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Investigation of Platinum contacts on High-Flux CdZnTe

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With the rise of 4^{th} Generation Synchrotron Light Sources such as the Extremely Brilliant Source (EBS) of the ESRF, the need for direct X-ray detection under high photon flux with moderate to high energies ($30-100\ keV$ range) has increased. Moreover, multiple medical imaging companies that build prototypal Computed Tomography (CT) scanners need to innovative material able to withstand to extremely high photon fluxes. One of the candidate materials for these applications is Cadmium Zinc Telluride (CdZnTe or CZT). Thanks to its high atomic number ($Z = 50$) and its bandgap value ($1.57\ eV$), the CZT allows to realize spectroscopic detector able to operate at room temperature and with high stopping power also with high energy radiation (5 mm of CZT can absorb $> 99\ \%$ of $100\ keV$ photons). Furthermore, the novel CZT material developed by Redlen for high-flux applications (HF-CZT) seems promising as it limits the polarizing phenomena observed in standard CZT under high photon flux.
However, the novel high-flux CdZnTe showed a different behavior with respect to the standard grade when combined with gold electroless contacts. While they typically resulted in blocking contacts with very low dark leakage current on standard low-flux CZT, they led instead to high leakage current even at low biasing on high-flux material.
In this work, a detailed study on the behavior of platinum and gold contacts is shown. The behavior of several HF-CZT sensors with different contact configuration (Au/Au, Au/Pt, Pt/Au, Pt/Pt) has been investigated using current-voltage characteristics in dark and under X-ray irradiation, as well as gamma-ray spectroscopy. The linearity of Au/HF-CZT/Pt sensors under high X-ray fluxes up to $10^{11}\ photons/mm^2/s$ has been demonstrated. In addition, the morphology of the Pt/CZT contact has been investigated by means of Transmission Electron Microscopy (TEM) in order to reveal the microscopic peculiarity of this contact with respect to the standard Au/CZT contact. Results of these characterizations will be presented in this work.

Summary

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