

Characterization of Redlen high-flux CdZnTe

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The Keck-PAD was developed at Cornell as a burst rate imager capable of recording images from successive electron bunches (154 ns period) from the Advanced Photon Source (APS) [1]. Both Si and hole-collecting Schottky CdTe have been successfully bonded to this ASIC and used with this frame rate. The facility upgrades at the APS will lower the bunch period to 77 ns, which will require modifications to the Keck-PAD electronics as well as necessitating a high-energy sensor material which has a shorter charge collection time. For the target energy of 40 keV for this project, simulations have shown that electron collecting CdTe should allow > 90% charge collection within 35 ns. We have obtained 750 μ m thick electron-collecting Schottky CdTe from AcroRad and bonded it to two different charge-integrating ASICs developed at Cornell (CU-APS-PAD "MM-PAD-2.1" [2] and the Keck-PAD). Carrier mobility has been investigated using the detector response to single x-ray bunches at the Cornell High Energy Synchrotron Source and to a pulsed optical laser. The material has also been characterized for other detector properties such as polarization, resolution and uniformity. The tests indicate that the collection time will meet the requirements for 77ns imaging.

[1] J. Becker, M.W. Tate, K.S. Shanks, H.T. Philipp, J.T. Weiss, P. Purohit, D. Chamberlain and S.M. Gruner, Sub-microsecond x-ray imaging using hole-collecting Schottky type CdTe with charge-integrating pixel array detectors, JINST 12 (2017) P06022.

[2] D. Gadkari, K.S. Shanks, H. Hu, H.T. Philipp, M.W. Tate, J. Thom-Levy, and S.M. Gruner, Characterization of 128x128 MM-PAD-2.1 ASIC: A Fast Framing Hard X-Ray Detector with High Dynamic Range, JINST 17 (2022) P03003.

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