



Standard Guide for Correction of Interelement Effects in X-Ray Spectrometric Analysis¹

This standard is issued under the fixed designation E 1361; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide is an introduction to mathematical procedures for correction of interelement (matrix) effects in quantitative X-ray spectrometric analysis.

1.1.1 The procedures described correct only for the interelement effect(s) arising from a homogeneous chemical composition of the specimen. Effects related to either particle size, or mineralogical or metallurgical phases in a specimen are not treated.

1.1.2 These procedures apply to both wavelength and energy-dispersive X-ray spectrometry where the specimen is considered to be infinitely thick, flat, and homogeneous with respect to the depth of penetration of the exciting X rays (1).²

1.2 This document is not intended to be a comprehensive treatment of the many different techniques employed to compensate for interelement effects. Consult Refs (2-5) for descriptions of other commonly used techniques such as standard addition, internal standardization, etc.

2. Referenced Documents

2.1 ASTM Standards:

E 135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials³

3. Terminology

3.1 For definitions of terms used in this guide, refer to Terminology E 135.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *absorption edge*—the maximum wavelength (minimum X-ray photon energy) that can expel an electron from a given level in an atom of a given element.

3.2.2 *analyte*—an element in the specimen whose concentration is to be determined.

3.2.3 *characteristic radiation*—X radiation produced by an element in the specimen as a result of electron transitions between different atomic shells.

3.2.4 *coherent (Rayleigh) scatter*—the emission of energy from a loosely bound electron that has undergone collision with an incident X-ray photon and has been caused to vibrate. The vibration is at the same frequency as the incident photon and the photon loses no energy. (See 3.2.7.)

3.2.5 *dead-time*—time interval during which the X-ray detection system, after having responded to an incident photon, cannot respond properly to a successive incident photon.

3.2.6 *fluorescence yield*—a ratio of the number of photons of all X-ray lines in a particular series divided by the number of shell vacancies originally produced.

3.2.7 *incoherent (Compton) scatter*—the emission of energy from a loosely bound electron that has undergone collision with an incident photon and the electron has recoiled under the impact, carrying away some of the energy of the photon.

3.2.8 *influence coefficient*—designated by α (β , γ , δ and other Greek letters are also used in certain mathematical models), a correction factor for converting apparent mass fractions to actual mass fractions in a specimen. Other terms commonly used are alpha coefficient and interelement effect coefficient.

3.2.9 *mass absorption coefficient*—designated by μ , an atomic property of each element which expresses the X-ray absorption per unit mass per unit area, cm^2/g .

3.2.10 *primary absorption*—absorption of incident X rays by the specimen. The extent of primary absorption depends on the composition of the specimen and the X-ray source primary spectral distribution.

3.2.11 *primary spectral distribution*—the output X-ray spectral distribution usually from an X-ray tube. The X-ray continuum is usually expressed in units of absolute intensity per unit wavelength per electron per unit solid angle.

3.2.12 *relative intensity*—the ratio of an analyte X-ray line intensity measured from the specimen to that of the pure analyte element. It is sometimes expressed relative to the analyte element in a multi-component reference material.

¹ This guide is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.20 on Fundamental Practices.

Current edition approved Oct. 10, 2002. Published July 2003. Originally published as E 1361 – 90. Last previous edition E 1361 – 90 (1999).

² The boldface numbers in parentheses refer to the list of references at the end of this standard.

³ *Annual Book of ASTM Standards*, Vol 03.05.