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Standard Terminology Relating to Natural and Artificial Weathering Tests of Nonmetallic Materials¹

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1. Scope

1.1 This terminology standard covers terms that relate to the durability testing of Nonmetallic Materials using natural and artificial weathering exposure techniques.

1.2 It is the intent of this terminology standard to include those weathering terms in wide use in ASTM for which standard definitions appear desirable.

2. Referenced Documents

2.1 ASTM Standards:²

D 9 Terminology Relating to Wood and Wood-Based Products

E 41 Terminology Relating To Conditioning

E 772 Terminology Relating to Solar Energy Conversion

E 973 Test Method for Determination of the Spectral Mismatch Parameter Between a Photovoltaic Device and a Photovoltaic Reference Cell

G 84 Practice for Measurement of Time-of-Wetness on Surfaces Exposed to Wetting Conditions as in Atmospheric Corrosion Testing

G 90 Practice for Performing Accelerated Outdoor Weathering of Nonmetallic Materials Using Concentrated Natural Sunlight

2.2 AATCC Method:³

16 Colorfastness to Light

2.3 ANSI Standards:⁴

ANSI/NCSL Z540-2-1997 American National Standard for Expressing Uncertainty—U.S. Guide to the Expression of Uncertainty in Measurement

ISO 9370 Plastics -- Instrumental Determination of Radiant Exposure in Weathering Tests -- General Guidance and Basic Test Method

3. Significance and Use

3.1 This terminology is not intended to supersede the requirements of similar definitions in certain other documents, but is intended to provide a listing of terms that are in current widespread usage, and their context in relation to weathering.

4. Terminology

4.1 Definitions:

accelerated outdoor weathering, n —outdoor weathering using the sun as the source of irradiance, and where the rate of deterioration is accelerated over that of the in-service exposure position increasing one or more of the influencing parameters.

acceleration factor, n —the ratio of exposure time required to produce a specified amount of change in a material by one exposure test divided by the exposure time required to produce the same change by another exposure test.

DISCUSSION—Acceleration factors must be used with great caution because they vary between materials (including different formulations of the same material) and are strongly dependent on the exposure conditions and variability of both the natural and laboratory accelerated exposures. Acceleration factors may also vary depending on the level of material property change used to determine the acceleration factor. Do not ratio irradiance in laboratory accelerated tests to irradiance in outdoor exposures, or use equivalent radiant exposures to estimate time to fail in outdoor exposures. These calculations ignore differences in temperature and moisture between the accelerated test and exterior exposures, and in the spectral power distributions of the laboratory light source and sunlight.

actinic radiation, n —the spectral region(s) of a light source responsible for the photodegradation of a particular material.

ambient temperature, n —the existing temperature of the air or of an object in thermal equilibrium with the surrounding atmosphere.

azimuth angle, n —an angle of a plane to the horizon measured clockwise to the object.

backed exposure, n —a technique of weathering in which the test specimens being exposed are mounted onto a solid

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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.

³ Available from American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

⁴ Available from National Conference of Standards Laboratories, 1800 30th St., Suite 305B, Boulder, CO 80301.

backing material, of sufficient strength to hold the specimen. When the specimen and the backing are in direct contact the backing material must be of a type that will not contaminate the specimen. When two materials are intimately joined together to form one composite, the materials below the top surface are not considered as a backing.

DISCUSSION—The backing is typically plywood which has the effect of increasing specimen temperature and wet time during exposure, compared to exposure unbacked.

black box, *n*—a thin metal box painted flat black on the outside only exclusive of the bottom surface with an open top where the flat test specimens to be exposed constitute the top surface of the box; the box is equipped with mounting strips to hold the test specimens firmly in place; the top surface of the box must be completely filled at all times; any blank spaces on the top surface must be occupied by flat black “dummy” panels to maintain correct operating condition.

black box under glass, *n*—a glass covered enclosure or cabinet of any convenient size. It shall be constructed of corrosion resistant metal and be enclosed to prevent ambient air from circulating over the samples. Exterior non-glass surfaces shall be painted black. The interior shall remain unpainted.

black panel thermometer, *n*—a temperature measuring device consisting of a metal panel, having a black coating which absorbs all wavelengths uniformly, with a thermal sensitive element firmly attached to the center of the exposed surface. The black panel thermometer is used to control an artificial weathering device and to provide an estimate of the maximum temperature of samples exposed to a radiant energy source.

climatological types, *n*—major regions of significantly different recurring weather patterns. In weathering, several distinct climatological types are used to evaluate the atmospheric durability of materials. Within any single climatological variation, at a specific geographic location, short term weather patterns may fluctuate significantly. This may cause variability in short term exposures. Major climatic variations that are used for the study of weathering are:

warm, moist climate—subtropical climate distinguished as warm and humid year round, with frequent rain showers.

hot, dry climate—desert climate distinguished as sunny, hot, and dry year round, with rare scattered showers.

control, *n*—**in weathering**, the term control has three current widespread uses:

1. A material which is of similar composition and construction to the test material used for comparison, exposed at the same time.

DISCUSSION—A reference material can often be used as the control.

2. A portion of the material to be tested which is stored under conditions in which it is stable, and is used for comparison between exposed and original state.

DISCUSSION—This definition is deprecated in favor of “File Specimen.”

3. A portion of the exposed specimen which is protected from light exposure by masking.

DISCUSSION—This definition is deprecated in favor of “Masked Area.”

daylight, *n*—as used in weathering, the term equivalent to “sunlight”. It refers to the full spectrum of solar irradiance, that is, ultraviolet through infrared, and includes both diffuse sky and direct solar irradiance.

DISCUSSION—This definition differs from CIE (Commission Internationale de l’Eclairage) Publication No 17.4 which defines daylight as “the visible part of global (sun plus sky) radiation.”

direct weathering, *n*—a technique of weathering in which the test specimens are exposed to all prevailing elements of the atmosphere.

dry-bulb temperature, *n*—the temperature of the ambient air; for example, the temperature that is measured by the dry-bulb thermometer of a psychrometer. **D 4023**

durability, *n*—in weathering, a measure of the retention of original condition and function of a material after exposure to a specified set of conditions.

enclosed carbon arc, *n*—a light source in which an arc is produced across a pair of carbon rods by a high energy electrical source, such that a high intensity light is emitted. The carbons are enclosed in an inverted glass dome which acts to prolong the life of the carbons, and to modify the spectral power distribution received by the specimens.

exposure, *n*—the act of subjecting the test specimen to the test conditions.

exposure angle, *n*—the tilt from horizontal of the test specimen or any other exposed material, or both.

fading unit (AATCC), *n*—a specific amount of exposure made under the conditions specified in various test methods where one Fading Unit is one-twentieth ($1/20$ th) of the exposure required to produce a color change equal to Step No. 4 on the Gray Scale for Color Change or 1.7 ± 0.3 CIELAB units of color difference on Blue Wool Lightfastness Standard L 4 or 20 ± 1.7 CIELAB units of color difference on the Xenon Reference Fabric or combination thereof.

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file specimen, *n*—portion of the material to be tested which is stored under conditions in which it is stable, and is used for comparison between exposed and original state.

fluorescent ultraviolet lamp, *v*—a lamp in which the irradiance from a low pressure mercury arc is transformed to a longer wavelength UV radiation by a phosphor; the spectral power distribution of a fluorescent lamp is determined by the emission spectrum of the mercury arc light source, the emission spectrum of the phosphor and the UV transmittance of the glass tube.

fresnel-reflector system, *n*—flat mirrors arranged in an array such that they reflect onto a target, the illuminated area of which simulates the size and shape of the flat mirror. Such an array simulates the ray-tracing of a parabolic trough of the same aperture angle. **G 90**

gray scale, *n*—the scale consists of nine pairs of standard gray chips each pair representing a difference in color or contrast (shade and strength) corresponding to a numerical fastness rating. The results of colorfastness tests are rated by visually comparing the difference in color represented by the scale.

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