Wavelength Dependence of Diamond Detector for X-ray Beam Position Monitor

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Diamond is promising as a base material of a detector head for a X-ray beam position monitor(XBPM) because of its excellent thermodynamical and electrical properties. We have been developing an area type XBPM which is operating in photo-conduction mode. Our goal in this experiment is to know the wavelength dependence of the detective efficiency and other fundamental properties. We designed and prepared the sample of the detector head for test measurements at BL01B1. Figure 1 shows the schematic view of the test sample. The size of this sample is 20mm × 40mm × 0.24mm. A pair of aluminum electrodes is place on the both sides of the CVD diamond. One electrode is for signal reading, and another is for applying bias voltage. The top part of the CVD diamond sample is for heat contact. This sample was installed in the vacuum chamber which has two stepping motors for horizontal and vertical motion. The typical pressure of this chamber is about 10^{-5} Pa.

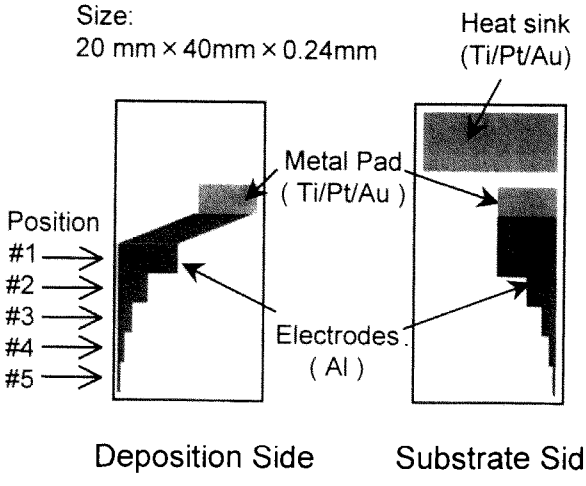

Figure 1 Schematic View of the CVD Diamond

The sample was mounted in two ways. One is to be set perpendicularly with the monochromatic beam to see the performances as a transmitting photo-conduction type. Another is to be set in parallel with the beam to see the performances as a blade photo-conduction type. There are five spots which have various effective thickness(0.5, 1, 2, 4, 8mm). We have carried out following tests during this beam time.

(a) Stability and response on the beam dose. We have observed the relatively slow rising time. This is because of poor quality of the base material.

(b) Bias voltage dependence. Figure 1 shows the result of the measurement with the sample set in parallel with the beam. As an effective area is thicker, the signal is increasing. We think that a blade photo-conduction type can be a candidate of XBPMs.

(c) Wavelength dependence. We have measured the wavelength dependence of the detective efficiency. Further analysis is in progress.

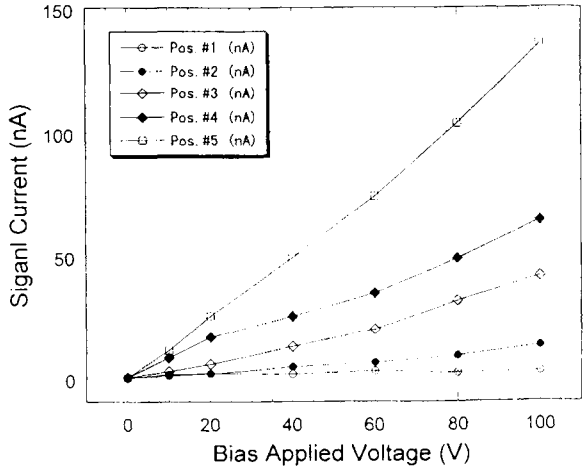

Figure 2 Bias Voltage Dependence of Signal Current