~~Designation:C650–97~~ Designation: C 650 – 04 (Reapproved 2009)

Standard Test Method for Resistance of Ceramic Tile to Chemical Substances[1]

This standard is issued under the fixed designation C 650; 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, and to what degree, ceramic tiles are affected by prolonged exposure to chemical substances that are commonly used in the household or for cleaning purposes as well as other more severe conditions.

~~1.2The units used for concentration in this standard are v/v which refers to the volume of reagent/1 L of solution and g/L which refers to the weight of reagent, in g, to be dissolved in 1 L of water.~~

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

1.2.1 The units used for concentration in this standard are v/v which refers to the volume of reagent/1 L of solution and g/L which refers to the weight of reagent, in g, to be dissolved in 1 L of water.

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

2. Summary of Test Method

2.1 This test method calls for one or more tests, each consisting of exposing flat pieces of ceramic tile to the action of a specific chemical substance for a definite period of time at a prescribed temperature. After exposure, the surfaces of the tile are rinsed with water and inspected for effect.

3. Significance and Use

3.1 This test method is intended for testing ceramic tile that are to be used for food counters, lavatories, and similar residential, medical, and commercial installations, where they may come in contact with food, chemical, and waste substances and for tile in areas where they may be exposed to contact with strong cleaning agents.

3.2 The specification of 10 % hydrochloric acid solution and 10 % potassium hydroxide solution as normal testing fluids, and the length of exposure time and temperature are based on experimental laboratory work and interlaboratory tests, where it was indicated that resistance to these two substances probably assures resistance also to any other acidic or alkaline substance coming in contact with tile, except hydrofluoric acid.

3.3 The validity of using color difference as means of determining the degree to which tile surfaces are affected by acids and alkalies has been established by interlaboratory test and was found to be more reliable than the determination of loss of gloss, particularly for unglazed tile and mat or semimat glazed surfaces. Lack of coordination between instrumental value and visual effect was noted only in the case of minute surface changes, detectable only by oblique viewing.

4. Apparatus

4.1 *Test Tubes*, plain-end flint glass test tubes with a diameter of 20 mm and a length of 150 mm.

4.2 *Pipets*, glass with a volume of at least 50 mL with gradations in 1-mL increments.

4.3 *Oven*, capable of maintaining a constant temperature of 110 ± 5°C.

4.4 *Pencil*, HB hardness grade.

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

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

4.7 *Light Source*, standard, that supplies a 300 lux of illumination.

[1] This test method is under the jurisdiction of ASTM Committee ~~C-21~~C21 on Ceramic Whitewares and Related Products and is the direct responsibility of Subcommittee C21.06 on Ceramic Tile.

Current edition approved ~~Oct. 10, 1997.~~Jan. 1, 2009. Published ~~February 1998.~~March 2009. Originally ~~published as C650–70.~~approved in 1970. Last previous edition ~~C650–83 (1995)$^{\varepsilon 1}$~~ .approved in 2004 as C 650–04.

5. Reagents

5.1 *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.[2] 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.

5.2 The required dilutions for the preparation of each test solution is found in Table 1 of this test method.

5.2.1 *Common Household and Cleaning Chemicals*:

5.2.1.1 Acetic acid, 3 % (v/v).

5.2.1.2 Acetic acid, 10 % (v/v).

5.2.1.3 Ammonium chloride, 100 g/L.

5.2.1.4 Citric acid solution, 30 g/L.

5.2.1.5 Citric acid solution, 100 g/L.

5.2.1.6 Lactic acid, 5 % (v/v).

5.2.1.7 Phosphoric acid, 3 % (v/v).

5.2.1.8 Phosphoric acid, 10 % (v/v).

5.2.1.9 Sulfamic acid, 30 g/L.

5.2.1.10 Sulfamic acid, 100 g/L.

5.3 *Swimming Pool Chemicals*—Sodium hypochlorite solution, 20 mg/L, prepared from technical grade sodium hypochlorite with about 13 % of active chloride.

5.4 *Acids and Bases*:

5.4.1 Hydrochloric acid solution, 3 % (v/v).

5.4.2 Hydrochloric acid solution, 18 % (v/v).

5.4.3 Potassium hydroxide, 100 g/L.

[2] *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 Pharmacopeial and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

TABLE 1 Preparation of Test Solutions

Test Solution	Reagent Source	Amount of Reagent Required for Test Solution	Distilled Water Required for Test Solution
Common Household and Cleaning Chemicals			
~~Acetic acid, 3 % (v/v)~~	~~99.7 % glacial acetic acid~~	~~30 mL~~	~~1000 mL~~
Acetic acid, 3 % (v/v)	99.7 % glacial acetic acid	30 mL	970 mL
~~Acetic acid, 10 % (v/v)~~	~~99.7 % glacial acetic acid~~	~~1000 mL~~	~~1000 mL~~
Acetic acid, 10 % (v/v)	99.7 % glacial acetic acid	100 mL	900 mL
~~Ammonium chloride, 100 g/L~~	~~99.5 % ammonium chloride~~	~~100 g~~	~~1000 mL~~
Ammonium chloride, 100 g/L	99.5 % ammonium chloride	100 g	900 mL
~~Citric acid solution, 30 g/L~~	~~99.5 % citric acid~~	~~30 g~~	~~1000 mL~~
Citric acid solution, 30 g/L	99.5 % citric acid	30 g	970 mL
~~Citric acid solution, 100 g/L~~	~~99.5 % citric acid~~	~~100 g~~	~~1000 mL~~
Citric acid solution, 100 g/L	99.5 % citric acid	100 g	900 mL
~~Lactic acid, 5 % (v/v)~~	~~85 % lactic acid~~	~~59 mL~~	~~991 mL~~
Lactic acid, 5 % (v/v)	85 % lactic acid	50 mL	950 mL
~~Phosphoric acid, 3 % (v/v)~~	~~85 % phosphoric acid~~	~~35 mL~~	~~995 mL~~
Phosphoric acid, 3 % (v/v)	85 % phosphoric acid	30 mL	970 mL
~~Phosphoric acid, 10 % (v/v)~~	~~85 % phosphoric acid~~	~~118 mL~~	~~982 mL~~
Phosphoric acid, 10 % (v/v)	85 % phosphoric acid	100 mL	900 mL
~~Sulfamic acid, 30 g/L~~	~~99 % sulfamic acid~~	~~30 g~~	~~1000 mL~~
Sulfamic acid, 30 g/L	99 % sulfamic acid	30 g	970 mL
~~Sulfamic acid, 100 g/L~~	~~99 % sulfamic acid~~	~~100 g~~	~~1000 mL~~
Sulfamic acid, 100 g/L	99 % sulfamic acid	101 g	899 mL
Swimming pool chemicals			
~~Sodium hypochlorite solution, 20 mg/L~~	~~technical grade sodium hypochlorite with 13 % active clorine~~	~~20 mg~~	~~1000 mL~~
Sodium hypochlorite solution, 20 mg/L	technical grade sodium hypochlorite with 13 % active clorine	20 mg	980 mL
Acids and Bases			
~~Hydrochloric acid solution, 3 % (v/v)~~	~~38 % hydrochloric acid~~	~~79 mL~~	~~951 mL~~
Hydrochloric acid solution, 3 % (v/v)	38 % hydrochloric acid	30 mL	970 mL
~~Hydrochloric acid solution, 18 % (v/v)~~	~~38 % hydrochloric acid~~	~~474 mL~~	~~706 mL~~
Hydrochloric acid solution, 18 % (v/v)	38 % hydrochloric acid	180 mL	820 mL
~~Potassium hydroxide, 100 g/L~~	~~90 % potassium hydroxide~~	~~100 g~~	~~1000 mL~~
Potassium hydroxide, 30 g/L	90 % potassium hydroxide	33.33 g	967 mL
~~Potassium hydroxide, 30 g/L~~	~~90 % potassium hydroxide~~	~~30 g~~	~~1000 mL~~
Potassium hydroxide, 100 g/L	90 % potassium hydroxide	111 g	889 mL