Designation: D6441 – 05 (Reapproved 2024)

Standard Test Methods for Measuring the Hiding Power of Powder Coatings[1]

This standard is issued under the fixed designation D6441; 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 These test methods determine and report the hiding power of a powder coating with respect to two parameters:

1.1.1 Test Method A—Contrast Ratio at a given film thickness

1.1.2 Test Method B—Film thickness at 0.98 (98 %) contrast ratio.

NOTE 1—The measured parameters follow powder coating industry practice by measuring hiding power in relation to film thickness, rather than the "Spreading Rate" function employed in Test Methods D344 and D2805 and other hiding power test methods.

NOTE 2—Hiding power is photometrically defined as the spreading rate at 0.98 contrast ratio. See definitions of spreading rate and hiding power in Terminology D16, D2805, and the *Paint and Coatings Testing Manual*.

NOTE 3—The contrast ratio 0.98 is conventionally accepted in the coatings industry as representing "complete" hiding for reflectometric hiding power measurements. But visually, as well as photometrically, it is slightly less than complete.

1.2 These test methods cover the determination of the hiding power of powder coatings applied by electrostatic spraying.

1.3 These test methods determine hiding power by means of reflectometric and thickness gauge measurements. They are limited to coatings having a minimum CIE-Y reflectance of 15 %.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 *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.*

1.6 *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:*[2]

D16 Terminology for Paint, Related Coatings, Materials, and Applications

D344 Test Method for Relative Hiding Power of Paints by the Visual Evaluation of Brushouts (Withdrawn 2018)[3]

D2805 Test Method for Hiding Power of Paints by Reflectometry

D3451 Guide for Testing Coating Powders and Powder Coatings

E284 Terminology of Appearance

E1331 Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry

E1347 Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry

E1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45°:0° or 0°:45°) Geometry

2.2 *Other Standard:*

1-GP-71 Method 14.7, Hiding Power, Contrast Ratio Method, October 1982[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *reflectance, n*—term of wide applicability, referring herein to the *luminous reflectance factor* as defined in Terminology E284, and equivalent to the CIE Tristimulus value *Y* measured in accordance with Test Methods E1331, E1347 or Test Method E1349 with specular reflection excluded. It is expressed as a percentage in this standard.

3.1.2 *white substrate, n—For purposes of this test*, a substrate of neutral shade with a minimum reflectance of 78 %.

[1] These test methods are under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and are the direct responsibility of Subcommittee D01.51 on Powder Coatings.

Current edition approved Feb. 1, 2024. Published February 2024. Originally approved in 1999. Last previous edition approved in 2016 as D6441 – 05 (2016). DOI: 10.1520/D6441-05R24.

[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] The last approved version of this historical standard is referenced on www.astm.org.

[4] Canadian General Standards Board, (CGSB), 222 Queen St., Ottawa, Ont., Canada K1A 1G6.

3.1.3 *black substrate, n*—A substrate with a maximum reflectance of 1 %, which is effectively zero for the purpose of measuring hiding power.

3.1.4 *white reflectance (R_W), n*—Reflectance of the applied test film over a white substrate of reflectance *W*.

3.1.5 *black reflectance (R_o), n*—Reflectance of the applied test film over a black substrate.

3.1.6 *reflectivity (R_∞), n*—The reflectance of a coating applied thickly enough to be completely opaque, as evidenced by equal reflectance over the black and a white test substrate.

3.1.7 *contrast ratio (C_W), n*—(*1*) The ratio of the reflectance of a film applied on a black substrate to a film of equal thickness applied on a white substrate. (*2*) An instrumental measure of film opacity.

3.1.7.1 *Discussion*—Contrast ratio can be expressed as a decimal fraction (R_O/R_W) or as a percentage ($100R_O/R_W$), the latter being preferred for the general concept of hiding or opacity, and employed in these test methods.

3.1.8 *opacity, n*—The degree to which a coating film hides a black and white substrate, as perceived visually or as measured instrumentally, (see *contrast ratio* defined in 3.1.7).

3.1.9 *wedge of coating, n*—A film of coating having a range of film thickness giving a corresponding range of opacities on a black and white substrate. (see Fig. 1).

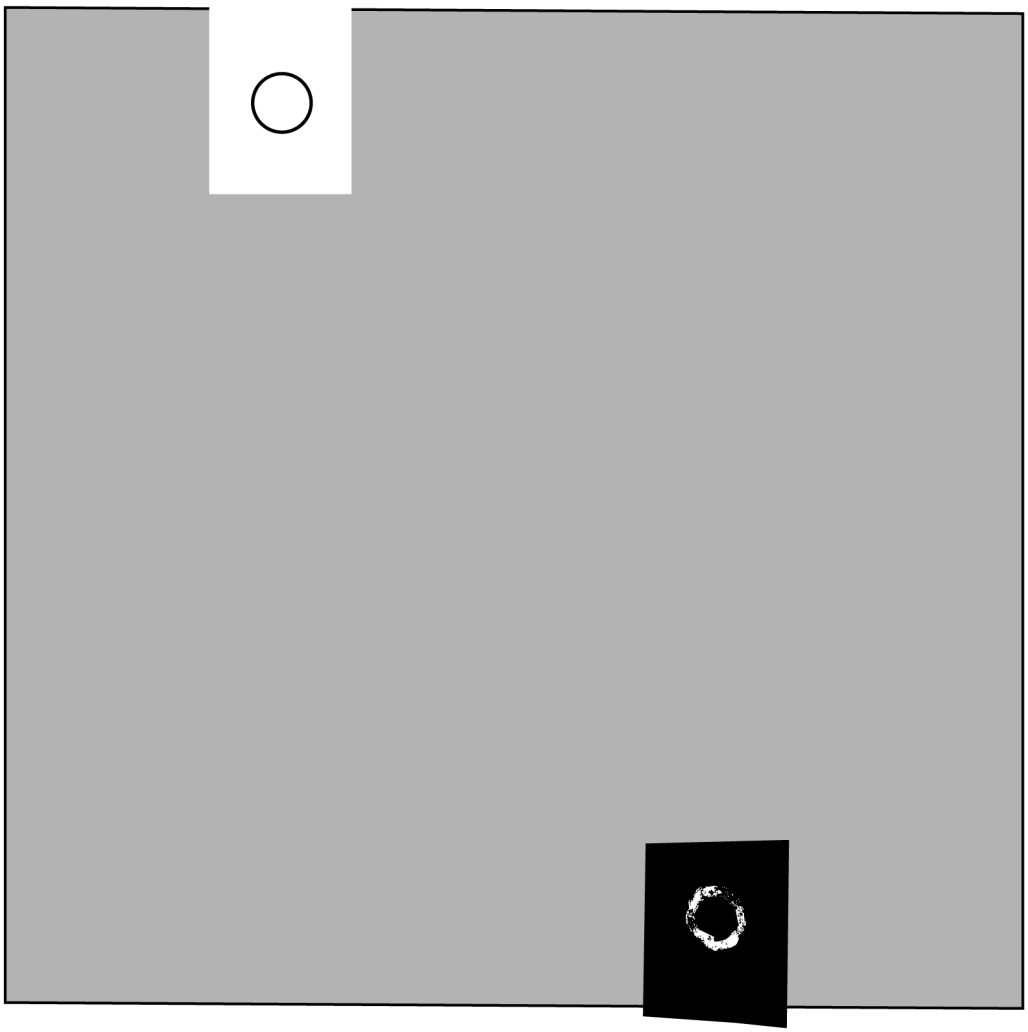
3.2 *Definitions of Symbols Used in Calculations Specific to This Standard*:

3.2.1 *T, n*—the specified or measured thickness of the test coating on the substrate.

3.2.2 t_o, *n*—the amount by which the black substrate exceeds the white substrate in thickness.

3.2.3 *T′, n*—$T + t_o$; the thickness reading corresponding to *T* over the black substrate when measured with the gauge calibrated to the white substrate as zero.

3.3 For additional definitions applicable to these test methods see Terminology E284.



NOTE 1—Shows black and white substrate areas exposed after removal of masking tape.

FIG. 1 "Wedge" Film Application