



Designation: E 307 – 72 (Reapproved 1996)<sup>ε1</sup>

## Standard Test Method for Normal Spectral Emittance at Elevated Temperatures<sup>1</sup>

This standard is issued under the fixed designation E 307; 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.

ε<sup>1</sup> NOTE—Section 11 was added editorially in May 1996.

### 1. Scope

1.1 This test method describes a highly accurate technique for measuring the normal spectral emittance of electrically conducting materials or materials with electrically conducting substrates, in the temperature range from 600 to 1400 K, and at wavelengths from 1 to 35 μm.

1.2 The test method requires expensive equipment and rather elaborate precautions, but produces data that are accurate to within a few percent. It is suitable for research laboratories where the highest precision and accuracy are desired, but is not recommended for routine production or acceptance testing. However, because of its high accuracy this test method can be used as a referee method to be applied to production and acceptance testing in cases of dispute.

1.3 The values stated in SI units are to be regarded as the standard. The values 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.*

### 2. Referenced Documents

2.1 *ASTM Standards:*

E 349 Terminology Relating to Space Simulation<sup>2</sup>

### 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *spectral normal emittance*—the term as used in this specification follows that advocated by Jones (1),<sup>3</sup> Worthing (2) and others, in that the word emittance is a property of a specimen; it is the ratio of radiant flux emitted by a specimen per unit area (thermal-radiant exitance) to that emitted by a blackbody radiator at the same temperature and under the same conditions. Emittance must be further qualified in order to convey a more precise meaning. Thermal-radiant exitance that

occurs in all possible directions is referred to as hemispherical thermal-radiant exitance. When limited directions of propagation or observation are involved, the word directional thermal-radiant exitance is used. Thus, normal thermal-radiant exitance is a special case of directional thermal-radiant exitance, and means in a direction perpendicular (normal) to the surface. Therefore, spectral normal emittance refers to the radiant flux emitted by a specimen within a narrow wavelength interval centered on a specific wavelength and emitted in a direction normal to the plane of an incremental area of a specimen's surface. These restrictions in angle occur usually by the method of measurement rather than by radiant flux emission properties.

NOTE 1—All the terminology used in this test method has not been standardized. Definitions E 349 contain some approved terms. When agreement on other standard terms is reached, the definitions used herein will be revised as required.

### 4. Summary of Test Method

4.1 The principle of the test method is a direct comparison of the radiant flux from a specimen at a given temperature to the radiant flux of a blackbody at the same temperature and under the same environmental conditions of atmosphere and pressure. The details of this test method are given by Harrison et al (3) and Richmond et al (4).

4.2 The essential features of the test method are the use of a double-beam ratio-recording infrared spectrophotometer with variable slit widths, which combines and compares the signals from the specimen and the reference blackbody through a monochromator system which covers the wavelength range from 1 to 35 μm (Note 2). According to Harrison et al (3) a differential thermocouple with suitable instrumentation is used to maintain a heated specimen and the blackbody at the same temperature.

NOTE 2—An electronic-null, ratio-recording spectrophotometer<sup>4</sup> is preferred to an optical-null instrument for this use. It may be difficult to obtain and maintain linearity of response of an optical-null instrument if the optical paths are not identical to those of the instrument as manufactured.

### 5. Significance and Use

5.1 The significant features are typified by a discussion of

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee E-21 on Space Simulation and Applications of Space Technology and is the direct responsibility of Subcommittee E21.04 on Space Simulation Test Methods.

Current edition approved Sept. 29, 1972. Published November 1972. Originally published as E 307 – 68 T. Last previous edition E 307 – 68 T.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 15.03.

<sup>3</sup> The boldface numbers in parentheses refer to the list of references at the end of this test method.

<sup>4</sup> The Perkin-Elmer Model 13U has been found satisfactory for this purpose.