

T 646 om-11

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This Test Method may include safety precautions which are believed to be appropriate at the time of publication of the method. The intent of these is to alert the user of the method to safety issues related to such use. The user is responsible for determining that the safety precautions are complete and are appropriate to their use of the method, and for ensuring that suitable safety practices have not changed since publication of the method. This method may require the use, disposal, or both, of chemicals which may present serious health hazards to humans. Procedures for the handling of such substances are set forth on Material Safety Data Sheets which must be developed by all manufacturers and importers of potentially hazardous chemicals and maintained by all distributors of potentially hazardous chemicals. Prior to the use of this method, the user must determine whether any of the chemicals to be used or disposed of are potentially hazardous and, if so, must follow strictly the procedures specified by both the manufacturer, as well as local, state, and federal authorities for safe use and disposal of these chemicals.

Brightness of clay and other mineral pigments (45/0)

1. Scope

1.1 This method describes a procedure for determining the brightness of clay or other mineral pigment that has been pulverized under controlled conditions and made into a uniformly compacted pigment plaque. This method is for use with minerals normally used in the manufacture of paper and is not intended for highly colored pigments.

1.2 The instrument employed has the same spectral, geometric, and photometric characteristics as that described in TAPPI T 452 "Brightness of Pulp, Paper, and Paperboard (Directional Reflectance at 457 nm)." The brightness scale applicable to this method is the same as the brightness scale described in TAPPI T 452.

1.3 In contrast to TAPPI T 534 "Brightness of Clay and Mineral Pigments ($d/0^\circ$ diffuse)," which uses an instrument with an integrating sphere to provide hemispherical illumination and perpendicular observation, this method utilizes an instrument which uses 45° illumination and perpendicular viewing.

NOTE 1: Brightness values obtained using this method will not agree with those obtained using TAPPI T 534.

1.4 The specimens must be prepared with close adherence to the instructions found in the Appendices.

1.5 This method utilizes sample preparation apparatus which is identical to that required for TAPPI T 534. The measurement procedure is also similar.

2. Summary

This method provides: (a) a scale for the measurement of the brightness of clay and mineral pigments using $45/0$ geometry, (b) a method for verifying the calibration of each instrument used for brightness testing, (c) procedures for the preparation of specimens from both dry powder or aqueous slurry including procedural variations for several specific clays and mineral pigments.

Approved by the Standard Specific Interest Group for this Test Method



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3. Significance

The brightness of clay or mineral pigment affects the brightness of the paper with which it is used. Although one might assume that the measured brightness is a property of the material, in fact the value obtained depends significantly on the manner of specimen preparation. For this reason, detailed instructions for drying and pulverizing the material and for pressing the test plaque are given in the appendices.

4. Definitions

4.1 *Brightness*, reflectance of an opaque thickness of material measured for blue light with centroid wavelength of 457 nm under specified spectral and geometric conditions of measurement.

4.2 *Reflectance*, ratio of the reflected radiant or luminous flux to the incident flux in the given conditions.

5. Apparatus

5.1 *Reflectance meter*¹, adhering to the geometric, photometric and spectral specifications stated in TAPPI T 452.

5.2 *Standards*¹, set of at least 5 pads of paper tabs and 2 polished white opal glass standards shall be supplied monthly by the standardizing laboratory with calibrations based on a master instrument. Additional opal glass or ceramic standards (to be re-evaluated at least yearly), which have brightness values within 5 brightness units of each sample to be measured, shall be available upon request.

5.3 *Sample (plaque) preparation apparatus* as described in the Appendices.

6. Calibration

6.1 Obtain a set of 5 paper and 2 opal glass standards at monthly intervals and as soon as they are received, calibrate the test instrument to the assigned value of the mid-range tab. If the instrument readings of the other standards differ from their assigned value by more than ± 0.3 point, adjust the instrument in accordance with the manufacturer's instructions so that the readings agree with the assigned values to within 0.3 point.

6.2 A frequent calibration check should be made with the opal glass or ceramic standard which is within 5 brightness units of the sample to be measured. The frequency of these checks will depend on the amount of use of the instrument and the accuracy required. Clean the opal glass or ceramic standards frequently (at least weekly) with the appropriate solution and dry with lint-free tissue.

NOTE 2: To clean opal glass standards use a solution of 0.3% nitric acid, 95% ethyl alcohol (190 proof) and 4.7% distilled water. To clean ceramic standards use window cleaner with ammonia.

NOTE 3: Opal glass or ceramic standards should not be left over the instrument opening as it may harm the standard.

7. Sampling and preparation of test specimens

7.1 From each test unit obtained in accordance with TAPPI T 657 "Sampling of Fillers and Pigments," take a specimen of dry clay or pigment sufficient for the test.

7.2 In the event that the test unit is in a dispersed aqueous slurry form, determine the percent solids and remove a slurry equivalent to 100 g of dry pigment.

7.3 Prepare plaques (3 are recommended) by the procedure outlined in the Appendices. Leave the plaques in place as prepared until immediately prior to testing. They should be protected from circulating air, ultraviolet radiation, high humidity, dust or other contamination which might affect the optical reflectance.

¹ Names of suppliers of testing equipment and materials for this method may be found on the Test Equipment Suppliers list in the set of TAPPI Test Methods, or may be available from the TAPPI Quality and Standards Department.

8. Measurement

8.1 When ready to test, “break” the plaque free of the plate. Lift the plaque cylinder vertically to prevent “burnishing” of the plaque surface, which will result if the cylinder is twisted or moved across the glass plate. Visually inspect the plaque surface to detect surface irregularities, contamination, or other flaws in the surface to be tested. Should any such be noted, discard the plaque and prepare another.

NOTE 4: Visual inspection and measurement should be made within 10 s of breaking the plaque free to minimize the effects of rapidly diminishing brightness when exposed to room air.

8.2 Carefully place each prepared test plaque into position on the reflectance instrument and measure its reflectance with reference to that of a calibrated working standard in accordance with the operating instructions supplied with the instrument.

9. Report

Report the average brightness of the plaques to one decimal place. Indicate that the measurements were obtained in accordance with TAPPI T 646. The report must also include the type of reflectance instrument used for the measurement and any deviations from TAPPI T 646.

10. Precision

10.1 The following data are taken from Reports 137 through 142 of the Paper and Paperboard Collaborative Reference Program conducted by Collaborative Testing Services, Inc. The data were modified to include only the 7-10 laboratories that used the Anglo type pulverizer, as specified in this method. All samples were anhydrous, spray dried kaolin clays and ranged in brightness from 86 to 91 percent (measured in accordance with TAPPI T 452). Five test determinations were made per sample. Samples A1, A2 and A3 were from the same batch of clay; samples B1, B2 and B3 were from the same batch of clay etc.

10.2 The terms repeatability and reproducibility are used as defined in TAPPI T 1200 “Interlaboratory Evaluation of Test Methods to Determine TAPPI Repeatability and Reproducibility.”

Sample	Grand Mean	Between-Lab Std. Dev.	Repeatability Std. Dev.	Reproducibility Std. Dev	Repeatability	Reproducibility
A1	90.82	0.22	0.18	0.27	0.50	0.76
A2	90.63	0.27	0.11	0.29	0.31	0.80
A3	90.82	0.33	0.17	0.36	0.48	1.02
B1	89.75	0.23	0.11	0.25	0.31	0.70
B2	89.86	0.11	0.12	0.15	0.34	0.43
B3	89.95	0.24	0.11	0.26	0.31	0.73
C1	86.18	0.19	0.10	0.21	0.28	0.59
C2	86.22	0.19	0.11	0.21	0.31	0.60
C3	85.94	0.92	0.11	0.93	0.31	2.59
D1	86.47	0.10	0.10	0.13	0.28	0.36
D2	86.15	0.55	0.10	0.56	0.28	1.56
D3	86.65	0.38	0.12	0.40	0.34	1.11

10.3 The user of these precision data is advised that it is based on actual mill testing, laboratory testing, or both. There is no knowledge of the exact degree to which personnel skills or equipment were optimized during its generation. The precision quoted provides an estimate of typical variation in test results which may be encountered when this method is routinely used by two or more parties.

