



Designation: B 490 – 92 (Reapproved 1998)

Standard Practice for Micrometer Bend Test for Ductility of Electrodeposits¹

This standard is issued under the fixed designation B 490; 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 practice describes a procedure for measuring the ductility of electrodeposited foils.²

1.2 This practice is suitable only for the evaluation of electrodeposits having low ductility.

1.3 The obtained ductility values must only be considered semi-quantitative because this test has a significant operator dependence.

1.4 This practice is best used for in-house process control where measurements are always made by the same operator. A change in ductility value can be used as an indication of possible changes in the electroplating solution.

1.5 *This standard does not purport to address 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:*

B 177 Guide for Chromium Electroplating on Steel for Engineering Use³

3. Summary of Practice

3.1 This practice consists of measuring the bend of a foil held between the jaws of a micrometer; these are closed until fracture or cracks appear.

4. Significance and Use

4.1 This practice is useful as one method of controlling some electroplating solutions. It serves to indicate the presence of contamination or some other adverse condition.

4.2 Ductility measurements are of particular value when electroplated parts are to be subjected to moderate stress such as that involved in bolting an electroplated bumper to an automobile.

¹ This practice is under the jurisdiction of ASTM Committee B-8 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.10 on General Test Methods.

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² For a discussion of this test see Mohrheim, A. F., "The Bend Test for Measuring the Strain Limit of Surfaces," *Plating*, Vol 50, 1963, pp. 1094–1099.

³ *Annual Book of ASTM Standards*, Vol 02.05.

NOTE 1—The foils used in this practice are typically 25 to 40 μm thick. Foils in this thickness range do not have the same properties as bulk metal. For example, a nickel electrodeposit 0.5 mm thick, prepared in purified bright nickel electroplating solutions for which this test is being used, had less than 3 % elongation in a tension test, and could not be bent to a 90° angle without complete fracture. However, foils 25 to 40 μm thick, electroplated at the same time, had micrometer ductility values in the 10 to 25 % range.

5. Apparatus

5.1 *Micrometer*, 25-mm with flat jaws to measure the thickness and to compress the foil.

5.2 *Hand or Power Shear*, grinding wheel, or hack saw, to trim the edges of the electroplated panel and to separate the foil from the basis metal.

5.3 *Pair of Sharp Scissors* to cut the test specimens.

6. Test Specimens

6.1 An electrodeposit shall be prepared using a basis metal with a smooth surface from which the electrodeposit can be readily separated. A stainless steel or nickel electroplated steel panel may be used for this purpose, prepared as in 6.2.

6.2 A piece of cold-rolled steel, of any convenient size, such as 100 by 150 mm, shall be properly cleaned, acid dipped, and electroplated with approximately 7.5 μm of nickel. After rinsing, the specimen shall be cleaned anodically for 15 s in a hot alkaline cleaner, rinsed, acid dipped in about 1 N sulfuric acid (about 27 mL of concentrated sulfuric acid added to about 900 mL of cold water, mixed, and diluted with cold water to 1 L), and immediately placed in the electroplating solution of the metal to be tested. An electrodeposit 25 to 40 μm thick shall be electroplated on the prepared surface. The deposit shall be plated at an average current density and under conditions (agitation, temperature, etc.) approximating those used on parts plated in the solution being tested.

6.3 The volume of the plating solution used to produce the test specimen shall be sufficient so that the concentration of the additives do not drop below 90 % of original additive concentration. Additions to the test solution shall not be made since they can alter the original composition.

NOTE 2—The ductility of nickel, with or without chromium, will vary depending upon plating conditions, contamination, and the additive system used. If electroplated with chromium, the foil may require heating or aging to overcome temporary hydrogen embrittlement. A procedure to overcome hydrogen embrittlement is covered in 8.2 of Guide B 177.