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Designation: D 985 – 97 (Reapproved 2002)

An American National Standard

Standard Test Method for Brightness of Pulp, Paper, and Paperboard (Directional Reflectance at 457 nm)[1]

This standard is issued under the fixed designation D 985; 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 determines the brightness of white, near-white, and naturally colored pulp, paper, and paperboard. Brightness is a commonly used industry term for the numerical value of the reflectance factor of a sample, with respect to blue light of specific spectral and geometric characteristics. This test method requires an instrument employing 45° illumination and 0° viewing geometry, with the illuminating and viewing beams adjusted so that translucent materials are evaluated on an arbitrary but specific scale (**1-4**).[2]

1.2 This test method is applicable to all naturally-colored pulps, and papers and board made from pulps. The measurement is not suitable for paper and paperboard containing added coloring matter (such as yellow or green dyestuff) which appreciably absorbs light in that part of the spectrum extending from about 400 to 500 nm. Colored papers must be measured spectrophotometrically or colorimetrically in order to obtain meaningful results (TAPPI T 442, T 524, and T 527). This test method is, however, suitable for pulps or papers which contain optical (fluorescent) brightening agents.

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:* [3]

D 585 Practice for Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, and Related Product

D 1968 Terminology Relating to Paper and Paper Products

2.2 *TAPPI Standards:*

T 218 Forming handsheets for reflectance tests of pulp[4]

T 442 Spectral reflectance factor, transmittance and color of paper and pulp (Polychromatic illumination)[4]

T 452 Brightness of pulp, paper and paperboard (Directional reflectance of 457 nm)[4]

T 524 Color of white and near-white paper and paperboard by *L, a, b* 45° 0° colorimetry[4]

T 527 Color of paper and paperboard in CIE system[4]

T 1206 Precision statements for test methods[4]

3. Terminology

3.1 *Definitions*—Definitions shall be in accordance with Terminology D 1968 and the *Dictionary of Paper.*[4]

4. Summary of Test Method

4.1 This test method provides the following:

4.1.1 A scale for measurement of paper brightness (blue directional reflectance factor),

4.1.2 A method for verifying the calibration of each instrument used for brightness testing so that the user can rely upon the test results, and

4.1.3 Criteria for the geometric, and photometric characteristics required by instruments employed in the use of this test method.

4.2 A procedure is also described for separating the fluorescent component of brightness from the non-fluorescent component of brightness and measuring it quantitatively.

5. Significance and Use

5.1 Brightness is the most extensively used optical property of pulp, paper, and paperboard. The measurement of brightness (blue reflectance) was originally devised as a means of quantitatively assessing the effectiveness of pulp bleaching. A specific spectral response has been defined and rigorously maintained, providing long–term stability of brightness values to the industry.

5.2 The accurate determination of brightness is of vital importance in the buy-sell relationship between the paper producer and consumer. High brightness is an indication of high-quality paper, resulting in a price structure where price is

[1] This test method is under the jurisdiction of ASTM Committee D06 on Paper and Paper Products and is the direct responsibility of Subcommittee D06.92 on Test Methods.

Current edition approved Dec. 10, 1997. Published October 1998. Originally approved in 1948. Last previous edition approved in 1993 as D 985 – 93.

[2] The boldface numbers in parentheses refer to the list of references at the end of this test method.

[3] 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.

[4] Available from the Technical Association of the Pulp and Paper Industry, P.O. Box 105113, Atlanta, GA 30348.

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relatively proportional to the brightness level. Paper producers are required to employ additional bleaching or the addition of costly optical brighteners in order to obtain high-brightness paper. The high cost of such brightening materials mandates adherence to close production tolerances for the brightness of the end product.

6. Apparatus

6.1 *Brightness Tester*—A test instrument which embodies the geometric and spectral characteristics specified in Annex A1 and in such adjustment that its calibration is correct within the tolerances specified in Section 8.

6.2 *Standards*—A set of five pads of paper sheets and two opal glass standards as described in Section 8 and Annex A3.[5]

6.3 *Backing Weight*, 1-kg weight with flat bottom (used with top loading instrument).

7. Sampling and Test Specimens

7.1 *Sample Preparation*:

7.1.1 *Paper and Paperboard*:

7.1.1.1 Sample the material to be tested in accordance with Practice D 585. From each test unit, cut a representative portion of the paper or board into seven or more sheets at least 37 by 50 mm (1½ by 2 in.) with the short dimension parallel to the machine direction. Avoiding any watermark, dirt, or blemish, assemble the sheets in a pad with the top sides up. Using the top sheet as a cover only, mark it near one corner to identify the sample and the top side. More than seven specimen sheets may be required for thin or transparent samples to ensure that the pad is completely opaque. (Only a few sheets will be required for paperboard.) The number of sheets in the pad should be such that the measured reflectance is not changed by doubling the number of sheets.

7.1.1.2 Do not touch test areas of the specimen with the fingers. Protect the test areas from contamination, excessive heat, or intense light.

7.1.2 *Pulp*—Prepare sheets from pulp samples in accordance with TAPPI T 218.

8. Calibration

8.1 Obtain a set of paper and opal glass standards at monthly intervals. Calibrate the test instrument in accordance with manufacturers' instructions, to the assigned values of a mid-range paper tab and an opal glass standard.

8.2 Check the test instrument readings against the assigned values of all five paper pads and two opal glass standards. If the instrument reading on any individual paper pad or opal glass standard differs from the respective assigned value by more than ±0.3 brightness points, adjust the instrument in accordance with the manufacturer's instructions so that the readings agree to within 0.3 brightness points.

8.2.1 The brightness value for a paper pad is the average of brightness values obtained for the five sheets under the cover sheet. The cover sheet is not to be measured.

8.3 Check the test instrument readings at least monthly against the assigned values of five paper tabs and two opal glass standards. A check should be made with one of the opal glass standards at least daily. The frequency of these checks will depend on the amount of use of the instrument and the accuracy required. Care should be exercised that the paper standards do not become soiled through frequent use.

8.4 At intervals of six months to two years, depending upon the conditions and frequency of use, the test instrument should be carefully inspected, tested, and adjusted to ensure that its geometric and spectral characteristics fall to within prescribed limits, and that its photometric system is within the specified tolerances.

9. Conditioning

9.1 Preconditioning of test specimens for this test method is not normally required.

10. Procedure

10.1 *Measuring Brightness*:

10.1.1 Place the filter selector in the *brightness* position.

10.1.2 Without touching the test areas with the fingers, remove the protective cover sheet and place it at the back of the pad. Place the pad over the specimen aperture of the instrument with the machine direction of the paper parallel to the plane determined by the axis of the incident and reflected rays of light and with the top side in contact with the instrument. If an orientation effect is suspected (as in testing of creped or embossed specimens), rotate the pad and observe the highest and lowest readings. Clearly record in the report how the specimens are oriented and the reading for each orientation.

10.1.3 Place the 1-kg backing weight on the pad or clamp the pad in place with the specimen clamp. Measure and record the brightness reading to at least 0.1 % reflectance.

10.1.4 Move the sheet just measured to the back of the pad and measure the second sheet while being backed by the pad. Repeat this procedure until five sheets have been measured. Average the five readings.

10.2 *Measuring Fluorescent Component of Brightness*:

10.2.1 Set the filter selector to the *fluorescence* position.

10.2.2 Place the opal glass standard over the specimen aperture and, if necessary, adjust to the standard value.

10.2.3 Place the specimen over the specimen aperture as described in 10.1.2. Measure and record the brightness readings for five sheets and average the five readings as described in 10.1.3 and 10.1.4.

10.2.4 Calculate the fluorescent component by subtracting the value obtained in 10.2.3 from the value obtained in 10.1.4.

NOTE 1—Some instruments automatically measure fluorescent component of brightness.

11. Report

11.1 Report the average brightness of the sample to one decimal place together with the minimum and maximum readings. State clearly and conspicuously any deviations from the standard procedure, and note any unusual features or characteristics of the sample.

[5] Available from The Institute of Paper Science & Technology, P.O. Box 105113, Atlanta, GA 30348, and Technidyne Corporation, 100 Quality Ave., New Albany, IN 47150.

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