



Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres¹

This standard is issued under the fixed designation E903; 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 measurement of spectral absorptance, reflectance, and transmittance of materials using spectrophotometers equipped with integrating spheres.

1.2 Methods of computing solar weighted properties from the measured spectral values are specified.

1.3 This test method is applicable to materials having both specular and diffuse optical properties.

1.4 This test method is applicable to material with applied optical coatings with special consideration for the impact on the textures of the material under test.

1.5 Transmitting sheet materials that are inhomogeneous, textured, patterned, or corrugated require special considerations with respect to the applicability of this test method. Test Method [E1084](#) may be more appropriate to determine the bulk optical properties of textured or inhomogeneous materials.

1.6 For homogeneous materials this test method is preferred over Test Method [E1084](#).

1.7 This test method refers to applications using standard reference solar spectral distributions but may be applied using alternative selected spectra as long as the source and details of the solar spectral distribution and weighting are reported.

1.8 *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

¹ This test method is under the jurisdiction of ASTM Committee [E44](#) on Solar, Geothermal and Other Alternative Energy Sources and is the direct responsibility of Subcommittee [E44.20](#) on Glass for Solar Applications.

Current edition approved Dec. 1, 2012. Published December 2012. Originally approved in 1982. Last previous edition approved in 1996 as E903–96 which was withdrawn August 2005 and reinstated in December 2012. DOI: 10.1520/E0903-12.

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.

[E275 Practice for Describing and Measuring Performance of Ultraviolet and Visible Spectrophotometers](#)

[E424 Test Methods for Solar Energy Transmittance and Reflectance \(Terrestrial\) of Sheet Materials](#)

[E490 Standard Solar Constant and Zero Air Mass Solar Spectral Irradiance Tables](#)

[E772 Terminology of Solar Energy Conversion](#)

[E971 Practice for Calculation of Photometric Transmittance and Reflectance of Materials to Solar Radiation](#)

[E1084 Test Method for Solar Transmittance \(Terrestrial\) of Sheet Materials Using Sunlight](#)

[E1175 Test Method for Determining Solar or Photopic Reflectance, Transmittance, and Absorptance of Materials Using a Large Diameter Integrating Sphere](#)

[E2554 Practice for Estimating and Monitoring the Uncertainty of Test Results of a Test Method Using Control Chart Techniques](#)

[G173 Tables for Reference Solar Spectral Irradiances: Direct Normal and Hemispherical on 37° Tilted Surface](#)

[G197 Table for Reference Solar Spectral Distributions: Direct and Diffuse on 20° Tilted and Vertical Surfaces](#)

2.2 Other Documents:

[Federal Test Method Standard No. 141, Method 6101](#)³

[ASHRAE Standard 74-1988](#)⁴

[CIE 38 Radiometric and Photometric Characteristics of Materials and their Measurement](#)⁵

[CIE 44 Absolute Methods for Reflection Measurement](#)⁵

[NIST SP 250-48 Spectral Reflectance](#)⁶

[NIST SP 250-69 Regular Spectral Transmittance](#)⁷

3. Terminology

3.1 The following definitions are consistent with Terminology [E772](#). Additional terms appropriate to this test method are included in Terminology [E772](#).

³ Available from Standardization Documents, Order Desk, Building 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5049, Attn: NPODS.

⁴ Available from American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc., 191 Tullie Circle, NE, Atlanta GA 30329.

⁵ Available from U.S. National Committee of the CIE (International Commission on Illumination), C/o Thomas M. Lemons, TLA-Lighting Consultants, Inc., 7 Pond St., Salem, MA 01970, <http://www.cie-usnc.org>.

⁶ Available on line at <http://www.nist.gov/pml/div685/pub/upload/sp250-48.pdf>

⁷ Available on line at <http://www.nist.gov/calibrations/upload/SP250-69.pdf>