DEVELOPMENT OF A NOVEL MULTI-ELEMENT SILICON DRIFT DETECTOR ARRAY

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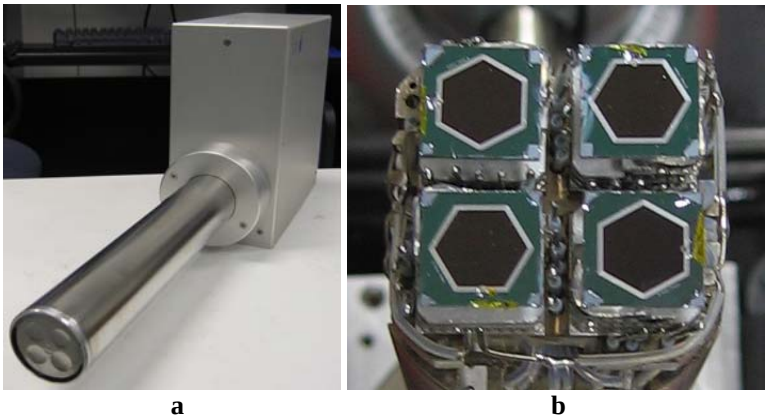
A novel, four-element silicon drift detector (SDD) array (the Vortex-ME4 ^{TM}) has been developed for x-ray fluorescence (XRF) applications requiring a large detection area, such as fast XRF imaging and x-ray absorption spectroscopy (XAS) using synchrotron radiation. The new compact SDD array spectrometer, cooled without liquid nitrogen (LN), can replace traditional, bulky, LN-cooled multi-element germanium detectors. The SDD element is fabricated on ~ 0.35 mm thick, high resistivity n-type silicon with an active area of ~ 42 mm^2, featuring extremely low capacitance (~ 0.06 pF) and excellent energy resolution (< 130 eV FWHM, at 5.9 keV and optimum peaking time). The SDDs also feature a very short signal rise time (< 100 ns) allowing for pulse processing using very short peaking times (~ 0.25 µs) to achieve very high signal throughput (up to 500 kcps output rate). The four-element SDD array, offers a total active area of ~ 170 mm^2 with a maximum output rate up to 1.5 – 2 Mcps.

Vacuum-sealed with a 12.5 µm thick beryllium window, the four SDD elements are in a square arrangement around the center and are cooled using separate Peltier coolers, with the heat removed through an innovative heat pipe heat transfer system. The SDD array spectrometer utilizes the X-Ray Instrumentation Associates 4-channel digital pulse processor, (the DXP xMAP system), in conjunction with the National Instruments PXI/CompactPCI module, offering 4 MB on-board high speed memory and ~100 MB/s data transfer speed. Figure 1 shows the external and internal views of the Vortex-ME4 ^{TM}. Performance and application data from the new Vortex-ME4™ will be presented.



a **b**

Figure 1. Vortex-ME4^{TM} 4-element spectrometer: (a) external view; (b) internal view of the 4 SDD elements.

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