~~Designation:B858–95~~ Designation: B 858 – 06

Standard Test Method for ~~Determination of Susceptibility to Stress Corrosion Cracking in Copper Alloys Using an Ammonia Vapor Test~~Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys[1]

This standard is issued under the fixed designation B 858; 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*

~~1.1This test method describes a procedure that may be used to determine the presence of residual stresses which may lead to stress corrosion cracking of wrought copper alloy products. This test method uses an ammonia atmosphere to simulate service conditions under which stress corrosion cracking may occur.~~

~~1.2This test method is only suitable for products fabricated from copper alloys that are known to be susceptible to stress corrosion cracking in ammonia vapor atmospheres. It is intended to create an environmental condition of reproducible severity, but it is well known that the critical step in the cracking mechanism is the development of an environment in the condensate film that occurs on the surface of the test specimen, which is rich in copper complex ions.~~

~~1.3This test method is a conversion of ISO 6957, "Copper Alloys—Ammonia Test for Stress Corrosion Resistance."~~

~~1.4The severity of this test method depends upon the pH of the corrosive solution. In~~

1.1 This test method describes a procedure to determine the presence of residual stresses in wrought copper alloy products that may lead to stress corrosion cracking. An ammonia vapor atmosphere is used as an accelerated test.

1.2 This test method is only suitable for products fabricated from copper alloys that are known to be susceptible to stress corrosion cracking in ammonia vapor atmospheres. It is intended to create an environmental condition of reproducible severity.

NOTE 1—It is well known that the critical step in the cracking mechanism is the development of an environment in the condensate film that occurs on the surface of the test specimen, and is rich in copper complex ions.

1.3 The severity of this test method depends upon the pH of the corrosive solution. In Annex A1 are given four different atmospheres to which the product may be exposed, and the appropriate pH of the solution to be used for the test, depending on the risk level associated with the intended application.

~~1.4.1The appropriate pH value for the test shall be specified in the product specification, or as per established agreement between the supplier and purchaser, with respect to the alloy and its intended application.~~

~~1.5The values stated in SI units are the standard.~~

~~1.6~~

1.3.1 The appropriate pH value for the test shall be specified in the product specification, or as per established agreement between the supplier and purchaser, with respect to the alloy and its intended application.

1.4 *Units*—The values stated in SI units are to be regarded as the standard. No other units of measurement are included in this standard.

1.5 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

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[1] This test method is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.06 on Methods of Test.

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[2] ~~This test method is a conversion of ISO 6957 "Copper Alloys—Ammonia Test for Stress Corrosion Resistance." Additional background information is included in Appendix X1.~~

[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 Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard.**

B 154 Test Method for Mercurous Nitrate Test for Copper ~~and Copper~~ Alloys
B 846 Terminology for Copper and Copper Alloys
D 1193~~Specification for Reagent Water~~
~~2.2 *Other Documents:*~~
~~ISO 6957Copper Alloys—Ammonia Test for Stress Corrosion Resistance~~ Specification for Reagent Water

3. Terminology

~~3.1*Definitions:*~~
~~3.1.1*applied stress*~~
3.1 For definitions of terms related to copper and copper alloys, refer to Terminology B 846.
3.2 *Definitions:*
3.2.1 *applied stress*, *n*—stress in a body as a result of application of an external load.
~~3.1.2*residual stress*—stresses that remain within a body as the result of processing, which may include plastic deformation or casting.~~
~~3.1.3*stress corrosion crack*—spontaneous failure of metals by cracking under combined action of corrosion and stress, residual or applied.~~

4. Summary of Test Method

4.1 The prepared test specimen is placed in a closed container and exposed to ammonia vapor with a specific pH at ambient temperature for 24 h. Upon removal from the test atmosphere, the test specimen is examined for the presence of cracks.

5. Significance and Use

5.1 This test method is an accelerated test to determine if a copper alloy product ~~in a specific stress condition~~ will be susceptible to stress-corrosion cracking when exposed to a particular atmospheric condition during service with the appropriate risk level—see Annex A1.
5.1.1 This test method is generally intended to determine if a copper alloy product will crack because of internal stresses when subjected to the test, and is not intended for testing assemblies under applied stress. If used for this purpose, it shall be for information only and not a cause for rejection of the assembly, its component parts, or the original mill product.

6. Apparatus

6.1 *pH meter*.
6.2 *Closed vessel*, such as a desiccator.
6.3 Equipment for examining test pieces at 10× to 15× magnification.

7. Reagents and Materials

7.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.[3] 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.
7.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Type IV or better, of Specification D 1193.
7.3 *Ammonium Chloride Solution (4N)*— Dissolve 107 g of ammonium chloride (NH_4Cl) in water and dilute to 500 mL. Store the solution in a closed vessel.
7.4 *Hydrogen Peroxide (H_2O_2)*, 30 to 35 % technical grade. (**Warning**~~—Hydrogen peroxide in high concentrations can cause severe skin burns.)~~ —Hydrogen peroxide in high concentrations can cause severe skin burns. Use of proper safety equipment is advised.)
7.5 *Sodium Hydroxide Solution (300 to 500 g/L)*—Dissolve 300 to 500 g of sodium hydroxide (NaOH) into water and dilute to 1 L. (**Warning**—Sodium hydroxide can cause chemical burns to the skin and eyes. Use of proper safety equipment is advised.)
~~7.6A clean organic solvent or hot alkaline solution.~~
7.6 A clean organic solvent or hot alkaline solution that contains no ammoniacal-type groups or substituents.
7.7 *Sulfuric Acid Solution (50 mL/L)*— Slowly add 50 mL of concentrated sulfuric acid (H_2SO_4) into water and dilute to 1 L.

8. Test Media

8.1 Slowly add sodium hydroxide solution to ammonium chloride solution to give a test solution with a pH value appropriate to the intended application (see Annex A1). Maintain the solution at ambient temperature and dilute with DI water up to a volume

[3] ~~*Annual Book of ASTM Standards*, Vol 02.01.~~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 *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.