

HIGH-PERFORMANCE SILICON DRIFT DETECTORS

M. Hofmann, M. Bachmann, T. Eggert, R. Fojt, M. Fraczek, L. Höllt, P. Iskra,
J. Knobloch, N. Miyakawa, A. Pahlke, S. Pahlke, J. Rumpff, O. Scheid, A. Simsek, R. Stötter,
I. Wennemuth, F. Wiest

KETEK GmbH, Hofer Str. 3, 81737 Munich, Germany

Silicon Drift Detectors are the state of art detectors for X-ray fluorescence analysis and SEM/TEM energy dispersive X-ray analysis. We will present the latest developments and improvements with regards to spectroscopic performance.

KETEK offers a large variety of Silicon Drift Detectors with collimated areas starting at 7 mm² up to 150 mm². All detectors are available in different configurations and KETEK also offers complete electronics to operate the detectors.

Very recently, KETEK has introduced the combination of Silicon Drift Detectors with an ASIC readout based on the CUBE chip. This combination opens new possibilities with regards to count-rate capability, excellent spectroscopic performance, and operation at high ambient temperatures. We will present spectroscopic test results of the CUBE-based SDDs in comparison to FET-based SDDs showing the superior performance. CUBE-based SDDs achieve Mn-K α FWHM down to 125 eV at digital peaking times of 1 to 2 μ s independent of the active area. This allows input count rates of up to 300 kcps without significant loss in performance. For even shorter peaking times down to 100 ns the CUBE-based SDDs still achieve FWHM of less than 140 eV. At 100 ns peaking time the SDD can handle up to 1 Mcps input count rate. Even at room temperature FWHM of 155 eV are achievable with 7 mm² SDDs.

The CUBE technology will also be used in the 7-channel SDD array KETEK is working on. This array will have an active collimated area of in total 560 mm² mounted in a detector head with a diameter of only 45mm.

All KETEK SDDs achieve a Peak-to-Background ratio of typically >20,000 and are equipped with a multilayer collimator suppressing any stray lines from the collimator.

For applications with high X-ray energy excitation KETEK also offers an SDD with an internal absorber layer that suppresses any stray lines from the integrated thermo electric cooler. This allows the detection of materials like Sn, Sb, Te at very low concentration levels. New SDDs with a thickness of 775 μ m increase the detection probability for X-rays at 15 keV to 80%, having the same spectroscopic properties as standard 450 μ m SDDs.

For low-energy applications, on the other hand, KETEK offers modules with an AP3.3 window that achieve a resolution as low as 35 eV for the Be-K α line and allow the detection of Lithium (@ 52 eV).