



Designation: **C641–17** C641 – 23

## Standard Test Method for Iron Staining Materials in Lightweight Concrete Aggregates<sup>1</sup>

This standard is issued under the fixed designation C641; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### 1. Scope\*

1.1 This test method covers the testing of lightweight concrete aggregates to evaluate the potential degree of staining from iron compounds.

1.2 The values stated in SI units are to be regarded as the standard. The inch-pound values given in parentheses are provided for information only.

1.3 *This standard does not purport to address all of the safety problems—concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health 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. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

- [C125 Terminology Relating to Concrete and Concrete Aggregates](#)
- [C330/C330M Specification for Lightweight Aggregates for Structural Concrete](#)
- [C331/C331M Specification for Lightweight Aggregates for Concrete Masonry Units](#)
- [C702/C702M Practice for Reducing Samples of Aggregate to Testing Size](#)
- [C1761/C1761M Specification for Lightweight Aggregate for Internal Curing of Concrete](#)
- [D75/D75M Practice for Sampling Aggregates](#)
- [E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves](#)
- [E832 Specification for Laboratory Filter Papers](#)

### 3. Terminology

#### 3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology [C125](#).

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee [C09](#) on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee [C09.21](#) on Lightweight Aggregates and Concrete.

Current edition approved ~~June 15, 2017~~ June 1, 2023, Published ~~July 2017~~ July 2023. Originally approved in 1969. Last previous edition approved in ~~2009~~ 2017 as [C641–09](#); [C641 – 17](#). DOI: [10.1520/C0641-17](#); [10.1520/C0641-23](#).

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](#), or contact ASTM Customer Service at [service@astm.org](#). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

\*A Summary of Changes section appears at the end of this standard

#### 4. Significance and Use

4.1 This test method evaluates the potential degree of staining attributable to the presence of iron compounds in a lightweight aggregate sample primarily by means of a visual classification method. Such compounds may or may not produce stains on the surface of the concrete in which the aggregate is incorporated.

#### 5. Apparatus

5.1 *Balance*—A balance or scale accurate to within 0.1 % of the test load at any point within the range of use.

5.2 *Sieves*—9.5-mm ( $\frac{3}{8}$ -in.) and 600- $\mu$ m (No. 30) sieves conforming to Specification **E11**.

5.3 *Filter Paper*—shall comply with Specification **E832** class E2 with a minimum diameter of 240 mm.

5.4 *Cheesecloth Wrapping*—Two thicknesses, reagent grade cheesecloth, approximately 457 mm (18 in.) square is sufficient for wrapping each sample.

5.5 *Steam Bath*—Any suitable apparatus that will meet the requirement of the test procedure. Water in the steam bath, and makeup water, shall be iron-free water or distilled water.

NOTE 1—An oven top glassware sterilizer made of nonferrous materials is satisfactory.

#### 6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.<sup>3</sup>

6.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean distilled water or water of equal purity.

6.3 *Concentration of Reagents:*

6.3.1 *Concentrated Acid and Ammonium Hydroxide*—When reagents are specified by name it shall be understood that concentrated reagents of the following specific gravity are intended:

Hydrochloric acid (HCl)	sp gr 1.19
Ammonium hydroxide (NH <sub>4</sub> OH)	sp gr 0.90

6.3.2 *Diluted acid* is described in terms of the number of volumes of the concentrated reagent to be added to a given number of volumes of water. Thus HCl (1 + 2) means 1 volume of HCl (sp gr 1.19) added to 2 volumes of water.

#### 7. Sampling

7.1 Sample in accordance with Practice **D75/D75M**.

7.2 After reducing a field sample to an appropriate size in accordance with Practice **C702/C702M**, thoroughly dry the aggregate and prepare by sieving material to pass the 9.5-mm ( $\frac{3}{8}$ -in.) sieve and is retained on the 600- $\mu$ m (No. 30) sieve.

#### 8. Procedure

8.1 Select two portions each weighing 100 g from the aggregate sample prepared for test.

<sup>3</sup> “Reagent Chemicals, American Chemical Society Specifications,” Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see “Reagent Chemicals and Standards,” by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY, and the “United States Pharmacopeia.”

8.2 Crimp the edges of two filter papers to form cup-shaped receptacles approximately 130 mm (5 in.) in diameter and 60 mm (2½ in.) in depth. Place one of the 100-g portions in each filter cup, spreading to a uniform depth. Fold the sides of the cup to the center and press in that position.

8.3 Wrap both portions of the prepared sample, one on top of the other, in cheesecloth. Saturate with distilled water and expose to steam in the steam bath for 16 h ± 30 min, adding distilled water as make-up water as required.

8.4 Remove from the steam bath, and carefully remove the aggregate from the filter papers. Wash both papers in water, place on a watch glass, and oven dry at a temperature of  $110\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$  ( $230\text{ }^{\circ}\text{F} \pm 9\text{ }^{\circ}\text{F}$ ). The insoluble products of the decomposition of iron compounds in the aggregate will be deposited on the filter paper as red, green, or black stains.

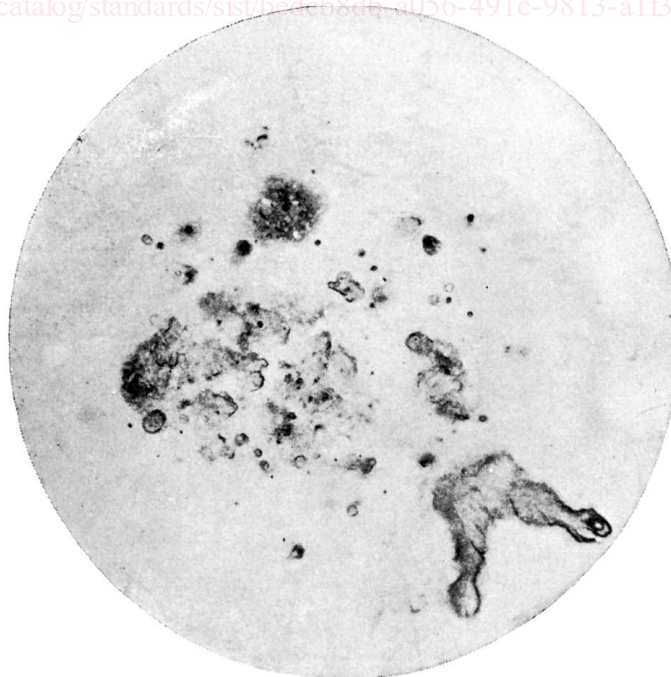
8.5 Rate the extent of staining on the filter papers by the Visual Classification Method.

8.5.1 *Visual Classification Method*—Evaluate the extent and intensity of the stains on the filter paper in accordance with the photographic stain index reference standards shown in Figs. 1-5: The photographic stain index ranges from No Stain (stain index = 0) to a Very Heavy Stain (stain index = 100).

8.6 When required by Specification C330/C330M and Specification C331/C331M, or Specification C1761/C1761M, follow the procedure of the Chemical Analysis Method.

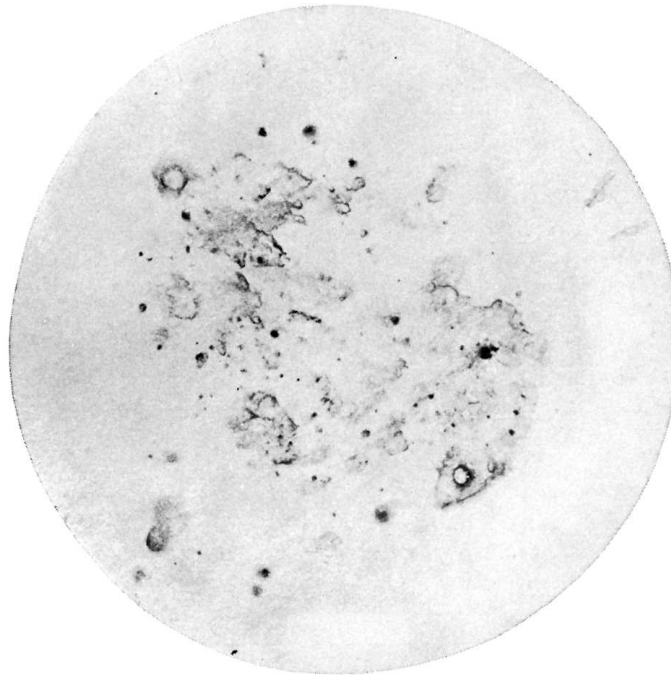
8.6.1 *Chemical Analysis Method*—The iron deposits may be dissolved from the filter papers by careful application of HCl from a dropping bottle and rinsing with hot distilled water from a wash bottle. Otherwise, dissolve the iron compound on the washed and dried filter papers by digesting in HCl (1 + 1) and filtering out the residue of filter pulp washing thoroughly with hot water. Precipitate the iron in the filtrate as ferric hydroxide Fe(OH)<sub>3</sub> by adding NH<sub>4</sub>OH dropwise to neutralize the acid using methyl red indicator solution. Redissolve the Fe(OH)<sub>3</sub> precipitate using 10 cm<sup>3</sup> of HCl (1 + 1) and determine the iron quantitatively as Fe<sub>2</sub>O<sub>3</sub> by standard titration procedures.

NOTE 2—The iron may be determined by using other standard quantitative procedures.



Stain Index = 100

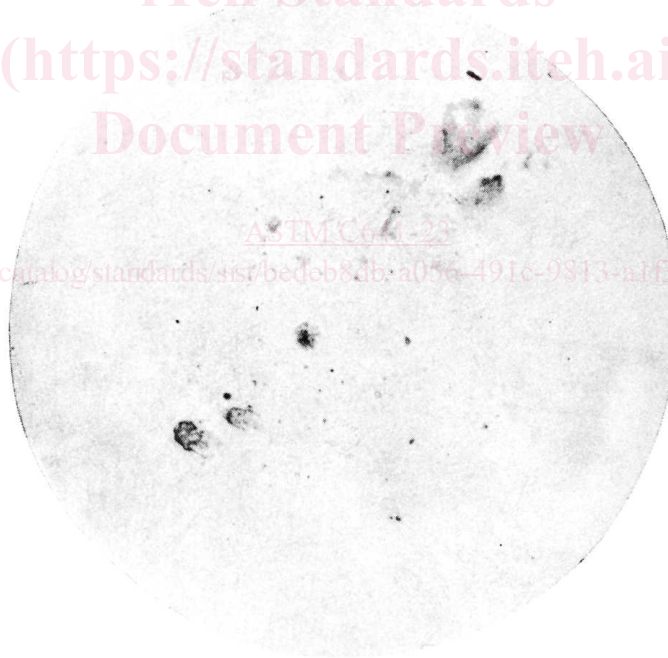
FIG. 1 Visual Degree of Staining



Stain Index = 80

FIG. 2

iTeh Standards  
(<https://standards.itih.ai>)  
Document Preview



Stain Index = 60

FIG. 3

<https://standards.itih.ai/catalog/standards/sist/bedcb83b-a056-491c-9813-a1f3518eed3a/astm-c641-23>

## 9. Calculation

9.1 Calculate the determined  $\text{Fe}_2\text{O}_3$  to the nearest 0.01 mg (to be reported to the nearest 0.1) as follows:

$$\text{Fe}_2\text{O}_3, \text{mg}/200 \text{ g} = E \times V \quad (1)$$