Designation: E 1217 – 00

Standard Practice for Determination of the Specimen Area Contributing to the Detected Signal in Auger Electron Spectrometers and Some X-Ray Photoelectron Spectrometers[1]

This standard is issued under the fixed designation E 1217; 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 practice describes methods for determining the specimen area contributing to the detected signal in Auger electron spectrometers and some types of X-ray photoelectron spectrometers when this area is defined by the electron collection lens and aperture system of the electron energy analyzer. The practice is applicable only to those X-ray photoelectron spectrometers in which the specimen area excited by the incident X-ray beam is larger than the specimen area viewed by the analyzer, in which the photoelectrons travel in a field-free region from the specimen to the analyzer entrance, and in which an auxiliary electron gun can be mounted to produce an electron beam of variable energy on the specimen.

1.2 This practice is recommended as a useful means for determining the specimen area viewed by the analyzer for different conditions of spectrometer operation, for verifying adequate specimen and beam alignment, and for characterizing the imaging properties of the electron energy analyzer.

1.3 *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:*

E 673 Terminology Relating to Surface Analysis[2]

E 1016 Practice for Describing and Specifying the Properties of Electrostatic Electron Spectrometers[2]

2.2 *ISO Standards:*

ISO/DIS 18115 Surface Chemical Analysis—Vocabulary (in ballot)[3]

3. Terminology

3.1 *Definitions*—See Terminology E 673 for terms used in Auger electron spectroscopy and X-ray photoelectron spectroscopy.

4. Summary of Practice

4.1 An electron beam with a selected energy is scanned across the surface of a test specimen. The beam may be scanned once, that is, a line scan, or in a pattern, that is, rastered. As the electron beam is deflected across the specimen surface, measurements are made of the intensities detected by the electron energy analyzer as a function of the beam position for selected conditions of analyzer operation. The measured intensities may be due to electrons elastically scattered by the specimen surface, to electrons inelastically scattered by the specimen, or to Auger electrons emitted by the specimen. The intensity distributions for a particular detected electron energy can be plotted as a function of beam position in several ways and can be utilized to obtain information on the specimen area contributing to the detected signal and on analyzer performance for the particular conditions of operation. This information can be used to determine the analysis area (see Terminology E 673 or ISO 18115).

5. Significance and Use

5.1 Auger electron spectroscopy and X-ray photoelectron spectroscopy are used extensively for the surface analysis of materials. This practice summarizes methods for determining the specimen area contributing to the detected signal for instruments in which a focused electron beam can be scanned over a region with dimensions greater than the dimensions of the specimen area viewed by the analyzer.

5.2 This practice is intended as a means for determining the observed specimen area for selected conditions of operation of the electron energy analyzer. The observed specimen area depends on whether or not the electrons are retarded before energy analysis, the analyzer pass energy or retarding ratio if the electrons are retarded before energy analysis, the size of selected slits or apertures, and the value of the electron energy to be measured. The observed specimen area depends on these selected conditions of operation and also can depend on the

[1] This practice is under the jurisdiction of ASTM Committee E-42 on Surface Analysis and is the direct responsibility of Subcommittee E42.03 on Auger Electron Spectroscopy and X-ray Photoelectron Spectroscopy.

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[2] *Annual Book of ASTM Standards*, Vol 03.06.

[3] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

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