Designation: B 895 – 99

Standard Test Methods for Evaluating the Corrosion Resistance of Powder Metallurgy (P/M) Stainless Steel Parts/Specimens by Immersion in a Sodium Chloride Solution[1]

This standard is issued under the fixed designation B 895; 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 These test methods cover a procedure for evaluating the ability of sintered P/M stainless steel parts/specimens to resist corrosion when immersed in a sodium chloride (NaCl) solution.

1.2 Corrosion resistance is evaluated by one of two methods. In Method 1, the stainless steel parts/specimens are examined periodically and the time to the first appearance of staining or rust is used to indicate the end point. In Method 2, continued exposure to the sodium chloride solution is used to monitor the extent of corrosion as a function of time.

1.3 *This standard does not purport to address 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:*

A 380 Practice for Cleaning and Descaling Stainless Steel Parts, Equipment and Systems[2]

B 243 Terminology of Powder Metallurgy[3]

B 528 Test Method for Transverse Rupture Strength of Sintered Metal Powder Specimens[3]

D 1193 Specification for Reagent Water[4]

G 1 Practice for Preparing, Cleaning and Evaluating Corrosion Test Specimens[5]

G 48 Test Method for Pitting and Crevice Corrosion Resistance of Stainless Steel and Related Alloys By the Use of Ferric Chloride Solution[5]

3. Terminology

3.1 *Definitions*—Useful definitions of terms for metal powders and powder metallurgy are found in Terminology B 243.

4. Summary of Test Method

4.1 Method 1 is recommended for evaluating the corrosion resistance of stainless steel powder metallurgy parts/specimens and to verify that proper materials and processing conditions were used.

4.1.1 In this method, parts/specimens are immersed in 5 % (by mass) NaCl solution and examined periodically until the first appearance of staining or rust. A part or specimen is considered to have reached the end point when the first sign of corrosion occurs.

4.2 Method 2 is recommended for evaluating the processing variables used in producing parts/specimens.

4.2.1 In this method, parts/specimens are exposed further to the NaCL solution and periodically rated as either A, B, C, or D (A-no corrosion; D-high or extreme corrosion) by comparison with Fig. 1, a photograph of corroded specimens which serves as a standard. Method 2 has been found useful in alloy screening and process optimization studies.

5. Significance and Use

5.1 The ability of sintered powder metallurgy stainless steel parts/specimens to resist corrosion when immersed in sodium chloride solution is important to their end use. Causes of unacceptable corrosion may be incorrect alloy, contamination of the parts by iron or some other corrosion-promoting material or improper sintering of the parts (for example, undesirable carbide and nitride formations caused by poor lubricant burnoff or improper sintering atmosphere).

5.2 This standard may be part of a purchase agreement between the P/M parts producer (seller) and the user of the parts (purchaser) (Method 1). It may also be used to optimize part or specimen production parameters (Method 2).

[1] These test methods are under the jurisdiction of Committee B-9 on Metal Powders and Metal Powder Products, and is the direct responsibility of Subcommittee B09.05on Structural Parts.

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[2] *Annual Book of ASTM Standards*, Vol 01.01.

[3] *Annual Book of ASTM Standards*, Vol 02.05.

[4] *Annual Book of ASTM Standards*, Vol 11.01.

[5] *Annual Book of ASTM Standards*, Vol 03.02.

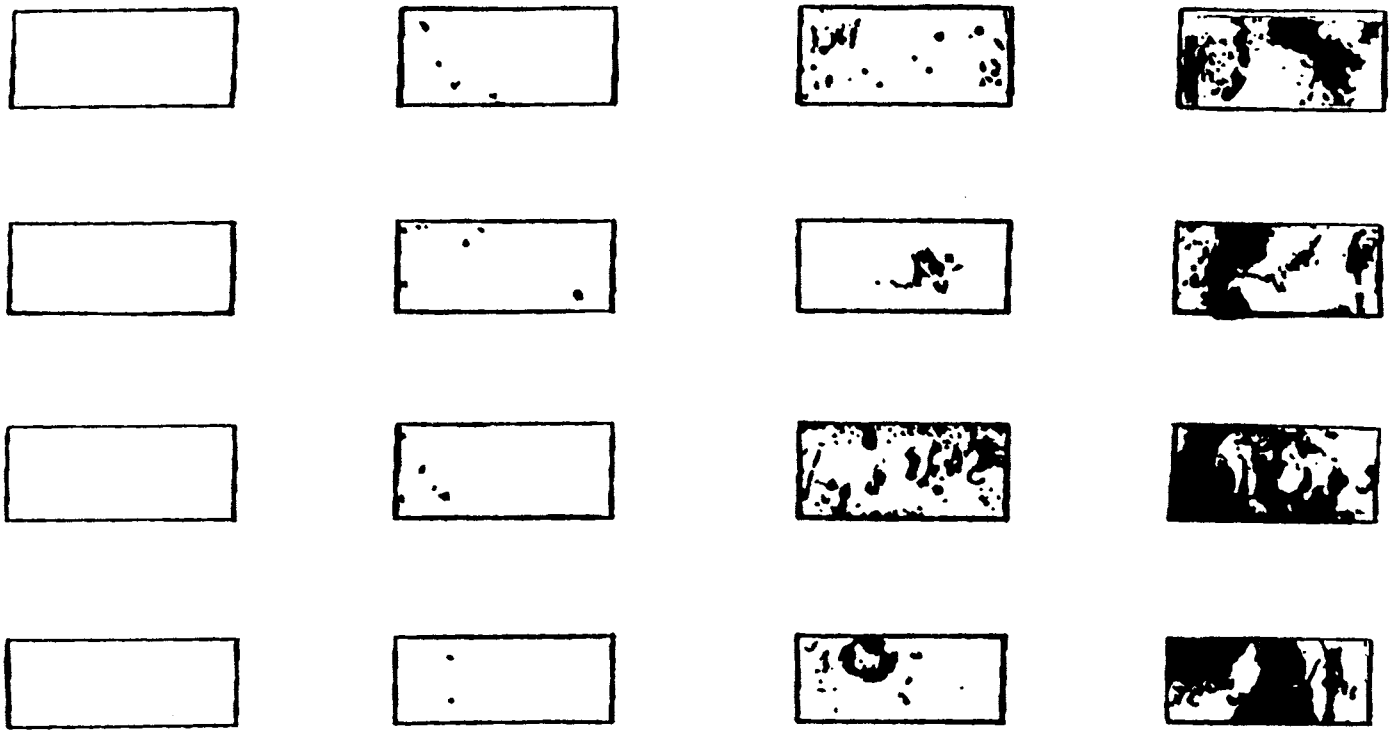

FIG. 1 Rust or Stain (Immersion in Aqueous Solution of 5 % NaCl)

6. Apparatus

6.1 *Sealable Glass or Plastic Jars*, of suitable capacity for specimens to be completely covered by the NaCl solution.

6.2 *Glass Beads* (4 mm is recommended).

6.3 *Glass Stirring Rods.*

6.4 *Tongs* (Stainless steel or plastic, nonmetallic plated).

7. Reagents

7.1 A sodium chloride solution consisting of 5 ± 0.1 % (by mass) NaCl shall be prepared using distilled or deionized water conforming to Specification D 1193 (Type 4) and ACS reagent grade NaCl solution. The 5 % NaCl solution shall be prepared no less than 16 h before beginning the corrosion testing.

7.2 Concentrated HCl.

7.3 Distilled or deionized water.

8. Test Specimen

8.1 Usually test parts are sintered parts, but they may also be standard transverse rupture bars as defined in Test Method B 528. A minimum of five parts/specimens shall be used for each test.

8.1.1 The density of the parts or specimens as well as any post sintering treatments, (that is, coining, repressing, machining, etc.) shall be stated. Parts or specimens shall be free of oil, dirt, grease and fingerprints. If they have been cleaned, the cleaning method shall be stated. Refer to Practices A 380 and G 1 for recommended cleaning practices.

8.1.2 The use of tongs or gloves, or both, to prevent contamination in handling is suggested.

9. Preparation of Apparatus

9.1 Soak previously used jars and glass beads in concentrated HCl for at least 12 h to remove rust stains; rinse with distilled or deionized water, then rinse again and allow to dry.

9.1.1 Place the glass beads in the bottom of the beaker. Use a sufficient number of beads to keep the test specimen off the bottom of the jar.

10. Procedure

10.1 *Method 1*:

10.1.1 Place one part or specimen per jar on top of the glass beads. Add the NaCl solution to each jar so that the volume of solution, in millilitres, is at least five times the mass of the specimen in grams. The distance from the surface of the part/specimen to the top of the solution should be at least 25 mm. The ratio of the volume of air to the volume of solution in a jar is recommended to be about 1:2 to 1:3. Remove air bubbles attached to the specimen surface and glass beads by swirling the solution or moving the specimen with a glass stirring rod. Close the jars. Record the date and the time of the start of the test. Store the immersed test specimens at a temperature of 21 to 24°C.

10.1.2 Examine the parts/specimens after ½, 1, 2, 4, and 8 h and at 24 h intervals from the onset of the test. Thereafter, the