



Standard Guide for Depth Profiling in Auger Electron Spectroscopy¹

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1. Scope

1.1 This guide covers procedures used for depth profiling in Auger electron spectroscopy.

1.2 Guidelines are given for depth profiling by the following:

	Section
Ion Sputtering	6
Angle Lapping and Cross-Sectioning	7
Mechanical Cratering	8
Nondestructive Depth Profiling	9

1.3 *This standard does not purport to address all of the safety problems, 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 Analysis²

E 684 Practice for Approximate Determination of Current Density of Large-Diameter Ion Beams for Sputter Depth Profiling of Solid Surfaces²

E 827 Practice for Elemental Identification by Auger Electron Spectroscopy²

E 1634 Guide for Performing Sputter Crater Depth Measurements²

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this guide, refer to Terminology E 673.

4. Summary of Guide

4.1 In ion sputtering, the surface layers are removed by ion bombardment in conjunction with Auger analysis.

4.2 In angle lapping, the surface is lapped or polished at a small angle to improve the depth resolution as compared to a cross section.

4.3 In mechanical cratering, a spherical or cylindrical crater is created in the surface using a rotating ball or wheel. The sloping sides of the crater are used to improve the depth resolution as in angle lapping.

4.4 In nondestructive techniques, different methods of varying the electron information depth are involved.

5. Significance and Use

5.1 Auger electron spectroscopy yields information concerning the chemical and physical state of a solid surface in the near surface region. Nondestructive depth profiling is limited to this near surface region. Techniques for measuring the crater depths and film thicknesses are given in (35).

5.2 Ion sputtering is primarily used for depths of less than the order of 1 μm .

5.3 Angle lapping or mechanical cratering is primarily used for depths greater than the order of 1 μm .

5.4 The choice of depth profiling methods for investigating an interface depends on surface roughness, interface roughness, and film thickness (1).³

6. Ion Sputtering

6.1 First introduce the specimen into a vacuum chamber equipped with an Auger analyzer and an ion sputtering gun. Align the ion beam using a sputtering target or a Faraday cup, paying careful attention to the relative spot size of the electron beam, ion beam, and Faraday cup and their respective orientations to ensure accurate convergence of the two beams at the specimen surface.

6.1.1 Place the specimen in front of the Auger analyzer and direct the ion gun towards the analysis area. If the ion beam is not normal to the specimen surface then possible shadowing of the analysis area from the ion beam must be considered.

6.2 Choose the elements to be investigated from previous experience or from an initial Auger electron spectrum or an energy-dispersive X-ray spectrum since the latter spectrum can reveal additional elements present at depths greater than those that contribute to the Auger electron spectrum (2). Select a specific transition for each element. During the depth profiling, record the peak-to-peak heights for Auger derivative data, or peak heights or peak areas for $N(E)$ data. The data may be

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² Annual Book of ASTM Standards, Vol 03.06.

³ The boldface numbers in parentheses refer to the list of references at the end of this guide.