



Standard Guide for Elemental Analysis by Wavelength Dispersive X-Ray Fluorescence Spectrometry¹

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1. Scope

1.1 This guide provides guidelines for developing and describing analytical procedures using a wavelength dispersive X-ray spectrometer for elemental analysis of solid metals, ores, and related materials. Material forms discussed herein include solids, powders, and solid forms prepared by chemical and physical processes such as borate fusion and pressing of briquettes.

1.2 Liquids are not discussed in this guide because they are much less frequently encountered in metals and mining laboratories. However, aqueous liquids can be processed by borate fusion to create solids specimens, and X-ray spectrometers can be equipped to handle liquids directly.

1.3 Some provisions of this guide may be applicable to the use of an energy dispersive X-ray spectrometer.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials

E1257 Guide for Evaluating Grinding Materials Used for Surface Preparation in Spectrochemical Analysis

E1329 Practice for Verification and Use of Control Charts in

Spectrochemical Analysis

E1361 Guide for Correction of Interelement Effects in X-Ray Spectrometric Analysis

E1601 Practice for Conducting an Interlaboratory Study to Evaluate the Performance of an Analytical Method

E2857 Guide for Validating Analytical Methods

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide, refer to Terminologies E135 and the terminology section of E1361.

4. Summary of Guide

4.1 Important aspects of test equipment for wavelength dispersive X-ray fluorescence spectrometry are discussed including equipment components and accessories, reagents, and materials. Key aspects of the application of X-ray spectrometry to materials analysis are discussed including interferences and correction options, specimen preparation by a variety of procedures, and materials and accessories for presentation of specimens for measurement in spectrometers. Key elements of measurement procedures, calibrations procedures, and result reporting are explained.

4.2 In an X-ray spectrometric test method, the test specimen is prepared with a clean, uniform, flat surface. It may be prepared by grinding, polishing, or lathing a metal surface or by fusing or briquetting a powder. This surface is irradiated with a primary source of X-rays. The secondary X-rays produced in the specimen are dispersed according to their wavelength by means of crystals or synthetic multilayers. Their count rates at selected wavelengths, hereinafter called intensities, are measured by suitable detector systems. Amounts of the elements are determined from the measured intensities using analytical curves prepared with suitable calibrants.

4.3 Important aspects of background estimation are covered in an appendix to the guide.

5. Significance and Use

5.1 X-ray fluorescence spectrometry can provide an accurate and precise determination of metallic and many non-metallic elements in a wide variety of solid and liquid

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.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.