

ASTM B 136 - Standard* method for measurement of stain resistance of anodic coatings on Aluminum

1. Scope

1.1 This method is intended to determine whether anodic oxide coating on aluminum and its alloy that have undergone a sealing treatment and contact with an acid solution are stain proof or non-absorptive with respect to dyes.

1.2 Coatings that have been properly sealed should be proof against absorption of coloring materials, and hence, 'non-staining' in many types of service.

1.3 This method is applicable to anodic coatings intended for applications where they are exposed to the weather, or for prospective purposes in corrosion media, and where resistance to staining is important.

Note 1 - Performance in this test is predictive only of susceptibility to stain by dyes. It is not intended to be predictive of other factors in service performance such as pitting or general corrosion.

Note 2 - For Aluminum Association Class I and II architectural anodic coatings that are sealed in solution containing less than 15 ppm silicates or 3 ppm phosphates, the acid pretreatment may be omitted.

1.4 In the case of coatings colored in deep shapes, where estimation of the intensity of any residual dye stain is difficult, interpretation of the test is based on whether or not the original color has been affected by the action of the test.

1.5 This method is not applicable to:

1.5.1 Chromic acid type anodic coatings.

1.5.2 Anodic coatings on aluminum alloys containing more than 2 mass % Cu and 4.5 mass % Si.

1.5.3 Anodic coatings that have been sealed only in dichromate solution.

1.5.4 Anodic coatings that have undergone a treatment to render them hydrophobic.

1.6 This standard does not purport to address all the safety concerns, if any, associated with its use. It is the responsibility of whoever uses this standard to consult and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use

2.0 Summary of method

2.1 The method depends upon the observation that a non-sealed or poorly sealed anodic coating is attacked by acid and easily colored by dye, while an adequately sealed coating is not appreciably attacked and does not easily retain any dye stain.

2.2 The method comprises contacting the test area of the anodized specimen with nitric acid solution and, after rinsing, and drying, applying a special dye solution followed by rinsing and rubbing the test area with pumice powder, drying and visual examination of the test area for retention of dye stain. Coating that exhibits no dye stain or change in color are considered to have pass the test.

3. Reagents

3.1 Purity of reagents

Reagents grade chemicals shall be used in all tests. Unless otherwise stated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society**, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

3.2 Nitric Acid Solution

Prepare a 40 (plus minus 5) mass % solution of nitric acid (HNO₃) in distilled or DI water.

Note 3 - A convenient way is to carefully add one volume of 70% HNO₃ (SG 1.41 at 20 deg C) to an equal volume of water, while stirring, observing the normal precautions for handling strong acids.

3.3 Special Dye Solution

Dissolve 1 gm of Aluminum Blue 2LW Dye*** in 50 ml of Distilled water or DI water. The pH of the dye test solution shall be adjusted to 5.0(plus minus 0.5) and maintain at this value with addition of acetic acid or sodium hydroxide as required.

Note 4 - Dye solutions contaminated with soluble phosphates have reduced capability for staining non-sealed or poorly sealed anodic coatings. The dye test solution should have less than 20 ppm of phosphorous as soluble PO₄. This correspond to a phosphorous content of less than 0.05 mass % in dye powder. Under some condition of storage and use, dye test solutions may become contaminated or deteriorate with age. To check the reliability of a used or aged dye test solution, it should be applied from time to time to a freshly prepared, non-sealed anodic coating on aluminum to confirm that it will produce a permanent, deeply colored stain in the anodic film.

4. Procedure.

4.1 Perform the test on an area that has not been contaminated by h.

4.2 Apply a drop of HNO₃ (40 plus minus 5 mass %) on the test area and allow it to remain there for 2 mins plus minus 5 seconds. The temperature of the HNO₃ and of the test specimen shall be 25 plus minus 5 deg C.

4.3 Wash the area thoroughly with running water and blot dry with a clean cloth. The temperature of the water shall be 25 plus minus 5 deg C.

Note 5: If the part is already dyed, there is no need to follow through with the blue dye. The original dye on the part may discolor but will not disappear. If it does disappear to leave a clear bear aluminum spot the seal has failed the test.

4.4 Apply a drop of dye solution to the test area and allow it to remain for 5 mins plus minus 10 seconds. The temperature of the dye solution and test specimen shall be 25 plus minus 5 deg C.

4.5 Wash the test area thoroughly with running water, then rub it with pumice powder (NF or USP Fine Grade)^{****} and a clean cloth wet with water, and finally rinse with water and blot dry with clean cloth. The temperature of the water shall be 25 plus minus 5 deg C.

Note 6 - The pumice scrub removes sealing smut that may absorb the dye. Smut is more difficult to remove after aging than it is from freshly sealed work. Dye that has penetrated the pores of the oxide will not be removed except by removing the oxide. On sound oxides, a pumice scrub will do little more than burnish the surface, even with heavy hand pressure.

5 Interpretation of Results.

5.1 The test specimen shall be considered to have passed the test if no color from the dye is visible in the test area. Any visible retention of dye color in the test area is considered a failure.

5.2 In the case of anodic coatings colored in deep shades, where visible detection of any residual dye stain is difficult or impossible, the criterion of passing the test shall be no visible absence of color of the coating from the action of the test.

Note 7 - For special applications, it may be found desirable to make the staining test using the solution with which the article may come in contact in service. For example, it is sometimes convenient to test anodically coated aluminum cafeteria trays with coffee. Composition of test solution and test conditions should be standardized for each application.

Note 8 - Sometimes the time interval between sealing and application of the stain test influences the result. In such cases, the purchaser and seller should agree upon a time limit for application of this test after the sealing operation.

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**** "Reagent Chemicals, American Chemical Society Specifications "American Chemical Society, Washington DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see" Reagent Chemicals and Standards", by Joseph Rosin, D.Van Nostrand Co., Inc, New York, NY and" United States Pharmacopeia."**

***** A suitable dye for this test is Aluminum Blue 2LW, available from Sandoz Colors and chemicals, East Hanover, NJ, 07936.**

****** A suitable material is available as Product No. P363 from Fisher Scientific Co., Fairlawn, NJ, 07410.**