



Standard Test Method for Determining Solar or Photopic Reflectance, Transmittance, and Absorptance of Materials Using a Large Diameter Integrating Sphere¹

This standard is issued under the fixed designation E1175; 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 the absolute total solar or photopic reflectance, transmittance, or absorptance of materials and surfaces. Although there are several applicable test methods employed for determining the optical properties of materials, they are generally useful only for flat, homogeneous, isotropic specimens. Materials that are patterned, textured, corrugated, or are of unusual size cannot be measured accurately using conventional spectrophotometric techniques, or require numerous measurements to obtain a relevant optical value. The purpose of this test method is to provide a means for making accurate optical property measurements of spatially nonuniform materials.

1.2 This test method is applicable to large specimens of materials having both specular and diffuse optical properties. It is particularly suited to the measurement of the reflectance of opaque materials and the reflectance and transmittance of semitransparent materials including corrugated fiber-reinforced plastic, composite transparent and translucent samples, heavily textured surfaces, and nonhomogeneous materials such as woven wood, window blinds, draperies, etc.

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

1.4 *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.* (For specific safety hazards, see [Note 1.](#))

2. Referenced Documents

2.1 ASTM Standards:²

[E772 Terminology of Solar Energy Conversion](#)

[E892 Tables for Terrestrial Solar Spectral Irradiance at Air Mass 1.5 for a 37° Tilted Surface](#)

[E903 Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres](#)

3. Terminology

3.1 Definitions:

3.1.1 *absorptance, n*—see Terminology [E772](#).

3.1.2 *integrating sphere*—optical device used to either collect flux reflected or transmitted from a sample into a hemisphere or to provide isotropic irradiation of a sample from a complete hemisphere.

3.1.2.1 *Discussion*—It consists of a cavity that is approximately spherical in shape with apertures for admitting and detecting flux and usually having additional apertures over which sample and reference specimens are placed.

3.1.3 *photopic optical properties, n*—absorptance, reflectance, and transmittance of a sample evaluated as the weighted average of the measured property, with the wavelength by wavelength of the product of the spectral irradiance for the measurement and the Commission Internationale de l'Eclairage (CIE) photopic spectral response,³ as the weighting function.

3.1.4 *photopic response, n*—spectral response of the average human eye when fully adapted to daylight conditions.

3.1.5 *reflectance, n*—see Terminology [E772](#).

3.1.6 *transmittance, n*—see Terminology [E772](#).

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 [E44.05](#) on Solar Heating and Cooling Systems and Materials.

Current edition approved March 1, 2015. Published April 2015. Originally approved in 1987. Last previous edition approved in 2009 as E1175–87(2009). DOI: 10.1520/E1175-87R15.

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 Available from Commission Internationale de l'Eclairage (CIE), International Light Vocabulary, 3rd Ed., Bureau Central de la CIE, Paris, 1970.