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Endorsed by American
Electroplaters' Society
Endorsed by National
Association of Metal Finishers

Standard Test Method for Peel Strength of Metal Electroplated Plastics[1]

This standard is issued under the fixed designation B533; 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 test method gives two procedures for measuring the force required to peel a metallic coating from a plastic substrate.[2] One procedure (Procedure A) utilizes a universal testing machine and yields reproducible measurements that can be used in research and development, in quality control and product acceptance, in the description of material and process characteristics, and in communications. The other procedure (Procedure B) utilizes an indicating force instrument that is less accurate and that is sensitive to operator technique. It is suitable for process control use.

1.2 The tests are performed on standard molded plaques. This method does not cover the testing of production electroplated parts.

1.3 The tests do not necessarily measure the adhesion of a metallic coating to a plastic substrate because in properly prepared test specimens, separation usually occurs in the plastic just beneath the coating-substrate interface rather than at the interface. It does, however, reflect the degree that the process is controlled.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Document

2.1 *ASTM Standards:*[3]

E4 Practices for Force Verification of Testing Machines

3. Summary of Test Method

3.1 A properly prepared standard test specimen, called a plaque, is copper electroplated, with no additional metal coating. The coated plaque is either tested as is, or it is conditioned by a low-temperature bake and then tested. The coating is cut through to the plastic substrate in a way that forms two strips of coating (see Fig. 1). Each strip is peeled from the substrate at a right angle using an instrument that indicates the force required to separate it from its substrate.

4. Significance and Use

4.1 The force required to separate a metallic coating from its plastic substrate is determined by the interaction of several factors: the generic type and quality of the plastic molding compound, the molding process, the process used to prepare the substrate for electroplating, and the thickness and mechanical properties of the metallic coating. By holding all others constant, the effect on the peel strength by a change in any one of the above listed factors may be noted. Routine use of the test in a production operation can detect changes in any of the above listed factors.

4.2 The peel test values do not directly correlate to the adhesion of metallic coatings on the actual product.

4.3 When the peel test is used to monitor the coating process, a large number of plaques should be molded at one time from a same batch of molding compound used in the production moldings to minimize the effects on the measurements of variations in the plastic and the molding process.

5. Apparatus

5.1 *Procedure A*—A tension testing machine that has self-aligning grips and that has a loading range that includes the

[1] This test method is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.05 on Decorative Coatings.

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[2] This test is also known as the Jacquet Test. A detailed treatment of the test has been published by Saubestre et al in *Plating,* Vol 52, 1965, p. 982.

[3] 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.

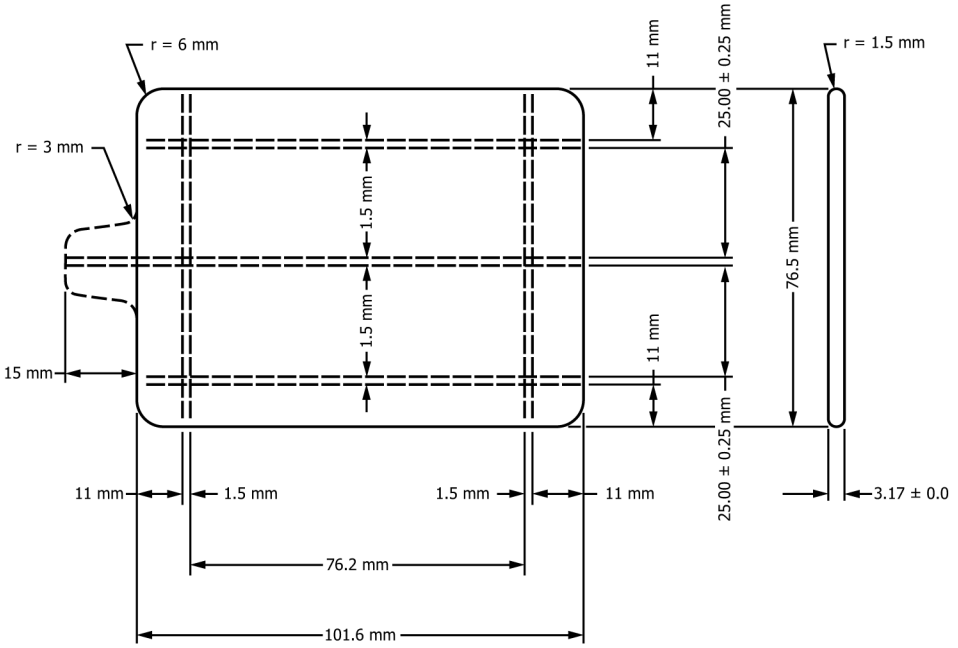

FIG. 1 Plaque

forces to be measured, 5 to 200 N, shall be used to separate the coating from the substrate, and measure the force required. The machine shall meet the verification requirements of Practices E4.[4,5] The speed of separation of the crossarms of the machine shall be adjusted to give a separation rate of 25 ± 3 mm/min. The machine shall automatically and continuously record on a chart the load on one coordinate and the amount of peel on the other coordinate. The amount of peel may be obtained from calculation, using a known chart speed.

5.2 *Procedure B*—A spring-loaded, force-indicating instrument with a measurement range that includes the force to be measured, 5 to 200 N, shall be used to measure the force required to separate the coating. The indicated force shall be accurate to ±10 %.

6. Sampling

6.1 A sampling procedure is not applicable to this test method.

7. Test Specimen

7.1 Perform the test using a flat, molded plastic plaque such as shown in Fig. 1. Plaque dimensions may vary up to ±10 % provided that the edges of slit peel strips are not closer than 11 mm from any plaque edge.

8. Conditioning

8.1 Condition the electroplated plaques requiring conditioning by baking for 1 h in an air-circulating oven operated at 70 ± 3 °C. Place the plaques in the oven in a way that permits free circulation of air around all surfaces of the plaques. Allow the conditioned plaques to cool to room temperature and then test them within 1 h. Test the plaques that do not require conditioning within 30 to 60 min following the coating process.

NOTE 1—The separation strength of an unconditioned plaque will change with time. The separation strength of a conditioned plaque may change with time after conditioning.

9. Procedure

9.1 Mold the required number of plaques using the specified molding compound and molding procedure.

NOTE 2—When the test is used as a control of the coating process, commercially prepared plaques can be used.

9.2 Clean, activate, and electroplate the plaques as specified. The thickness of the metallic coating in the test area (see Fig. 1) shall be 40 ± 4 µm.

NOTE 3—It is necessary to have a ductile copper coating to perform this test. The thickness and uniformity of thickness of the metallic coating directly influence the peel strength; therefore, in order to standardize this test, the coating thickness is specified. If a different coating thickness is used, the results will not be comparable to other test results. It may be necessary to use shielding during plating to obtain the required coating thickness uniformity.[6]

9.3 Cut through the coating along the dashed lines shown in Fig. 1, and also along the centerline so as to produce two parallel strips of coating that are 25.00 ± 0.25 mm wide and approximately 75 mm long.

NOTE 4—Following are methods that can be used to cut the coating:
(a) Slit the coating with a milling machine equipped with a slitting

[4] The sole source of supply of the Instron universal testing machine known to the committee at this time is Instron Corp., Canton, MA.

[5] If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

[6] Shielding methods are described in the *Technical Proceedings of the American Electroplaters' Society,* Vol 47, 1960, p. 94, and in the *Monthly Review of the American Electroplaters' Society,* Vol 34, 1947, p. 1361.