Facility for temperature dependent XAFS at BL10XU

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Rapid and sensitive XAFS provides us opportunities to investigate not only the dilute limit in a *static* sense but also *dynamical* aspects of the local structure associated with excitation. Indeed "pump and probe" XAFS technique is a promising tool for understanding the lattice distortion, relaxation and in some case atomic rearrangements induced by electronic or magnetic excitation. As demonstrated by a recent application to local melting phenomena at low temperature, i.e., photo-melting, this technique can have a potential to investigate the local structure snapshot if a tunable X-ray undulator is used with a high-efficiency fluorescence detector.

In this report, we describe the design and performance of the monolithic Ge pixel array detector designed for high-brilliance XAFS at BL10XU of SPring-8. Undulator gap and a fixed-exit double crystal monochromator with a rotated-inclined geometry were successfully controlled to cover a wide energy range (5-25 keV). Details are given in the separate report (1998A0292-NX). For high efficiency fluorescence data acquisition, pure Ge and Si(Li) 100-pixel arrays have been fabricated in a monolithic fashon, i.e., integrated on one wafer. Cooled penta-FETs were integrated on a circuit board and mounted on a cold finger, having a good electronic contact with a crystal. Preamplifiers were mounted in the other end of endcap. In a monolithic approach, the packing ratio around 88% is expected, achieving a great improvement over an independent element approach (57%).

In this design, each Ge pixel is 10 mm thick and has an effective area of 22 mm^2. A pixel-to-pixel distance is 300 microns. Although the initial test was unsuccessful, i.e., the energy resolution at 5.9 keV was more than 400 eV because of poor passivation problems in Ge surface. However, after a long testing period, a new passivation technique has achieved 220 eV which is close to the expected value from the capacitance.

Figure 1 shows the final arrangement of pixel pattern for Ge crystal. Details will be reported elsewhere. For data collection, commertial digital signal processor CAMAC modules (XIA Inc., DXP Model 4T) is used, which allows an independent measurement of energy spectrum for each channel. In total, 25 CAMAC modules which have four channel input are installed. A PC-based linux (2.0.30) WS is dedicated for data collection and control of beamline WS. The data collection software with a GUI has been developed and tested.

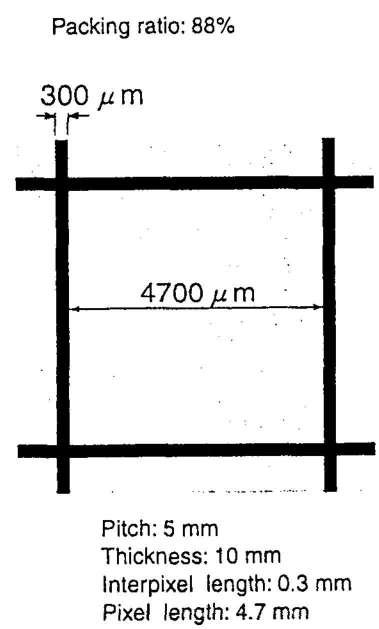

Fig. 1 Arrangement of pixel pattern for Ge crystal.