Designation: C1501 – 23

Standard Test Method for Color Stability of Building Construction Sealants as Determined by Laboratory Accelerated Weathering Procedures[1]

This standard is issued under the fixed designation C1501; 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 describes laboratory accelerated weathering procedures using either fluorescent ultraviolet or xenon arc test devices for determining the color stability of building construction sealants.

1.2 Color stability rankings provided by these two procedures may not agree.

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

1.4 There is no equivalent ISO standard for this test method.

1.5 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C717 Terminology of Building Seals and Sealants

C1442 Practice for Conducting Tests on Sealants Using Artificial Weathering Apparatus

D1729 Practice for Visual Appraisal of Colors and Color Differences of Diffusely-Illuminated Opaque Materials

D2244 Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

E284 Terminology of Appearance

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods

E1164 Practice for Obtaining Spectrometric Data for Object-Color Evaluation

G113 Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials

G151 Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources

G154 Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Materials

G155 Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials

2.2 *CIE Documents:*

CIE Publication Number 85: 1989, Technical Report-Solar Spectral Irradiance[3]

3. Terminology

3.1 *Definitions*—Definitions of the following terms are found in Terminology C717: standard conditions, compound, cure, sealant, and substrate. Definitions of the following terms are found in Terminology G113: sample, file specimen, control, fluorescent ultraviolet lamp, xenon arc, irradiance, radiant exposure, spectral power distribution.

4. Summary of Test Method

4.1 Specimens for this procedure are prepared in which the sealant to be tested adheres to flat aluminum panels. While any surface can be specified and used, this test method was developed with aluminum panels. At least four replicates of each sealant being tested are required. After curing, one replicate of each sealant being tested is retained as a file specimen and at least three replicates are exposed to actinic radiation, heat and moisture. At the end of the exposure period,

[1] This test method is under the jurisdiction of ASTM Committee C24 on Building Seals and Sealants and is the direct responsibility of Subcommittee C24.40 on Weathering.

Current edition approved June 1, 2023. Published July 2023. Originally approved in 2001. Last previous edition approved in 2019 as C1501 – 19. DOI: 10.1520/C1501-23.

[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.

[3] CIE Central Bureau, Vienna, Kegelgasse 27, A-1030 Wien, Austria

the test sealant is examined for color change by comparison to the unexposed file specimen.

4.2 As recommended in Practice G151 Section 4.2, unless several test sealants are exposed to determine their relative color stabilities, one or two control sealants of similar composition and construction to the test specimen and having known color stability should be exposed simultaneously with the test specimen to rank the color stability of the latter compared with the color stability of the control(s).

5. Significance and Use

5.1 This test method is intended to induce color changes in sealants, as well as their constituent pigments, associated with end-use conditions, including the effects of sunlight, moisture, and heat. The exposures used in this test method are not intended to simulate the color change of a sealant caused by localized weathering phenomena, such as atmospheric pollution, biological attack, or saltwater exposure.

5.2 When conducting exposures in devices that use laboratory light sources, it is important to consider how well the artificial test conditions will reproduce property changes and failure modes associated with end-use environments for the sealant being tested. Information on the use and interpretation of data from accelerated exposure tests is provided in Practice G151.

5.3 When this test method is used as part of a specification, exact procedure, test conditions, test duration and evaluation technique must be specified. Results obtained between the two procedures may vary, because the spectral power distribution of the light sources (fluorescent UV and xenon arc) differ. Sealants should not be compared to each other based on the results obtained in different types of apparatus.

5.4 These devices are capable of matching ultraviolet solar radiation reasonably well. However, for sealants sensitive to long wavelength UV and visible solar radiation, the absence of this radiation in the fluorescent UV apparatus can distort color stability ranking when compared to exterior environment exposure.

NOTE 1—Refer to Practice G151 for full cautionary guidance regarding laboratory weathering of non-metallic materials.

6. Apparatus

6.1 *Aluminum Panels*—Apply sealant to four aluminum panels, alloy 3003 H14, dimensions, 152 mm by 76 mm by 0.64 mm thick (6 by 3 by 0.025 in. thick), using rectangular Brass Frame described in 6.3. Other substrate materials are acceptable when specified.

6.2 *Spatula,* steel, about 150 mm (6 in.) long.

6.3 *Rectangular Brass Frame,* with outside dimensions of approximately 152 mm by 76 mm, and inside dimensions 75 mm by 65 mm by 3.0 mm (3 in. long by 2.5 in. wide by 0.125 in. deep).

6.4 *Thin Bladed Knife.*

6.5 *Color Evaluation Apparatus:*

6.5.1 *Lighting Equipment,* to evaluate color difference according to Practice D1729 or,

6.5.2 *Spectrophotometer,* complying with Practice E1164; or,

6.5.3 *Colorimeter,* complying with Test Method D2244.

6.6 *Cleaning Solvent,* isopropyl alcohol.

6.7 *Test Chamber*—Choice of type of apparatus shall be by mutual agreement among the interested parties. Because of differences in test conditions, test results may differ with the type of apparatus used. Consult Practices G154 and G155 for differences in the spectral power distributions of the exposure sources and Practice C1442 for the differences in test parameters in the two types of apparatus specified. The test cycles have been used by historical convention and may not adequately simulate the effects of outdoor exposure of sealants. Other cycles can be used by mutual agreement of all concerned parties.

6.7.1 *Fluorescent UV/Condensation Apparatus*—Operate the device in accordance with the procedure in Practice C1442, Section 7.3.

6.7.2 *Xenon Arc Light Apparatus*—Operate the device in accordance with the procedure in Practice C1442, Section 7.2.

NOTE 2—CIE Publication No. 85:1989 provides data on solar spectral irradiance for typical atmospheric conditions, which can be used as a basis for comparing laboratory light sources with daylight. For example, global solar irradiance is 0.68 W/(m^2·nm) at 340 nm as presented in CIE 85 table 4.

6.7.3 *Moisture*—The test specimens may be exposed to moisture in the form of water spray, condensation, immersion, or high humidity as agreed on by the mutual parties. Refer to Practice G151 Section 6.6 for discussion of the various forms of moisture in accelerated test devices.

7. Procedure

7.1 Condition sufficient sealant in an original closed container for at least 24 h at standard conditions and away from light.

7.2 Prepare at least four sealant test specimens and at least four of the control material, if used, on aluminum panels. Clean the aluminum panels using a suitable solvent. Allow solvent to dry before applying sealant.

7.3 Position the brass frame on the aluminum panel and overfill the entire frame with conditioned sealant. Strike off flat using the spatula. Immediately separate the sealant from the frame by running a thin bladed knife along the inside of the frame. Lift the frame from the aluminum panel.

7.4 Cure the test specimens at standard conditions for 21 days. Other conditions for curing are acceptable when specified provided they meet the following requirements: (*1*) the curing period shall not exceed 21 days, and (*2*) the temperature during the curing period shall not exceed 50 °C (122 °F). Keep one test specimen as an unexposed file specimen and store at standard conditions.

7.5 Place at least three of the cured specimens and the control material if used, in the weathering apparatus with the sealant surface facing the radiation source and positioned at the specified distance from the source. Specimens should be confined to an exposure area in which the irradiance is at least