

COMBINING CdTe AND Si DETECTORS FOR ENERGY-DISPERSIVE X-RAY FLUORESCENCE

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Most energy dispersive X-ray fluorescence (EDXRF) instruments use Si diodes as X-ray detectors. These provide very high energy resolution, but their sensitivity falls off at energies of 10-20 keV. These detectors are well suited for using the K lines of elements with $Z < 40$. However, for heavier elements, one must use K lines at low efficiency, or use L or M lines which often overlap other lines, producing a challenge for overlap correction and accurate quantitative analysis. To measure the K lines of heavier elements, some XRF systems use CdTe detectors, which have much higher sensitivity but poorer energy resolution compared to Si diodes.

In many important EDXRF measurements, both high and low Z elements are present. In this paper, we will compare the precision and accuracy of systems using (1) a high resolution Si detector (a 25 mm² SDD), (2) one using a CdTe detector, and (3) a composite system which combines both detectors to span the full range. Although combined systems would be more expensive, the increased accuracy, precision, and throughput will often outweigh the small increase in cost and complexity. Since both spectra could be acquired in parallel, assuming the same excitation conditions, there is no loss in speed other than the time to process two spectra. In fact the overall acquisition times may be shorter, because of the ability to use both detectors at once, assuming each one has dedicated acquisition electronics. Using software that can automatically combine the results from both detectors prior to making a full quantitative analysis, these systems will be compared for representative applications, which include both high and low Z elements including RoHS/WEEE and automotive catalysts. We will show where there are clear advantages for this dual-detector technique.