

## IMPROVED HIGH PERFORMANCE SILICON DRIFT DETECTORS

A. Pahlke, T. Eggert, R. Fojt, M. Fraczek, L. Höllt, J. Knobloch, N. Miyakawa, S. Pahlke, J. Rumpff, O. Scheid, 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 recent developments of KETEK's VITUS series of Silicon Drift Detectors:

- The spectroscopic performance of KETEK SDDs has been improved over the last years by advanced semiconductor processes. Today's KETEK detectors achieve energy resolutions close to the theoretical limit to less than 121 eV and Peak to Background values of  $>20,000$ .
- The low capacitance of the latest VITUS SDD generation allows very high count rates compared to other detectors. By introducing a new low capacitance FET KETEK has improved to count rate capability even more. At  $\leq 1 \mu\text{s}$  peaking time the energy resolution is improved by more than 10 eV with the new FET, allowing a FWHM of  $\leq 149$  eV at count rates of up to 200 kcps input count rate.
- To achieve very good spectroscopic performance the detectors only need to be cooled to operating temperatures below  $-20^\circ\text{C}$  with the integrated thermoelectric cooler. Especially in mobile applications the power consumption of the TEC needs to be very low. KETEK has introduced a new TEC with 30% lower power consumption to allow for longer operating times in mobile applications. The new TEC is also RoHS conform.
- VITUS SDDs can measure X-ray photons with energies down to 100 eV. To measure such low energy photons the chip entrance window has been optimized to avoid tailing effects and absorption within the entrance window. KETEK has developed a completely new entrance window that shows no tailing effects and allows energy resolutions of the Carbon line  $<41$  eV and even the detection of Beryllium.
- SDDs typically are collimated to improve the peak to background ratio. The material of the collimator can be seen in the spectrum and needs to be selected very carefully, dependent on the application. KETEK has developed a new multilayer collimator that is invisible in the spectrum and is therefore suited for any application.
- Materials used in the module itself can be excited by incoming radiation and can be seen in the spectrum. Careful selection of materials used in the VITUS modules reduces any undesired lines in the spectrum. In addition KETEK has developed a special filter layer located between the TEC and the detector to absorb any x-ray photons excited within the TEC.
- In high count rate applications the radiation hardness of SDDs is of great importance. KETEK has improved the radiation hardness again and guarantees total doses of  $>10^{12}$  photons without any loss in spectroscopic performance. Measurements will be presented that show the stability of the KETEK detectors with radiation dose.