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A study on CdZnTe high-flux radiation detector

Cd0.9Zn0.1Te(CZT) as room temperature radiation detector materials has a great potential in photon counting applications, which could achieve multi-energy photon imaging. However, the development of CZT suffers from the large counting rate caused degradation of detectors, where the mechanism was not fully recognized yet. This study focuses on the photocurrent characterization of the CZT detectors under large counting rate. The value of CZT detector' s photocurrent was evaluated by using a home-designed high flux X-ray system, where the current of the X-ray tube raise from 0.01mA to 0.6mA. For both high and low counting rate detectors the photocurrent was found to be linear related with the X-ray tube current, which proved that the low counting rate detector was not in polarization. Then we discovered that the photocurrent stability was strongly related with detector' s counting rate limitation. After a period of study, the electrode injection of CZT detector was determined to be the key factor to time stability of the photocurrent and thus the limitation of the detector' s counting rate. Fabrication process was accordingly improved. CZT linear detector with 1*32 array was successfully obtained, where the counting rate increased from 1×105/(mm2*s) to 5×106/(mm2*s), and multi-energy photon imaging was presented. Our work illustrated that the photocurrent provides important reference for understanding the mechanism of CZT detectors under high-flux radiation.

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