Designation: E 1247 – 92 (Reapproved 2000)

Standard Test Method for Identifying Fluorescence in Object-Color Specimens by Spectrophotometry[1]

This standard is issued under the fixed designation E 1247; 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 provides spectrophotometric methods for identifying the presence of fluorescence in object-color specimens.

1.2 This test method requires the use of a spectrophotometer in which the spectral distribution of illumination on the specimen can be altered as desired.

1.3 Within the above limitations, this test method is general in scope rather than specific as to instrument or material.

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 284 Terminology of Appearance[2]

E 991 Practice for Color Measurement of Fluorescent Specimens[2]

E 1164 Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation[2]

E 1331 Test Method for Reflectance Factor and Color by Spectrophotometry Using Hemispherical Geometry[2]

E 1348 Test Method for Transmittance and Color by Spectrophotometry Using Hemispherical Geometry[2]

E 1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional Geometry[2]

3. Terminology

3.1 The definitions in Terminology E 284 and Practice E 991 are applicable to this test method.

4. Significance and Use

4.1 Several standards, including Practices E 991, E 1164, and Test Methods E 1331, E 1348 and E 1349, require either the presence or absence of significant amounts of fluorescence exhibited by the specimen for correct application. This test method provides spectrophotometric procedures for identifying the presence of such fluorescence.

4.2 This test method is applicable to all object-color specimens, whether opaque, translucent, or transparent, meeting the requirements for specimens in the appropriate standards listed in 2.1. Translucent specimens should be measured by reflectance, with a standard nonfluorescent backing material, usually but not necessarily black, placed behind the specimen during measurement.

4.3 This test method requires the use of a spectrophotometer in which the spectral distribution of the illumination on the specimen can be altered in one of two ways. In one, an optical filter is inserted between the illuminating source and the specimen, without interfering with the detection of the radiation from the specimen. In the other, the illuminating and detecting systems of the instrument are interchanged, thus applying the so-called two-mode method.[3]

4.4 Either bidirectional or hemispherical instrument geometry may be used in this test method, but the instrument must be capable of providing polychromatic irradiation on the specimen.

5. Procedure

5.1 *Filter Method*:

5.1.1 Calibrate the instrument as required by the manufacturer. (See Practice E 1164 and the appropriate test method for the instrument geometry.)

5.1.2 Measure the specimen, obtaining either a table or a graph of spectral transmittance or reflectance factor versus wavelength.

5.1.3 Insert a short-wavelength cutoff filter between the illuminating source and the specimen. Select the cutoff wavelength of the filter according to the color of the specimen, by reference to Table 1.

5.1.3.1 For spectrophotometers equipped for polychromatic illumination by means of an integrating sphere, the filter must be placed between the illuminating source and the illumination entrance port of the sphere for reflectance measurement. For transmittance measurement, the filter must be placed between the illuminating source and the specimen.

5.1.3.2 For spectrophotometers equipped for polychromatic

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[2] *Annual Book of ASTM Standards*, Vol 06.01.

[3] Grum, F., "Colorimetry of Fluorescent Materials," *Color Measurement*, Academic Press, New York, Chapter 6, 1980.

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TABLE 1 Cutoff and Emission Wavelengths

Sample Color	Cutoff Wavelength, nm	Minimum Emission Wavelength, nm
White or blue	440	400
Green	510	480
Yellow	540	480
Orange	620	550
Red	650	560

illumination by means of bidirectional geometry, the filter must be placed between the illuminating source and the specimen.

5.1.4 Repeat the calibration in accordance with 5.1.1 and the measurement in accordance with 5.1.2.

5.2 *Two-Mode Method*:

5.2.1 Set the instrument for polychromatic illumination and calibrate it, following the instrument manufacturer's instructions. (See Practice E 1164 and the appropriate test method for the instrument geometry.)

5.2.2 Measure the specimen, obtaining either a table or a graph of spectral transmittance or reflectance factor versus wavelength.

5.2.3 Set the instrument for monochromatic illumination and calibrate it in a manner similar to that given in 5.2.1.

5.2.4 Measure the specimen in accordance with 5.2.2.

6. Interpretation of Results

6.1 Examine the tabulated or graphed values of the spectral transmittance or reflectance factor in the emission wavelength region. Select the wavelength region to be examined according to the color of the specimen by reference to Table 1.

6.2 If the spectral transmittances or reflectance factors obtained with full polychromatic illumination (see 5.1.2 or 5.2.2) are significantly larger than those for the altered condition (see 5.1.4 or 5.2.4), there is significant fluorescence from the specimen; otherwise not.

6.2.1 For many purposes, fluorescence can be considered significant if the two sets of spectral transmittances or reflectance factors differ by 1 % of full scale at the wavelength of greatest difference.

7. Report

7.1 Identify the specimen and state whether or not it exhibits significant fluorescence.

8. Precision and Bias

8.1 This test method requires no consideration of precision and bias as it reports only the identification of the presence or absence of significant fluorescence in the specimen. However, the selection of the criterion for significant fluorescence (see Section 6) may be influenced by the precision and bias of the measuring method used. This should be taken into account, and specific statements of precision and bias made if appropriate.

9. Keywords

9.1 fluorescence; light-transmission and reflection; spectrophotometry; transmittance and reflectance

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