



Designation: C1378 – 20

Standard Test Method for Determination of Resistance to Staining¹

This standard is issued under the fixed designation C1378; 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 test method covers a procedure for determining whether ceramic tiles and glass tiles are affected by prolonged exposure to staining agents.

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

1.3 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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. Summary of Test Method

2.1 The resistance to staining is determined by maintaining staining agents in contact with tile surfaces for a specified period of time. After exposure, the surface is cleaned in a defined manner, and the test specimens are visually inspected for change.

3. Significance and Use

3.1 This test method is intended to determine the resistance to staining of tile surfaces. This test method is suitable for use in specifications, quality control, and research and development.

4. Staining Agents

4.1 *Contrasting Grout*, unsanded tile grout, applied as a neat paste.

4.2 *Carbon Lamp Black*.

4.3 *Waterproof Ink Black*.

4.4 *Washable Ink*.

4.5 *Potassium Permanganate Solution, 1 %*, prepared from 99 % KMnO_4 crystals, dissolve 1g of reagent into 100 mL of distilled water.

4.6 *Methylene Blue Solution, 1 %*.

4.7 This test method may be used for exposing tile to any staining agent deemed appropriate for the expected service conditions and may specify any reasonable combination of time and temperature for the exposure period. Exposure substances, time, and temperatures should be selected so as to either simulate service conditions, or accelerate staining that is possible under expected service conditions, or bear some other meaningful relation to expected service conditions.

5. Apparatus

5.1 *Glass Test Tubes or PVC Tubes*, plain end glass test tubes or PVC tubes with a diameter of approximately 20 mm and a length sufficient to contain the required amount of test solution

5.2 *Oven*, capable of maintaining a constant temperature of at least 110 °C.

5.3 *Cloths*, a supply of lintless, absorbent cloths or paper towels.

5.4 *Distilled or Deionized Water*, for preparation of the solutions.

5.5 *Light Source*, standard light source that supplies a minimum of 300 lux of illumination.

5.6 *Cleaning Agents*.

5.6.1 *Hot Water*.

5.6.2 *Weak Cleaning Agent*, a commercial agent, not containing abrasive, with a pH of 6.5 to 7.5.

5.6.3 *Strong Cleaning Agent*, a commercial cleaning agent containing abrasive, with a pH of 9 to 10.

5.6.4 *Suitable Solvents*:

(1) 3 % (v/v) HCl solution, prepared from 38 % hydrochloric acid by adding 79 mL of the reagent hydrochloride acid solution to 921 mL of distilled water.

(2) 20 % KOH solution (200 g/L), prepared by dissolving 222 g of 90 % potassium hydroxide into 1 L of distilled water.

(3) Acetone (technical grade).

¹ This test method is under the jurisdiction of ASTM Committee C21 on Ceramic Whitewares and Related Products and is the direct responsibility of Subcommittee C21.06 on Ceramic Tile.

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6. Samples

6.1 *Number of Test Specimens*—One defect-free test specimen, which is representative of the entire surface, for each test solution is to be used. Test specimens shall be representative of the sample, and where tiles have different colors of decorative effects, care should be taken to include all distinctive parts. More test specimens may be necessary to incorporate all surface features.

6.2 *Size of Specimens*—The original tile for testing may be cut to 50 by 50 mm squares for testing with each cut piece labeled according to the testing solution to be applied.

6.3 The sample surfaces may be cleaned with a solvent, such as acetone.

6.4 The test specimens can be glazed or unglazed tile. If the tiles are glazed, then the staining agent should be applied to the glazed surface.

7. Procedure for Staining Agent Application

7.1 *Application of Staining Agent:*

7.1.1 The labeled test specimens are laid out on a table in a well-ventilated area. (**Warning**—This test method involves the use of chemical substances. Proper precautions for the handling of these chemicals should be taken, such as protective clothing and fume hoods.)

7.1.2 Using a glass test tube or PVC tube, place approximately 5 mL of the liquid staining agent described in 4.3 – 4.6 in contact with the surface of the specimens. If the surface of the specimen is textured, using a non-reacting sealing agent such as plumber’s putty or petroleum jelly around the outside of the tube may be necessary to prevent leaking.

7.1.3 Carefully place the assembly on the table and leave undisturbed for 24 h.

7.1.4 For the dry staining agents described in 4.1 and 4.2, apply a generous amount of the staining agent with a cloth in the center of the test specimen, being sure to leave some unexposed area for comparison. The grout described in 4.1 should be mixed with enough water to make a neat paste before application. For light-colored tile, black grout should be used, and for dark tile, white grout should be used.

7.2 *Removal of Test Solutions:*

7.2.1 After 24 h of contact between the test specimens and the liquid staining agents has expired, remove the tube from the specimen and dispose of the staining agent properly.

7.2.2 For the solid staining agents, proceed directly to the cleaning procedures.

7.3 *Cleaning Procedures*—The following cleaning procedures (A, B, C, and D) will be tried in succession until one of the procedures is successful at removing the stain. If the first procedure is successful, it is not necessary to try the remaining

three procedures. After each cleaning procedure, wipe the sample dry using an absorbent cloth or paper towel. If the stain is still visible after a cleaning procedure, move directly to the next procedure.

7.3.1 *Procedure A*—Flow of running hot water for 5 min; the surface then is wiped with a dry cloth.

7.3.2 *Procedure B*—Hand cleaning with the weak cleaning agent (5.6.2); a natural, nonabrasive sponge or a cloth can be used. The surface then is rinsed with running water and finally wiped with a dry cloth.

7.3.3 *Procedure C*—Hand cleaning with the strong cleaning agent (5.6.3) and a brush with hard bristles. The cleaning action is applied for approximately 2 min, then the surface is rinsed with running water and finally wiped with a dry cloth.

7.3.4 *Procedure D*—Immersion, for 24 h, of the test specimens in the suitable solvent listed in 5.6.4 that is capable of removing the stain.

7.4 Once a cleaning procedure is successful, dry the specimens by heating in an oven adjusted to a minimum of 110 °C and not exceeding 160 °C for a minimum of 4 h (or such other time as has been established for the oven in use and the mass of the tiles being dried). Cool the specimens to room temperature before evaluation.

8. Evaluation of Results

8.1 *Visual Evaluation*—Examine the surface at a standard distance of 25 cm and a standard illumination of approximately 300 lux. Rotate the sample to examine it from multiple angles. Examine for differences in appearance between the treated and untreated area. If the sample is stained visibly by the staining agent, then the results of that testing solution will be recorded as “affected.”

9. Report

9.1 Report the following information:

9.1.1 A description of the tiles being tested and state whether glazed or unglazed;

9.2 State the test conditions, that is, type of staining agents used and length of exposure; and

9.3 Report the results of the visual inspection for each tile by the simple statements “affected” or “not affected.”

10. Precision and Bias

10.1 *Qualitative Procedure*—This test method is a qualitative or pass/fail test; hence, precision and bias are not applicable.

11. Keywords

11.1 ceramic tile; glass tile; glaze durability; staining; stain resistance