



Standard Test Method for Color Retention of Red, Orange, and Yellow Porcelain Enamels¹

This standard is issued under the fixed designation C 538; 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.

^{e1} NOTE—Keywords were added editorially in September 2004.

1. Scope

1.1 This test method² covers only porcelain enamels containing the cadmium-sulfide or cadmium sulfo-selenide types of pigments. The purpose of the test is to detect those red, yellow, orange, and some green porcelain enamels that are likely to experience appreciable color changes upon exposure to atmospheric corrosion.

1.2 *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. Summary of Test Method

2.1 Cupric sulfate solution is placed on the surface of appropriate samples and allowed to remain for 20 h under controlled illumination. The samples are then washed, dried, and examined visually for a darkening of the color in the tested area.

3. Significance and Use

3.1 Correlation between results of this test and outdoor exposure tests of porcelain enamels colored with cadmium sulfo-selenide pigment shows that the cupric sulfate test is an effective indicator of the tendency for such coatings to experience appreciable color changes during weathering. The cupric sulfate test is considered useful for specification acceptance, quality control, and research and development purposes.

4. Interferences

4.1 In some cases, the treatment may change the gloss of the tested area. Any such gloss change shall be disregarded.

5. Apparatus for Control of Illumination

5.1 The light source shall consist of a 110-V, 15-W cool white fluorescent lamp (designation F 15 T8CW), 25.4 mm (1 in.) in diameter by 457.2 mm (18 in.) long. Center the lamp near the top of a box, made from plywood or other suitable material, in such a position that the distance between the specimen surface and the centerline of the lamp is 228.6 mm (9 in.). The box, with inside dimensions of 508 by 152 by 305 mm (20 by 6 by 12 in.) (length, width, height), shall be painted with a matte (flat), neutral white paint on the inside, and shall be vented for air circulation. Venting is accomplished by 11 holes, 12.7 mm ($\frac{1}{2}$ in.) in diameter, drilled 25.4 mm (1 in.) apart on a centerline 25.4 mm (1 in.) from the inside top, and 11 similar holes drilled on a centerline 25.4 mm (1 in.) from the bottom on each of the two long sides.

6. Reagents

6.1 The cupric sulfate solution is prepared by placing 50 g of cupric sulfate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$), reagent grade, in 100 mL of hot distilled water in a glass container, and permitting the mixture to age at room temperature ($27 \pm 5^\circ\text{C}$) ($80 \pm 10^\circ\text{F}$) for 16 h or longer with occasional stirring. This treatment produces a solution with some undissolved material remaining at the bottom of the container.

7. Specimens

7.1 Any size specimen larger than 50.8 by 50.8 mm (2 by 2 in.) may be used. Specimens should be reasonably flat.

8. Procedure

8.1 Clean the specimen by washing with soap and water, followed by copious rinsing with clean, but not necessarily distilled, water. Dry the surface with a clean dry towel by blotting or gentle rubbing.

8.2 Place several drops of the solution on the horizontal test area to form a pool, and immediately cover with a clean 25-mm (1-in.) diameter watch glass (with fire-polished edges) in the inverted position. The quantity of solution used shall be sufficient to fill the inverted watch glass except for a small bubble of entrapped air. Remove any excess solution from the

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² This test method is based on the Cupric Sulfate Test for Color Retention, Bulletin T-22 on the Porcelain Enamel Inst., Arlington, VA.

test area not under the watch glass. In some cases, it may be necessary to seal the area of contact between the watch glass and the specimen surface (with some material such as modeling clay or rubber cement) to prevent escape of the solution.

8.3 Place the specimen with watch glass in position under the light-chamber. It should remain in this position for 20 h in a room at $27 \pm 5^{\circ}\text{C}$ ($80 \pm 10^{\circ}\text{F}$). If the solution has escaped or dried out at the end of the test period, the test is invalid and shall be repeated on a different location on the specimen surface.

8.4 After exposure, remove the watch glass, rinse the treated area with water to remove all of the test solution, and dry with a clean cloth.

8.5 Visually examine the specimen *immediately* to determine whether there has been any darkening of the treated area. Use partially diffused daylight supplemented, if necessary, by artificial light, the total intensity being approximately that available within a few feet of an outside window, but do not

examine in direct sunlight. During observation, hold the specimen no nearer the light source (such as a window) than the minimum width of the source.

8.6 If any darkening can be detected visually, the specimen fails the test. Changes in gloss caused by the treatment shall not be considered in the grading.

9. Report

9.1 Report the type, color, and number of specimens tested, and whether each passed or failed the test.

10. Precision and Bias

10.1 A precision and bias statement is not applicable to this test method. Since it is a pass/fail test.

11. Keywords

11.1 color retention; porcelain enamel; red, orange, and yellow cadmium sulfo-selenide pigments

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