

# IMPROVEMENT IN DETECTION OF TRACE HAZARDOUS MATERIALS FOR RoHS DIRECTIVE USING A HIGH EFFICIENCY SILICON DRIFT DETECTOR

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The elements restricted by the RoHS (Restriction of Hazardous Substances) directive include Pb, Hg, Cd, Br and Cr, all of which can be readily detected and monitored using portable x-ray fluorescence (XRF) instruments. In recent years, the Vortex<sup>®</sup> XRF spectrometers, utilizing silicon drift detectors (SDD), have proven to be an excellent alternative to Si-PIN detectors due to their superior energy resolution (125 eV at 5.9 keV, 6  $\mu$ s peaking time) and high throughput rate (up to 600,000 cps at 0.25  $\mu$ s peaking time). In addition, the Vortex<sup>®</sup> spectrometers offer a large detection area (~ 50 mm<sup>2</sup>) and do not require LN<sub>2</sub> for cooling. These attributes result in faster and higher precision measurements than are currently possible with Si-PIN detectors. The RoHS elements, except for Cr, fall within the medium-to-high energy region for XRF analysis (10 – 25 keV). This energy range requires a relatively thick silicon detector in order to achieve high detection efficiency, especially for Cd for which a minimum detection limit lower than 100 ppm must be ensured. However, standard SDDs are typically ~0.35 mm thick and most Si-PIN detectors are only ~0.5 mm thick. Increasing the SDD thickness to 1 mm increases the detection efficiency from 55% to 91% at 15 keV, and from 30% to 64% at 20 keV, compared with 0.35 mm thickness. Figure 1 shows an example of XRF spectra of trace RoHS elements using 0.35 mm and 1 mm thick SDDs. This paper reports on the continuation of our efforts in exploring practical applications of the thick SDDs.

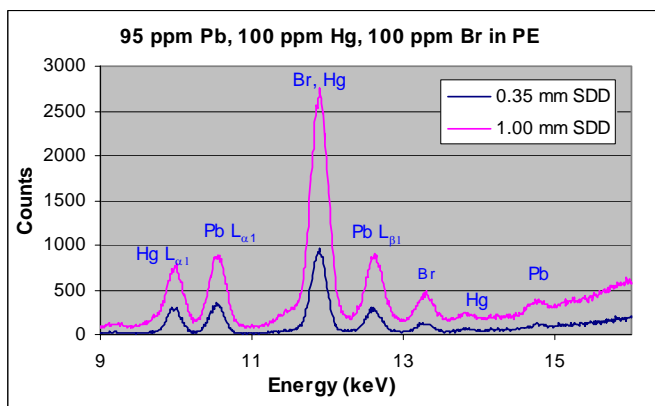


Figure 1. Comparison of detection of trace Pb, Hg, Br in Polyethylene (PE) using 0.35 mm and 1 mm thick SDDs, with a SIINT SEA 1200VX XRF Analyzer; Rh Tube, 50 kV, 500  $\mu$ A; Primary filter for Pb (proprietary); 1  $\mu$ s peaking time; 100 second live time.

