Designation: ~~G110 – 92 (Reapproved 2015)~~ G110 – 92 (Reapproved 2022)ε1

Standard Practice for Evaluating Intergranular Corrosion Resistance of Heat Treatable Aluminum Alloys by Immersion in Sodium Chloride + Hydrogen Peroxide Solution[1]

This standard is issued under the fixed designation G110; 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—Replaced Terminology G15 with Terminology G193, and other editorial changes made throughout in Dec. 2023.

1. Scope

1.1 This practice covers the procedures for immersion tests in sodium chloride + hydrogen peroxide solution. It is primarily for tests of wrought heat treatable aluminum alloys (2XXX and 7XXX) but may be used for other aluminum alloys, including castings. It sets forth the specimen preparation procedures and the environmental conditions of the test and the means for controlling them.

1.2 This practice is intended for evaluations during alloy development and for evaluating production where it may serve as a control test on the quality of successive lots of the same material (see MIL-H-6088 and U.S. Federal Test Method Std. 151b). Therefore strict test conditions are stipulated for maximum assurance that variations in results are attributable to lot-to-lot differences in the material being tested.

NOTE 1—This practice does not address sampling or interpretation or significance of results.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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~~ safety, health, and ~~health~~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 Documents

2.1 *ASTM Standards:*[2]

D1193 Specification for Reagent Water
E3 Guide for Preparation of Metallographic Specimens
E407 Practice for Microetching Metals and Alloys
G1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens

[1] This practice is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.05 on Laboratory Corrosion Tests.

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[2] 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~~standard's Document Summary page on the ASTM website.

~~G15 Terminology Relating to Corrosion and Corrosion Testing (Withdrawn 2010)~~[3]
G67 Test Method for Determining the Susceptibility to Intergranular Corrosion of 5XXX Series Aluminum Alloys by Mass Loss After Exposure to Nitric Acid (NAMLT Test)
G69 Test Method for Measurement of Corrosion Potentials of Aluminum Alloys
G193 Terminology and Acronyms Relating to Corrosion

2.2 *Other Documents:*[3]
U.S. Military Specification MIL-H-6088 Heat Treatment of Aluminum Alloys
U.S. Federal Test Method, Std. No. 151b Method 822.1, Intergranular Corrosion Test for Aluminum Alloys

3. Summary of Practice

3.1 This practice consists of immersing etched test specimens in a sodium chloride + hydrogen peroxide solution for 6 or more hours. After immersion, metallographic sections are examined to determine the extent of intergranular corrosion (see Terminology ~~G15~~G193).

4. Significance and Use

4.1 This practice is especially useful for evaluating the adequacy of quenching when performed on material in the as-quenched condition. The practice may also be used to study the effect of subsequent thermal processes (for example, paint or bonding cures) or of actual precipitation treatments on the inherent type of corrosion. Intergranular corrosion resistance of heat treatable aluminum alloys is often directly related to the quenching conditions applied after solution heat treatment and to the subsequent aging treatment.[4]

4.2 This practice is not well suited for non-heat treatable work hardening aluminum alloys, such as the 1XXX, 3XXX, and 5XXX series (see Test Method G67).

4.3 This practice does not deal with the interpretation of resulting intergranular corrosion. The significance of the extent and depth of any intergranular corrosion resulting from this test is to be agreed upon between producer and user.

5. Reagents

5.1 Reagent grade chemicals [sodium chloride (NaCl), 70 % nitric acid (HNO_3), 48 % hydrofluoric acid (HF), 37 % hydrochloric acid (HCl), and 30 % hydrogen peroxide (H_2O_2)] shall be used for preparation of all solutions.

5.2 The solutions shall be prepared using distilled or deionized water conforming to the purity requirements for Specification D1193, Type IV reagent water.

6. Solutions

6.1 Etching cleaner shall be prepared as follows: To 945 mL of reagent water add 50 mL of nitric acid (70 %) + 5 mL of hydrofluoric acid (48 %). (See 6.2).

6.2 Test solution shall be prepared as follows: 57 grams of sodium chloride +10 mL of hydrogen peroxide (30 %—add just prior to initiation of exposure) diluted to 1.0 L with reagent water. (**Warning—**Care should be exercised in handling and mixing strong acids to avoid personal injury and damage to apparatus. Care should include use of personal protective equipment and use of appropriate apparatus and procedures for particular acids.)

NOTE 2—The concentration of the 30 % hydrogen peroxide may degrade; therefore, it should be verified before each use by the procedure stated in Test Method G69.

6.3 Metallographic etchant (Keller's etch) shall be prepared as follows: To 95 mL of reagent water add 2.5 mL of nitric acid

[3] Available from ~~Standardization Documents Order Desk, Building 4, Section D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.~~DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

[4] Lifka, B. W., and Sprowls, D. O., "Significance of Intergranular Corrosion of High Strength Aluminum Alloy Products," *Localized Corrosion Cause of Metal Failure*, ASTM STP 516, 1972, pp. 120–144.