



Standard Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of a Cross Section¹

This standard is issued under the fixed designation B 487; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This test method covers measurement of the local thickness of metal and oxide coatings by the microscopical examination of cross sections using an optical microscope.

1.2 Under good conditions, when using an optical microscope, the method is capable of giving an absolute measuring accuracy of 0.8 μm . This will determine the suitability of the method for measuring the thickness of thin coatings.

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.* (This is especially applicable to the chemicals cited in Table X2.1.)

2. Referenced Documents

2.1 ASTM Standards:

E 3 Methods of Preparation of Metallographic Specimens²

3. Summary of Test Method

3.1 This test method consists of cutting out a portion of the test specimen, mounting it, and preparing the mounted cross section by suitable techniques of grinding, polishing, and etching. The thickness of the cross section is measured with an optical microscope.

NOTE 1—These techniques will be familiar to experienced metallographers but some guidance is given in Section 5 and in Appendix X1 for less experienced operators.

4. Significance and Use

4.1 Coating thickness is an important factor in the performance of a coating in service and is usually specified in a coating specification.

4.2 This method is suitable for acceptance testing.

5. Factors Influencing the Measurement Result

5.1 *Surface Roughness*—If the coating or its substrate has a rough surface, one or both of the interfaces bounding the coating cross section may be too irregular to permit accurate measurement. (See X1.4)

5.2 *Taper of Cross Section*—If the plane of the cross section is not perpendicular to the plane of the coating, the measured thickness will be greater than the true thickness. For example, an inclination of 10° to the perpendicular will contribute a 1.5 % error.

5.3 *Deformation of the Coating*—Detrimental deformation of the coating can be caused by excessive temperature or pressure during mounting and preparation of cross sections of soft coatings or coatings melting at low temperatures, and also by excessive abrasion of brittle materials during preparation of cross sections.

5.4 *Rounding of Edge of Coating*—If the edge of the coating cross section is rounded, that is, if the coating cross section is not completely flat up to its edges, the true thickness cannot be observed microscopically. Edge rounding can be caused by improper mounting, grinding, polishing, or etching. It is usually minimized by overplating the test specimen before mounting. (See X1.2.)

5.5 *Overplating*—Overplating of the test specimen serves to protect the coating edges during preparation of cross sections and thus to prevent an erroneous measurement. Removal of coating material during surface preparation for overplating can cause a low-thickness measurement.

5.6 *Etching*—Optimum etching will produce a clearly defined and narrow dark line at the interface of two metals. Excessive etching produces a poorly defined or wide line which may result in an erroneous measurement.

5.7 *Smearing*—Improper polishing may leave one metal smeared over the other metal so as to obscure the true boundary between the two metals. The apparent boundary may be poorly defined or very irregular instead of straight and well defined. To verify the absence of smearing, the coating thickness should be measured and the polishing, etching, and thickness measurement repeated. A significant change in apparent thickness

¹ This test method is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.10 on General Test Methods.

Current edition approved Feb. 22, 1985. Published May 1985. Originally published as B487 – 68. Last previous edition B487 – 79.

² *Annual Book of ASTM Standards*, Vol 03.01.