Contribution ID: **126** Type: **Oral presentation**

Cadmium Telluride pixel sensor development for high sensibility X-ray imaging device

Monday, 4 July 2011 17:00 (20 minutes)

Single X-ray photon counting pixel detector was expected to be a next generation 2D X-ray detector from the early stage of the third generation synchrotron radiation facilities. In fact, silicon-based hybrid pixel detectors such as PILATUS became commercially practical. To improve the detection sensibility in the high energy X-ray region, cadmium telluride (CdTe) is regarded as a promising semiconductor sensor material because of its high density and high atomic number. Therefore, we are developing CdTe-based pixel sensors and their readout ASICs for synchrotron radiation application.

We have investigated three-type electrode configurations of the ohmic contact structures on both sides with platinum electrodes (Type-1), a Schottky contact with an indium common electrode on the front side (Type-2), and a Schottky contact with aluminum electrodes on the pixel side (Type-3). Type-2 is operated in the hole-collection mode. On the other hand, Type-3 is operated in the electron-collection mode. Type-3 is expected to realize much superior performance because of the higher mobility of electrons than holes.

We designed and fabricated a prototype of a CdTe pixel detector (SP8-01). The format was 16 pixels × 16 pixels with a pitch of 200 μm × 200 μm. The sensor thickness was 500 μm. A full-custom ASIC with TSMC 0.25 μm technology was designed as a readout circuit, which is equipped with a preamplifier, a shaper, a window-type discriminator and 20-bits counter. The sensors were bump-bonded to the ASIC chips by a gold-stud bonding technique.

Operation temperature dependence study was performed by placing the type-3 prototype in a thermostatic chamber. The temperature was controlled at -20, -10, 0, 10 and 20 degree and the detector was irradiated with X-rays from 241-Am radio-isotope. Charge collection and energy resolution characters were examined by continuous threshold scans. The performance deteriorated in a short time and discontinuity behavior happened at 20 degree. On the other hand, the detector attained a long-term stable operation at lower temperatures.

We submitted the next step SP8-02 prototype with the same architecture for ASIC, but with the pixel format of 50 × 20. We could not achieve any valuable result for ohmic and indium-Schottky sensors in SP8-01 because of vendor failures in processing the In/Au stud bonding unfortunately. Three type sensors will be processed to try again in SP8-02.

Primary author: Dr TOYOKAWA, Hidenori (Japan Synchrotron Radiation Research Institute)

Co-authors: Dr SATO, Goro (Institute ofSpaceandAstronauticalScience,JAXA); Dr IKEDA, Hirokazu (Institute ofSpaceandAstronauticalScience,JAXA); Mr KAWASE, Morihiro (Japan Synchrotron Radiation Research Institute); Dr TAKAHASHI, Tadayuki (Institute ofSpaceandAstronauticalScience,JAXA); Ms HIRONO, Toko (Japan Synchrotron Radiation Research Institute); Dr OHATA, Toru (Japan Synchrotron Radiation Research Institute); Dr FURUKAWA, Yukito (Japan Synchrotron Radiation Research Institute)

Presenter: Dr TOYOKAWA, Hidenori (Japan Synchrotron Radiation Research Institute)

Session Classification: Sensor Materials, Device Processing & Technologies II

Track Classification: Sensor Materials, Device Processing & Technologies