

NEAR REAL TIME AEROSOL METALS MONITORING AT pg/m^3 CONCENTRATIONS USING LARGE AREA SILICON DRIFT DETECTORS

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The high resolution and count rate advantages of silicon drift detectors (SDD) over common Si(Li) and Ge x-ray detectors has previously been presented for several x-ray applications. The improvement in the high count rate capability using a 50 mm^2 SDD has been successfully achieved in a synchrotron application as well as in many XRF and XRD applications. The 50 mm^2 SDD offers a large solid angle, excellent energy resolution ($<130 \text{ eV}$ FWHM at 5.9 keV , $4\text{-}6 \mu\text{s}$ peaking time), and high count rate performance ($> 600 \text{ kcps}$ throughput at $0.25 \mu\text{s}$ peaking time).

Key to the success of many of these x-ray applications is the ability to rapidly collect and analyze large numbers of x-ray fluorescence photons. The ability to combine the advanced technologies of silicon drift diodes and adaptive digital pulse processing allows a dramatic increase in the accurate data volume which can be collected, and thus unlocks a whole new arena of samples for study, especially in ultra low concentrations.

A Vortex-EX60 (from SII NanoTechnology USA, Inc.) with a 50 mm^2 SDD (Figure 1), has been integrated into a near real time continuous aerosol sampling and analysis system based on reel-to-reel tape sampling and x-ray fluorescence analysis. This system has been demonstrated in aerosol monitoring applications, ranging from rural ambient measurements to continuous stack monitoring requiring measurement of both suspended particulate and vapor phase metals with 15 minute reporting times. The field monitor developed in this study represents a major advance in detection capabilities and reporting times over currently available methods, and could contribute greatly to surveys of hazardous elemental concentrations in ambient air. A typical x-ray spectrum of an aerosol sample collected over two hours in East St. Louis, Illinois using an Xact™ 620 (from Cooper Environmental Services, LLC) near real time metals monitor with a 50 mm^2 area Vortex-EX60 detector is shown in Figure 2. The performance and applications of this system will be described, and key innovations in both sampling and analysis contributing to its unique capabilities will be discussed.



Fig. 1 A Vortex-EX60 with 50 mm^2 SDD.

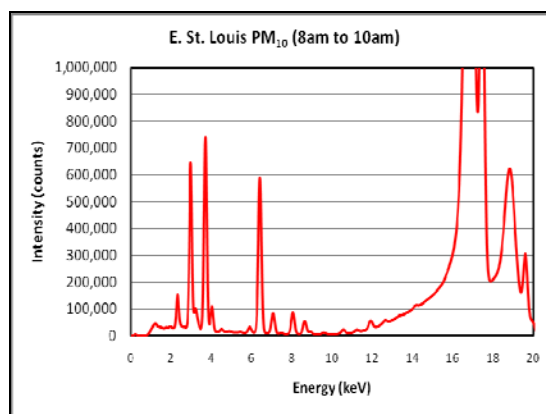


Fig. 2 Typical x-ray spectrum of a two hour aerosol sample colled in East St. Louis, Illinois, using an Xact 620 near real time metals monitor with a Vortex-EX60 spectrometer.