Designation: C 584 – 81 (Reapproved 2006)

Standard Test Method for Specular Gloss of Glazed Ceramic Whitewares and Related Products[1]

This standard is issued under the fixed designation C 584; 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 the determination of 60° specular gloss of glazed ceramic whitewares and related products.

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. Referenced Documents

2.1 *ASTM Standards:* [2]

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3. Terminology

3.1 *Definition:*

3.1.1 *specular gloss*—the ratio of reflected to incident light, times 1000, for specified apertures of illumination and reception when the axis of reception coincides with the mirror image of the axis of illumination.[3]

4. Significance and Use

4.1 This test method provides a means of establishing specular gloss limits for bright, semi-mat, and mat glazed surfaces. It is realized that specular gloss measurements do not always correlate well with visual rankings of glossiness because specular gloss is only one of several related appearance attributes that produce the sensation of gloss. However, the prescribed test method is of sufficient accuracy for the intended purpose.

NOTE 1—If a greater degree of distinction between bright glazed surfaces is desired, the 20° geometry instrument will provide it.[4]

5. Apparatus

5.1 *Instrumental Components*—The apparatus shall consist of an incandescent light source and lens furnishing an incident beam of rays of required aperture, means for locating the surface of the specimen, and a receptor located to receive the required pyramid of rays reflected from the specimen. The receptor shall be a photosensitive device having maximum response near the middle of the visible region of the specimen.

5.2 *Geometric Conditions*—The axis of the incident beam shall be 60° from the perpendicular to the specimen surface. The axis of the receptor beam shall be coincident with the mirror image of the axis of the incident beam. A flat piece of polished black glass in the specimen position shall form an image of the source in the center of the receptor window. The length of the illuminated area of the specimen shall be equal to not more than one third the distance from the center of this area to the receptor field stop. The axis of the incident beam and the axis of the receptor shall be within 0.1° of the nominal value indicated by the geometry. The dimensions and tolerances of the source and receptor shall be as indicated in Table 1 (see also Test Method D 523). The angular dimensions of the receptor field stop are measured from the receptor lens in a collimated-beam type instrument, and from the test surface in a converging-beam type instrument. See Fig. 1 for a generalized illustration of the dimensions. The tolerances are chosen so that errors of no more than one gloss unit at any point on the scale will result from errors in the source and receptor apertures.[4]

5.3 *Vignetting*—There shall be no vignetting of rays that lie within the field angles specified in 5.2.

5.4 *Spectral Conditions*—Results should not differ significantly from those obtained with a source-filter photocell combination that is spectrally corrected to yield CIE luminous efficiency with CIE Source C. Since specular reflection is, in

[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 C21.03 on Methods for Whitewares and Environmental Concerns.

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[2] 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.

[3] See Illing, A. M., "Comparison of Instrument Measurement and Visual Estimation of Specular Gloss of Glazed Ceramic Tile," *Materials Research & Standards*, Vol 2, No. 2, Feb. 1962, p. 117.

[4] For more complete data see Hammond III, H. K., and Nimeroff, I.," Measurement of Sixty-Degree Specular Gloss," *Journal of Research*, Nat. Bureau Standards, Vol 44, June 1950 (*RP* 2105): also Hunter, R. S., "Gloss Evaluation of Materials," *ASTM Bulletin*, No. 186, December 1962.

TABLE 1 Angles and Relative Dimensions of Source Image and Receptors

	In Plane of Measurement			Perpendicular to Plane of Measurement		
	θ, deg	2 tan θ/2	Relative Dimension	θ, deg	2 tan θ/2	Relative Dimension
Source image tolerance ±	0.75	0.0131	0.171	3.0[A]	0.0524	0.682
	0.25	0.0044	0.057			
60° receptor tolerance ±	4.4	0.0768	1.000	11.7	0.2049	2.668
	0.1	0.0018	0.023	0.2	0.0035	0.046

[A] Maximum; no minimum specification.

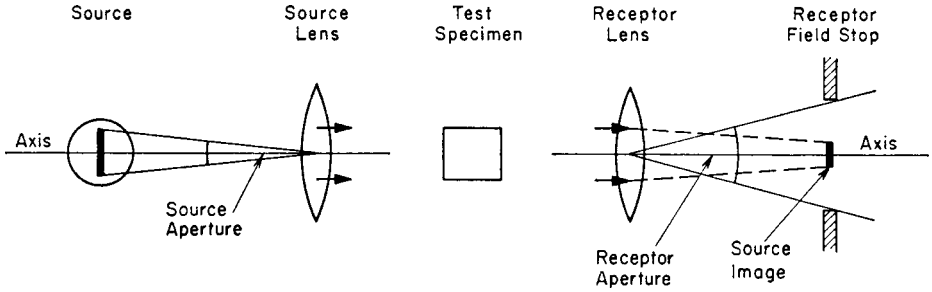

FIG. 1 Generalized Glossmeter Showing Apertures and Source Image Formation for a Collimated-Beam Type Instrument

general, spectrally nonselective, spectral corrections need be applied only to highly chromatic, low-gloss specimens upon agreement of users of this method.

5.5 *Measurement Mechanism*—The receptor-measurement mechanism shall give a numerical indication that is proportional to the light flux passing the receptor field stop within ±1 % of full-scale reading.

6. Specular Gloss Standards

6.1 *Primary Working Standard*—The primary working standard shall be a piece of highly polished black glass, having a plane surface and a refractive index of 1.540. It shall be assigned a 60° specular gloss value of 94. The gloss value for glass of another refractive index can be computed from the Fresnel equation.[4] For small differences in refractive index, however, the gloss value will be a linear function of index. Each 0.001 increment in refractive index will produce a change of 0.16 in the gloss value assigned to a polished standard for the 60° geometry.

6.2 *Secondary Working Standards*—Secondary working standards, such as ceramic tile, may be calibrated from the primary standard.

NOTE 2—Primary and secondary standards are normally furnished the purchase of a 60° glossmeter. Both standards should be protected from damage to their surfaces and the surfaces cleaned before use as described for the specimens under Section 9.[5]

7. Test Specimens

7.1 The specimens shall be 102 by 102 mm (4 by 4 in.) in size or larger. Only those specimens which present a reasonably plane surface shall be used, because warpage and waviness will affect the results.

[5] Gloss standards are available from Gardner Laboratory, P.O. Box 5728, Bethesda, MD 20014, Hunter Associates Laboratory, 9529 Lee Highway, Fairfax, VA 22030, and Photovolt, 1115 Broadway, New York, NY 10010.

8. Preparation of Apparatus

8.1 After a warm-up period of 1 to 2 min, place the instrument with its opening over the center of the polished black glass primary standard and adjust the meter reading to the assigned value for the black glass standard. Now test the white ceramic tile secondary standard. If this reading is within two gloss units of the value assigned to the white standard, the instrument is ready for operation. Should the reading for the white standard deviate more than two gloss units from the assigned value, this indicates lack of linearity in the gloss scale and requires adjustment of the instrument optics. Such readjustment should preferably be performed by the manufacturer of the instrument.

9. Procedure

9.1 Clean the surface of the specimens to be tested with a cotton swab dipped in alcohol and dry the surfaces with a lint-free cloth.

9.2 Operate the glossmeter in accordance with the manufacturer's instruction.

9.3 Take two readings in the center of each specimen, the second one after rotating the specimen 90°, and average the two readings.

10. Report

10.1 Report the following information:

10.1.1 Type of material tested,

10.1.2 Average specular gloss reading of each individual specimen,

10.1.3 Notation of the presence of any specimen, portions of the test surface of which differ in gloss from the average by more than 5 % of the average,

10.1.4 Identification of the glossmeter used by name of manufacturer and model designation, and

10.1.5 Identity of the working standard or standards of gloss used.

11. Precision and Bias

11.1 Readings obtained on the same instrument should be repeatable to within 1 % of the magnitude of the readings. Readings obtained on different instruments should be reproducible to within 5 % of the magnitude of the readings. Results obtained may be uncertain due to the cumulative effect of several sources of error, that is, difference between the geometric distribution of flux reflected from standards and specimens may bring about uncertainties in the measured gloss, even though the source and receiver apertures are within the tolerances specified in 5.2; inaccuracy of reading may result even though the precision of the measurement mechanism is held within the tolerance specified in 5.5; and lens arrangement and stray reflections from the interior walls of the instrument may cause errors in gloss readings.

12. Keywords

12.1 glazed ceramic whitewares; specular gloss