

BACKGROUND SUBTRACTION FOR TRACE-ELEMENT ANALYSIS – ANALYTICAL COMPARISON OF METHODS

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For wavelength-dispersive fluorescence analysis, the background is a nonlinear function of 2θ , and a linear interpolation between two background angles gives an erroneously high estimate. Several methods are commonly used, and a new class of methods, based on Lagrange's interpolation formula, was recently proposed.¹ This discussion is intended to unify the methods, to compare them analytically, and to demonstrate their strengths and weaknesses. Some of these methods are available with current software.

A constant factor times a single background measurement is often used if two suitable background angles are not available. This relies on the inaccurate assumption that backgrounds at the peak and background angles are proportional for all materials to be analyzed. A linear combination of measurements at two angles is often used to reduce the errors. If three or more angles are used, the errors are reduced further. Furthermore, a known blank sample is no longer required as a reference.

Linear combinations have other desirable properties. For two or more background angles, a linear combination can always be constructed that is invariant with changes in tube intensity, and with fluorescence and scattering from spectrometer parts. Furthermore, because spectral interference corrections are easily made, it is not required that the background angles be free from spectral interference.

There is one other useful refinement. Because interpolation on a straight line is preferable to interpolation on a curve, it makes sense to transform either the intensity or 2θ , into a linear function. Transformation of intensity preserves tube-intensity invariance, and can be used to represent a very wide range of sample compositions. Transformation of 2θ preserves all invariance, but appears to be less versatile.

¹ R. Couture (in press). Intelligent interpolation for background subtraction – a hybrid approach for trace-element analysis. *Advances in X-Ray Analysis*.