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CdTe pixel detector development for synchrotron radiation experiments

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This study describes a CdTe pixel detector development for the next generation high energy X-ray diffraction experiments at synchrotron radiation facilities. In such applications, a high stopping-power semiconductor material for the sensor and an X-ray photon counting capability for the ASIC are required. A Custom-designed ASIC (SP8-02) has been developed with TSMC 0.25 micron CMOS process, where each pixel has a preamplifier, a shaper, a window comparator, and a 20-bit counter. The analog circuit was characterized with a fast setting of 100 nsec and a dynamic range from 10 keV to 100 keV. The window comparator has advantage to avoid electric noise and fluorescent X-ray background by the lower threshold and higher-harmonics beam contamination by the upper threshold. We have fabricated a Pt/CdTe/Al-pixel sensor performing a Schottky diode detector with the electron-readout operation. This electrode-metal configuration realized a low leakage current and a long-term stability in near room temperature. The sensor was bump-bonded to the ASIC by the gold-stud bonding. The presentation will describe the features of SP8-02 and SP8-02B ASICs forming the 200 um x 200 um pixel size with the 20 x 50 matrix. The Pt/CdTe/Al-pixel sensor performance will be also discussed in comparison with Pt/CdTe/Pt-pixel and In/CdTe/Pt-pixel sensors.

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