Contribution ID: **148** Type: **Poster**

Defect detection and size classification in CdTe detector samples in 3D

Wednesday 3 July 2024 14:26 (1 minute)

Defects in CdTe crystals can have great detrimental effects on their performance as radiation detectors [1]. Defects cause charge trapping and recombination, leading to lower signal amplitudes and poor enegy resolution. We have designed and built a modular 3D scanner for analyzing these defects device samples using commercial off-the-shelf (COTS) components. Previous solutions offer great spatial resolution, but have limited sample holding capacity, use continuum light sources which can have difficulty differentiating between different materials within samples[2]. Our design also includes a modular sample holder allowing for easy changing of samples. In this presentation, we will showcase first results achieved with this custom built scanner as well as planned developments.

The base of the scanner is a commercial desktop CNC milling machine, modified by replacing the spindle with custom made sample holder and fixing a light source and a camera below and above the sample holder respectively. In the current version, the light source is a lab made infrared LED module with adjustable brightness which can be easily replaced to change the scanning wavelength which allows scanning different material samples. The current maximum resolution of the system is 3µm, determined using a USAF1951 optical standard [3]. A sample image from a scan of a CdTe sample is shown in Fig. 1, demonstrating a typical image produced by the system. Using OpenCV, we can extract the locations and sizes of defects in samples. We demonstrate a technique to remove duplicately detected defects from overlapping scan images and identifying the depth of a detected defect, allowing a full 3D reconstruction of the defect locations within the sample and estimating a size distribution. A small section of the 3D defect distribution of the CdTe sample is shown in Fig. 2.

In upcoming versions, the light source will be a collimated LED panel. This will eliminate some optical effects, and creates a uniform backlight. The 3D defect location algorithm will also be improved and other techniques for detecting the locations will be tested, especially for detecting larger defects like grain boundaries and twinning. The sample holder will also be further developed to allow scanning of larger samples and possibly even full wafers.

Author: Mr VÄÄNÄNEN, Mika (LUT University (FI))

Co-authors: Dr KALLIOKOSKI, Matti (Helsinki Institute of Physics (FI)); BEZAK, Mihaela (LUT University (FI)); Mr KRIGSMAN, Matias (The Finnish School of Watchmaking (FI)); Mr TURPEINEN, Raimo (Helsinki Institute of Physics (FI)); Dr KARJALAINEN, Ahti (LUT University (FI)); Dr KARADZHINOVA-FERRER, Aneliya (LUT University (FI)); LUUKKA, Panja-Riina (LUT University (FI))

Presenter: Mr VÄÄNÄNEN, Mika (LUT University (FI))

Session Classification: Poster Session