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Colorfastness to Ozone in the Atmosphere under High Humidities

Developed in 1962 by AATCC Committee RA33; editorially revised 1973, 1974, 1981, 1989, 1997, 2008; revised 1972, 1975, 1985, 2005, 2011; reaffirmed 1990, 2001; editorially revised and reaffirmed 1996, 2010. Partly equivalent to ISO 105-G03.

1. Purpose and Scope

1.1 This test method is used for determining the resistance of the color of textiles to the action of ozone in the atmosphere at elevated temperatures with relative humidities above 85%.

2. Principle

2.1 A test specimen and a swatch of control sample are simultaneously exposed to ozone in an atmosphere which is maintained at $87.5 \pm 2.5\%$ RH and a temperature of $40 \pm 1^\circ\text{C}$ ($104 \pm 2^\circ\text{F}$) until the control sample shows a color change corresponding to that of a standard of fading. The cycles are repeated until the specimen shows a definite color change or for a prescribed number of cycles.

2.2 On certain fibers, dye fading does not readily take place at humidities below 85%. Testing at high humidities is required to produce color change that predicts service fading under warm, humid conditions (see 11.1).

3. Terminology

3.1 **colorfastness**, *n.*—the resistance of a material to change in any of its color characteristics, to transfer of its colorant(s) to adjacent materials or both, as a result of the exposure of the material to any environment that might be encountered during the processing, testing, storage or use of the material.

4. Safety Precautions

NOTE: These safety precautions are for information purposes only. The precautions are ancillary to the testing procedures and are not intended to be all inclusive. It is the user's responsibility to use safe and proper techniques in handling materials in this test method. Manufacturers MUST be consulted for specific details such as material safety data sheets and other manufacturer's recommendations. All OSHA standards and rules must also be consulted and followed.

4.1 Good laboratory practices should be followed. Wear safety glasses in all laboratory areas.

4.2 Ozone is a sensory irritant. The test cabinet should be ventilated to the outside atmosphere in accordance with the manufacturer's instructions.

4.3 Exposure to chemicals used in this procedure must be controlled at or below levels set by governmental authorities (e.g., Occupational Safety and Health Administration's [OSHA] permissible exposure limits [PEL] as found in 29 CFR 1910.1000; see web site: www.osha.gov for latest version). In addition, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) comprised of time weighted averages (TLV-TWA), short term exposure limits (TLV-STEL) and ceiling limits (TLV-C) are recommended as a general guide for air contaminant exposure which should be met (see 11.2).

5. Apparatus and Materials (see 11.3)

5.1 Ozone Chamber for elevated temperatures and relative humidities above 85% (see 11.4).

5.2 Control Sample No. 129 for high humidities (see 11.5, 11.7 and 11.8).

5.3 Standard of Fading No. 129 for high humidities (see 11.6, 11.7 and 11.8).

5.4 Gray Scale for Color Change (AATCC Evaluation Procedure 1) (see 11.7).

6. Test Specimens

6.1 Cut each test specimen at least 100×60 mm (4.25×2.375 in.). For subsequent color comparison, the unexposed sample should be kept in an airtight container away from light to avoid further shade change.

6.2 When a laundered or drycleaned specimen is used, base the effects of ozone exposure on comparisons with the color of the laundered or drycleaned swatch. In the preparation of specimens for testing after laundering or drycleaning, use AATCC Methods 61, Colorfastness to Laundering: Accelerated, and 132, Colorfastness to Drycleaning.

7. Procedure

7.1 Suspend test and control specimens (see 11.5 and 11.7) in the exposure chamber (see 11.4) which is maintained at $87.5 \pm 2.5\%$ RH and a temperature of $40 \pm 1^\circ\text{C}$ ($104 \pm 2^\circ\text{F}$). Ozone concentrations must range from 10-35 pphm which should produce one cycle of fading in 3-28 h of test.

7.2 Examine the control specimen periodically

until the resulting color corresponds to that of the standard of fading (see 11.6 and 11.7) when compared in daylight ranging from average to slightly bluish north sky light, or equivalent artificial light. This constitutes one cycle (see 11.9).

7.3 Remove those specimens which exhibit a color change at the end of one cycle. One cycle will generally produce a measurable color change in specimens which are ozone sensitive.

7.4 Suspend a fresh control specimen and continue exposure of any remaining specimens for a second cycle.

7.5 Run additional similar cycles as necessary.

8. Evaluation

8.1 At the end of each cycle immediately compare those specimens which are removed from the exposure chamber with the preserved original from which they were drawn.

8.2 Rate the effect on color of test specimens after any specified number of cycles by reference to the Gray Scale for Color Change (AATCC Evaluation Procedure 1) or using AATCC Evaluation Procedure 7, Instrumental Assessment of the Change in Color of a Test Specimen, and record the numerical rating that corresponds to the appropriate one on the Gray Scale. Report the number of cycles run (see 11.7, 11.10 and 11.11).

9. Report

9.1 Report the numerical rating for the change in color of the test specimen, the number of cycles run and the temperature and relative humidity at which the test was performed.

10. Precision and Bias

10.1 Precision.

10.1.1 Interlaboratory Study. Four laboratories participated in this study. Twenty-one carpet materials were evaluated for colorfastness under conditions of the test method. Four specimens were assigned to each laboratory for each material. Three specimens were exposed in an ozone-humidity chamber, and one was retained in the original condition to evaluate color retention using AATCC Evaluation Procedure 1. The ILS exposure plan contained these factors: laboratories 4, materials 21, specimens 3, with 1 determination per specimen. Each laboratory assigned grades to specimens using AATCC Evaluation Procedure 1.