Designation: C703 – 72 (Reapproved 2011)ε1

Standard Test Methods for Spalling Resistance of Porcelain Enameled Aluminum[1]

This standard is issued under the fixed designation C703; 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.

ε[1] NOTE—Test Method was corrected editorially in 2011

INTRODUCTION

This test, using an ammonium chloride or antimony trichloride test solution, covers an accelerated procedure for determining the resistance of porcelain enamel coatings on aluminum and aluminum alloys to spontaneous loss of adhesion (spalling) resulting from exposure to moisture, weathering, or other environmental stress.

1. Scope

1.1 These test methods cover accelerated determination of the resistance of porcelain enamel coatings on aluminum alloys to spalling from exposure to moisture or weathering. Test Method A,[2] using a 5 % solution of ammonium chloride, requires 96-h immersion while Test Method B,[3] using a 1 % solution of antimony trichloride, is completed after 20 h of immersion. The spalling tendency is evaluated by the same criteria in both methods. While either method is suitable for magnesium silicon alloys, such as 6061, Test Method B is preferred for simple alloys or commercially pure aluminum, such as 1100.

1.2 The test methods appear in the following order:

2. Terminology

2.1 *Definitions:*

2.1.1 *spalling*—a defect characterized by separation of the porcelain enamel from the aluminum base metal without apparent external cause. Spalling can result from the use of improper alloys or enamel formulations, incorrect pretreatment of the base metal, or faulty application and firing procedures.

3. Significance and Use

3.1 It is difficult to overemphasize the importance of the spall test. Porcelain enameled aluminum that fails this test will probably spall in service if subjected to moisture or weathering.

TEST METHOD A—AMMONIUM CHLORIDE

4. Apparatus

4.1 *Container,* glass or plastic, large enough to immerse the test area of the specimen completely and hold a minimum of 3 mL of solution per square centimetre of the immersed surface. No metal other than the base metal of the specimen may be exposed to the test solution.

5. Reagent

5.1 *Ammonium Chloride Solution (5 %)*—The test solution, freshly prepared, shall consist of 5 parts, by mass, of ammonium chloride (NH_4Cl) (technical grade is adequate) dissolved in 95 parts, by mass, of water. Deionized or distilled water is preferred, but in the case of very large production pieces, tap water may be used. Sufficient solution shall be prepared to permit complete immersion of the specimens.

6. Test Specimens

6.1 Full-size production pieces should be tested. When this is not practical, specimens approximately 4 by 6 in. (102 by 152 mm), cut from production parts should be tested. At least one representative specimen from each "job" or each 1000 ft^2 (93 m^2) of production, whichever is applicable, should be spall tested. Spall-tested pieces should not be shipped.

6.2 Test production parts in as-produced condition.

7. Procedure

7.1 Immerse the test specimens completely in the NH_4Cl solution at room temperature. Large production pieces may be

[1] These test methods are under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatingsand are the direct responsibility of Subcommittee B08.12 on Materials for Porcelain Enamel and Ceramic-Metal Systems.

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[2] Method A is based on Bulletin AL-1a, *Recommended Test Methods for Evaluation and Control of Quality of Porcelain Enamel on Aluminum* , of the Porcelain Enamel Institute.

[3] Method B is based on Bulletin T-51, *Antimony Trichloride Spall Test of Porcelain Enameled Aluminum*, of the Porcelain Enamel Institute.