Designation: B995 – 15

# StandardTest Method for Chloride Resistance Test for Chromium Electroplated Parts (Russian Mud Test)[1]

This standard is issued under the fixed designation B995; 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 This standard details a laboratory method to accelerate the effects of exposure to hygroscopic corrosive chloride compounds on electroplated chromium components. It is applicable to any substrate and coating system that utilizes electroplated chromium as the final metallic coating.

1.2 Field experience has shown that hygroscopic chlorides are significantly more aggressive toward chromium electroplated deposits than sodium chloride. The most common of which is calcium chloride. Corrosion caused by these chlorides is commonly known as the Russian Mud effect.

1.3 The standard does not specify exposure periods to be used for a specific product nor the interpretation to be given to the results. The suitability of this test and correlation of results with service experience should be determined before it is specified for coating systems.

1.4 The values stated in SI units are to be regarded as 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. Significance and Use

2.1 This test is used for specification acceptance, simulated service evaluation, manufacturing control, and research and development. It was developed specifically for use on components with electrodeposited chromium coatings exposed to hygroscopic chlorides. Test and production specimens may be used. Use of a standardized test could help in developing improved quality of chromium electrodeposited components and lead to the development of improved electroplated chromium systems.

## 3. Apparatus

3.1 The apparatus required for this test consists of an environment chamber capable of controlling both temperature and humidity within the specified range (see 6.4). The chamber must be large enough to hold the test specimens without touching one another or the walls of the chamber. Also, the reaction products formed on one specimen shall not fall on another specimen. Materials of construction shall not affect the corrosiveness of the test environment, nor be themselves corroded by the test environment.

## 4. Reagents and Materials

4.1 Table 1 specifies the laboratory grade consumable materials used in this test.

**TABLE 1**

| Item Name | CAS # | Description/Use |
|---|---|---|
| Deionized Water | 7732-18-5 | |
| Kaolin | 1332-58-7 | Soil/mud base media |
| Calcium Chloride Dihydrate | 10035-04-8 | Corrosive media |
| Sodium Hydroxide[A] | 1310-73-2 | Solution pH adjustment |
| Sulfuric Acid[A] | 7664-93-9 | Solution pH adjustment |
| Isopropyl Alcohol | 67-63-0 | Test sample cleaning |

[A]For ease of control, solutions that are approximately 0.25 N are recommended.

## 5. Preparation of Test Slurry

5.1 Prepare a solution containing dissolved calcium chloride produced by maintaining a ratio of 57.5 g calcium chloride dihydrate for every 94 mL of deionized water and the equivalent of 8 mL of 0.25 N NaOH. This solution should have a pH of approximately 9.6.

5.2 Mix the calcium chloride solution with kaolin at a ratio of 3 g kaolin per 5 mL calcium chloride water.

NOTE 1—Various sources of kaolin have been shown to perform equally within this test. The kaolin only acts as the "mud/solid material" within the test slurry accounting for the term Russian Mud Test.

5.3 Verification of pH of the slurry:

5.3.1 Dilute a portion of the slurry (for example, 10 mL) by 50% with deionized water.

NOTE 2—The diluted slurry cannot be used on test samples.

5.3.2 Check the pH of the diluted slurry using a calibrated digital pH meter. A self-flushing probe is recommended.

[1] This test method is under the jurisdiction of ASTM Committee B08 on Metallic and Inorganic Coatings and is the direct responsibility of Subcommittee B08.10 on Test Methods.

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5.3.3 The pH of the diluted slurry shall be in the range of 6.5 to 7.5. If necessary, adjust the pH of the calcium chloride slurry with either approximately 0.25 N sodium hydroxide (to raise the pH) or 0.25 N sulfuric acid (to lower the pH) until pH is within the specified range using the procedure within 5.3.1 and 5.3.2.

NOTE 3—The amount of sodium hydroxide and deionized water in 5.1 typically yields a final pH of 6.5 to 7.5. However, some batches of kaolin may be more acidic and always require further pH adjustment in order to achieve the required pH of the slurry. It is permissible to initially adjust the amount of sodium hydroxide and deionized water in 5.1 in order to create a final slurry with the required pH of 6.5 to 7.5. Regardless of adjustment, maintain a mixture of 102 mL (NaOH + $H_2O$) for every 57.5 g calcium chloride dihydrate.

## 6. Procedure

6.1 Clean the test specimen using a clean, non-abrasive cloth soaked with a 50/50 mixture of isopropyl alcohol and deionized water. Ensure that the test piece is fully dried before proceeding.

6.2 Identify the surfaces on the specimens being tested that are to be evaluated during the test. At each designated location, apply approximately 0.6 mL of the slurry in a circular spot, using a pipette, eye dropper or similar application method. The solution shall be applied at the center of the circle and allowed to spread out naturally. Do not manually spread the slurry after applying it to the surface. Each application spot should be separated from other spots by at least 1 cm in all directions. If enough room is available at each location, apply up to three duplicate spots to observe possible variability in test results.

6.3 Test pieces shall be placed into the test chamber so that the calcium chloride slurry does not run off of the sample onto another sample, each test piece is completely exposed to the test environment, and the samples do not interfere with each other.

6.4 The test chamber shall be controlled at a temperature of 60 ± 3°C and 23 ± 5% relative humidity.

## 7. Evaluation of Results

7.1 The test duration, minimum number of test spots and inspection frequency must be specified and agreed upon before the beginning of the test.

7.2 At each inspection interval, remove samples from, or turn off, the test chamber. Remove the agreed upon test spots from each sample by wiping with warm water and a non-abrasive cloth. Evaluate the area from which the slurry was removed under 10 × magnification. Assign a rating to each spot according to the scale in Appendix X1. The acceptance criteria for evaluation are to be specified by the requestor. Continue test in the controlled chamber until the next inspection interval or until the end of the test.

NOTE 4—Operations should be scheduled that the cumulative maximum time for these interruptions is held to 60 minutes or less per day. It is recommended to have only one interruption per day if possible. If interruption time is longer than 60 minutes, it should be noted in the test report.

## 8. Records and Report

8.1 The following information will be included in the test report unless previously agreed upon:

8.1.1 Identification of the test specimens, including plating cycle and source.

8.1.1.1 Plating cycle, including thickness and type of chromium layer.

8.1.1.2 Identification of the layer prior to the chromium deposit and, if applicable, after the chromium layer.

8.1.2 The chamber temperature and relative humidity.

8.1.3 The frequency of evaluation, including the time intervals.

8.1.4 The test results using Appendix X1.

## 9. Precision and Bias

9.1 Information is being generated to develop the precision and bias of this test method.

9.2 The reliability, reproducibility, and accuracy of the test depend on proper and consistent control of a number of factors, including:

9.2.1 Preparation of the test solutions,

9.2.2 Cleaning of the test samples,

9.2.3 Chamber temperature and relative humidity,

9.2.4 Positioning of the specimens in the test chamber, and

9.2.5 Frequency of evaluation including the time interval.

## 10. Keywords

10.1 chloride; chromium; corrosion; decorative; electroplating; finishes; functional; Russian Mud