Single- and Four-Element Large Area Silicon Drift Detector X-Ray Spectrometers for XRF Applications

V. D. Saveliev, L. Feng, C. R. Tull, S. Barkan, M. Takahashi, E. Damron

SII NanoTechnology USA Inc., 19865 Nordhoff St., Northridge, CA 91324, USA

E-mail: vsaveliev@sintusa.com

A silicon drift detector (SDD) offers excellent energy resolution together with a large active area and a high count rate capability. These features are typically required by modern x-ray spectroscopy using synchrotron beams, such as EXAFS (Extended X-Ray Absorption Fine Structure) and XANES (X-Ray Absorption Near-Edge Structure) that are powerful means for material studies in a wide range of fields including chemistry, biology, surface and material sciences, geology, environmental science, as well as the state-of-the-art nano-materials research.

We have developed the Vortex® SDD that has a large active area of ~ 45 mm², fabricated on ~0.35 mm thick, high resistivity n-type silicon. These SDDs operate with thermoelectric cooling and feature excellent energy resolution (< 130 eV FWHM at 5.9 keV and optimum peaking time) [1]. They also exhibit a very short signal rise time (< 100 ns) allowing pulse processing using very short peaking times (~0.25 μs) to achieve very high signal throughput (300 – 500 kcps output rate). Based on these SDDs we have developed variety of single- and four-element x-ray spectrometers (the Vortex-EX®, Vortex-EM® and Vortex-ME4™), that are successfully used in synchrotron applications and demonstrate high performance [2].

The Vortex® spectrometers design utilizes SDDs installed directly on a thermoelectric coolers with the heat removed through an innovative heat pipe heat transfer system. This design enables us to develop customized x-ray spectrometers with a detector snout length up to 800 mm, including ultra high vacuum compatible versions. The main design features as well as the performance data, including performance in a high magnetic field, of the Vortex® single-element and four-element spectrometers will be presented.

References