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Standard Test Method for Evaluation of Color for Thermoplastic Traffic Marking Materials[1]

This standard is issued under the fixed designation D 4960; 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[1] NOTE—Research report was added editorially in March 2007.~~

1. Scope*

1.1 This test method describes the instrumental determination of color of thermoplastic traffic marking materials using the CIE tristimulus color measurement system.

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

1.3 *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]

D 883 Terminology Relating to Plastics

D 7307 Practice for Sampling of Thermoplastic Traffic Marking Materials

D 7308 Practice for Sample Preparation of Thermoplastic Traffic Marking Materials

E 179 Guide for Selection of Geometric Conditions for Measurement of Reflection and Transmission Properties of Materials

E 284 Terminology of Appearance

E 308 Practice for Computing the Colors of Objects by Using the CIE System

E 313 Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates

E 1164 Practice for Obtaining Spectrometric Data for Object-Color Evaluation

E 1347 Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry

E 1349 Test Method for Reflectance Factor and Color by Spectrophotometry Using Bidirectional (45:0 or 0:45) Geometry

F 412 Terminology Relating to Plastic Piping Systems

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology ~~D883, E284 and F412~~D 883, E 284 and F 412, unless otherwise indicated.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *thermochromism*, *n*—a change in color that takes place in the thermoplastic material with temperature changes.

3.2.2 *thermoplastic traffic marking material*, *n*—a highly filled 100 % total solids highway marking material that when heated to a molten state can be extruded or sprayed onto a road surface and when cooled forms a solid, durable delineator.

4. Summary of Test Method

4.1 The test specimen, representative of the material to be tested, is taken from a molten sample obtained in accordance with Practice D 7307. The thermoplastic specimen is prepared by pouring into a TFE-fluorocarbon coated pan, to form a patty of approximately 7.6 cm (3 in.) in diameter. The patty is allowed to cool to room temperature before measuring the color. Color measurements are made on the flat side or the top side of the thermoplastic patty.

NOTE 1—No significant color differences are encountered in reading the top or bottom of the patty.

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[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.44 on Traffic Coatings.

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[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.

***A Summary of Changes section appears at the end of this standard.**

5. Significance and Use

5.1 This test method provides a standard procedure for the determination of color of thermoplastic traffic marking materials. This test method can be used in conjunction with various thermoplastic pavement marking specifications to determine compliance of the material to said specification. This method can also be used by manufacturers of these materials to determine the uniformity of thermoplastic traffic marking materials from batch to batch.

5.2 There is a slight variation in color standards and colorimeters. This test method is only applicable when results are reported with information listing the instrument model designation and calibration standard.

6. Apparatus

6.1 *60 mL (2 oz.) Metal Ladle* .

6.2 *Color Measuring Instrument* , conforming to all requirements of Guide E 179, Practice E 1164, Test Method E 1347, Test Method E 1349, and Practice E 308(bidirectional 45°:0°, capable of reporting data for the CIE D65/2°, D6510° or C/2° illuminant/observer conditions).

6.3 *TFE-fluorocarbon Baking Pans or Uncoated Pint Can Lids*, for forming 7.6-cm (3-in.) diameter patties.

7. Procedure

7.1 Obtain a representative sample of the thermoplastic pavement marking material following the guidelines of Practice D 7307. Prepare the sample for testing by following Practice D 7308.

7.2 Prepare the thermoplastic sample obtained from step 7.1. Allow the material to remain at the specified temperature and specified time, under constant agitation, as required by the governing specification.

7.3 Remove the thermoplastic sample using a 60-mL (2 oz.) ladle and pour the thermoplastic sample into a clean, TFE-fluorocarbon-lined pan, to form a 7.6-cm (3-in.) diameter patty. If a TFE-fluorocarbon pan is not available, pour the sample into an uncoated pint tin lid to form a 3-in. diameter patty. If the sample is to be taken from a sample not under constant agitation the sample should be stirred vigorously for at least 10 s prior to removing material for preparation of the test specimen to prevent settling of the components and to provide a smooth homogeneous surface for color measurement.

7.4 Allow the patty to cool to room temperature for a minimum of 30 min.

NOTE 2—A 30 ± 5-min conditioning of the patty negates the initial effects of thermochromism.

7.5 Select the largest port available and calibrate the color-measuring instrument with a white calibration color standard according to the instructions supplied by the manufacturer.

7.6 Remove the patty from the TFE-fluorocarbon pan and read the color measurement values from the flat smooth side. If a pint tin lid is used then read the top of the patty. Without removing the patty from the sample port immediately take three readings. For a normal color measurement, record the average of two (2) each *Y*, *x*, and *y* readings with a 90 degree rotation between each reading.

7.6.1 If there is any evidence of thermochromism (measurements changing with sample orientation), record the average of 4 readings with a 90 degree rotation between each reading.

8. Report [3]

8.1 Report the following information:

8.1.1 The formula code, batch number, formula type, and color for each patty read,

8.1.2 The type of color measuring instrument used and the identification of the white color calibration standard, and

8.1.3 The exact cooling period and CIE *Y*, *x* and *y* color values (D65/2°, D6510° or C/2° illuminant/observer conditions) for each sample.

[3] This method allows for reporting of color values for several CIE illuminant/observer combinations in order to facilitate color communication. For direct comparison of color values – color scale, illuminant, standard observer, instrument geometry and standardization, sample preparation and presentation must be the same.