disturbing the electric field, resulting incomplete charge collection and signal formation of the detectors.

This thesis investigates the associated failure modes by identifying the types of defects that exist in the CZT crystal and studies their roles in the performance of X-ray radiation detectors using in-house diagnostic tools. The results from different screening methods are compared and studied in order to find meaningful relationships and correlations that will help researchers to better understand the underlying physics and give information and means for correction and improvements of the crystal quality.