AbstractID: 13939 Title: X-ray spectroscopy with a room temperature CdZnTe detector

Purpose: To investigate room temperature CdZnTe detectors for x-ray spectroscopy. **Method:** X-ray spectroscopy with accurate, simple, and room temperature detectors are of interest. The CdZnTe semiconductors are recognized as a good candidate. However, CdZnTe detectors suffer from hole trapping and spectral tailing which is unstable and difficult to correct. We investigated two CdZnTe detectors with different configurations for x-ray spectroscopy. A 1x1 cm^2 planar detector with 3 mm thickness and a 5x5x5 mm^3 capacitive grid detector were used. Tilted angle irradiation was used to decrease hole trapping. Spectra were first acquired from isotopes sources ^{241}Am, 59.5 keV, and ^{57}Co, 122 keV. Each source was measured at normal and tilted angle incidence of radiation and peak-to-total ratios were compared. X-ray spectra were acquired at 40, 60, 80, 100, and 120 kVp tube voltages. Monte Carlo calculations were used to simulate Cd and Te K x-ray escape from CdZnTe. The measured x-ray spectra were corrected for K x-ray escape using the stripping procedure. The corrected x-ray spectra were then compared to theoretical spectra simulated using published methods and verified software. **Results:** It was shown that tilted angle irradiation can virtually eliminate hole trapping and spectral tailing thus increasing peak-to-total ratios by more than 40% and 130% for 59.5 and 122 keV photons, respectively. X-ray spectra showed major improvement with tilted angle irradiation. The capacitive grid detector has shown overall better performance compared to planar detector. **Conclusion:** Tilted angle of the x-ray beam with respect to the detector surface virtually eliminates hole trapping and spectral tailing. Tilted angle increases K x-ray escape, however, this can be simulated with high accuracy and corrected for, while hole trapping is not stable and difficult to correct. The capacitive grid detector has shown better performance in tilted angle configuration due to its inherently higher energy resolution.