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Escape Peaks in Si(Li) Detectors\*

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Calculation and experiment indicate that the escape peak associated with any monochromatic radiation detected in a lithium drifted silicon detector is never greater than 1.5% of the main peak intensity. The relation between the counts recorded in the escape peak,  $I_e$ , the main counts,  $I_o$ , the K-shell fluorescence yield,  $\omega_K$ , the K absorption edge jump ratio for Si,  $r$ , the absorption coefficient for the monochromatic radiation in Si,  $\mu_o$ , and that for Si K $\alpha$  radiation in Si,  $\mu_e$ , is

$$I_e = \frac{1}{2} I_o \cdot \omega_K \cdot \frac{(r-1)}{r} \left\{ 1 - \frac{1}{a} \log(1+a) \right\}$$

where  $a = \mu_o / \mu_e$ .

Experiments with a commercial Energy Dispersive Spectrometer, having a lithium drifted silicon detector, mounted on a scanning electron microscope and using a series of pure element samples to produce a range of monochromatic wavelengths, gave data in fair agreement with the calculated curve.

Low energy lines were difficult to use in these experiments because of the rapidity with which the background varies at energies below about 3 keV.

The calculated expression should also be applicable to lithium drifted germanium detectors in which the escape peaks are expected to be much greater than those found in Si(Li) detectors because of the higher value of the fluorescence yield of that element.

The accompanying figure gives the curve for Si(Li) detectors calculated from absorption data due to Heinrich (1) and using 0.035 for the fluorescence yield of Si, a value derived from Fink et al.(2).

References

1. Heinrich, K. F. J., "X-ray Absorption Uncertainty," The Electron Microprobe, 296-377, John Wiley, New York, 1966.
2. Fink, R. W., Jopson, R. C., Mark, H., Swift, C. D., "Atomic Fluorescence Yields," Rev. Mod. Phys. 38, 513, 1966.

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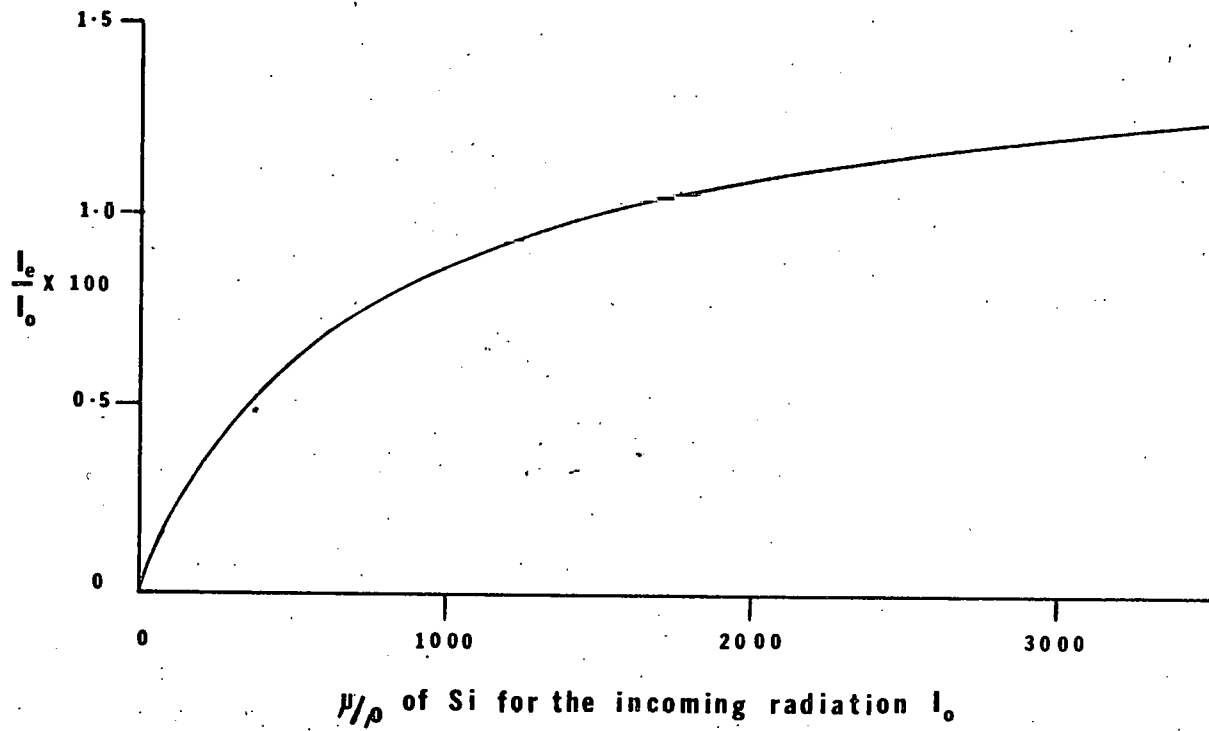


Figure 1.