INTERNATIONAL STANDARD

ISO 105-G04

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Textiles — Tests for colour fastness —

Part G04 :
Colour fastness to oxides of nitrogen in the atmosphere at high humidities

Textiles — Essais de solidité des teintures —

Partie G04 : Solidité des teintures aux oxydes d'azote en atmosphère à taux d'humidité élevés

Reference number
ISO 105-G04:1989(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 105-G04 was prepared by Technical Committee ISO/TC 38, *Textiles*.

ISO 105 was previously published in 13 "parts", each designated by a letter (e.g. "Part A"), with publication dates between 1978 and 1985. Each part contained a series of "sections", each designated by the respective part letter and by a two-digit serial number (e.g. "Section A01"). These sections are now being republished as separate documents, themselves designated "parts" but retaining their earlier alphanumeric designations. A complete list of these parts is given in ISO 105-A01.

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Introduction

This method is based on a test (AATCC 164-1987), developed by AATCC in response to a specific need in the USA for the determination of fading in the presence of oxides of nitrogen at high relative humidities. Such conditions are prevalent along the Gulf of Mexico coast of the USA and in Southern California. Fading of some dyes on certain man-made fibres, particularly on carpets, was observed to be quite severe under such conditions. The development of this test method enabled dye manufacturers, fibre producers and textile manufacturers to select dye/fibre combinations which were resistant to fading in the presence of oxides of nitrogen at high relative humidities. The same fabrics when tested at low humidities showed little or no fading.

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Textiles — Tests for colour fastness —

Part G04 :
Colour fastness to oxides of nitrogen in the atmosphere at high humidities

1 Scope

This part of ISO 105 specifies a method for determining the resistance of the colour of textiles to the action of oxides of nitrogen in the atmosphere at elevated temperatures and high relative humidities.

For testing at lower humidities, see ISO 105-G:1978, section G01.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 105. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 105 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 105-A02:1987, *Textiles — Tests for colour fastness — Part A02: Grey scale for assessing change in colour.*

ISO 105-C01:1989, *Textiles — Tests for colour fastness — Part C01: Colour fastness to washing: Test 1.*

ISO 105-C02:1989, *Textiles — Tests for colour fastness — Part C02: Colour fastness to washing: Test 2.*

ISO 105-C03:1989, *Textiles — Tests for colour fastness — Part C03: Colour fastness to washing: Test 3.*

ISO 105-C04:1989, *Textiles — Tests for colour fastness — Part C04: Colour fastness to washing: Test 4.*

ISO 105-C05:1989, *Textiles — Tests for colour fastness — Part C05: Colour fastness to washing: Test 5.*

ISO 105-D01:1987, *Textiles — Tests for colour fastness — Part D01: Colour fastness to dry cleaning.*

ISO 105-G:1978, *Textiles — Tests for colour fastness — Part G: Colour fastness to atmospheric contaminants.*

ISO 105-J01:1989, *Textiles — Tests for colour fastness — Part J01: Measurement of colour and colour differences.*

3 Principle

A test specimen and a piece of control fabric are simultaneously exposed to oxides of nitrogen in an atmosphere which is maintained at 87,5 % ± 2,5 % relative humidity and a temperature of 40 °C ± 1 °C until the control fabric shows a colour change corresponding to that of a reference of fading. The exposure/measurement cycle is repeated until the specimen shows a definite colour change or for a prescribed number of cycles.

4 Apparatus and reagents

4.1 Exposure chamber, made of stainless steel which is coated on the inside with a resistant coating, capable of maintaining an atmosphere having a relative humidity of 87,5 % ± 2,5 % relative humidity at a temperature 40 °C ± 1 °C and contain-

ing nitrogen dioxide at a concentration by volume of 5 ppm ± 1 ppm.

4.2 Control fabric (see 8.2).

4.3 Reference of fading (fabric) (see 8.2).

4.4 Grey scale for assessing change of colour, complying with ISO 105-A02.

4.5 Supply of oxides of nitrogen (see 8.3).

WARNING — Oxides of nitrogen in high concentrations are injurious to health and should be exhausted to the atmosphere or trapped in water and neutralized with a 10 % (*m*/*m*) solution of sodium hydroxide or sodium hydrogen carbonate. The maximum concentration in a work area should not exceed 5 ppm (*V*/*V*).

5 Test specimens

5.1 Cut out test specimens measuring at least 60 mm × 60 mm. For subsequent colour comparison, the unexposed sample shall be kept in an air-tight container away from light to avoid further colour changes.

5.2 If the test involves the effect of oxides of nitrogen on laundered or dry-cleaned material, use laundered or dry-cleaned material for both the control and test exposure. For the preparation of specimens for testing after laundering or dry cleaning, follow the procedures described in parts C01 to C05 and/or part D01 of ISO 105.

6 Procedure

6.1 Suspend the test specimens and piece of control fabric (4.2) in the exposure chamber (4.1) which should produce a cycle of fade within 5 h to 15 h of exposure.

6.2 Examine the control fabric periodically until its colour corresponds to that of the reference of fading. This constitutes one cycle.

An alternative method of determining one cycle of fade is to terminate the exposure cycle when the control fabric exhibits a colour change of (16,5 ± 1,5) CIELAB units (see ISO 105-J01).

6.3 Remove those specimens which exhibit a noticeable colour change at the end of one cycle. One cycle will generally produce a measurable colour change in samples which are sensitive to oxides of nitrogen.

6.4 Suspend a fresh piece of control fabric (4.2) for each additional cycle of fade until the required number of cycles has been completed.

Specimens exposed to oxides of nitrogen may continue to change colour after removal from the test chamber. The colour may be stabilized by plunging them into a buffered urea solution (see 8.4) for 5 min, squeezing them out, thoroughly rinsing them in clean water and drying them in air at a temperature not above 60 °C. Do not treat with the urea solution any specimen that is to be returned to the test chamber for additional exposure.

6.5 At the end of each cycle, immediately assess the change in colour of the specimen using the grey scale for assessing change in colour (4.4).

6.6 Classify the effect on colour of test specimens after the specified number of cycles, using the grey scale for assessing change in colour (4.4).

7 Test report

The test report shall include the following particulars:

a) the number and date of this part of ISO 105, i.e. ISO 105-G04:1989;

b) all details necessary for the identification of the sample tested;

c) the numerical rating for change in colour of the specimen, the number of cycles and the temperature and relative humidity at which the test was performed.

8 Notes

8.1 Humidity for testing

The fading of dyes by oxides of nitrogen on some fibres such as polyamide and acetate is altered greatly by relatively small variations in relative humidity at high humidities. Therefore, to achieve reproducibility and good interlaboratory correlation in test results, close control of temperature and relative humidity is required.

8.2 Test control and standard of fading

The test-control fabric is a dyeing of 0,4 % CI Disperse Blue 3 on secondary cellulose acetate satin. Use Celliton Blue FFRN since its fading characteristics are well known and other CI Disperse Blue 3 dyes tend to exhibit different fading characteristics and may differ in tinctorial strength.

The reference of fading for the control fabric is dyed on cellulose (viscose) satin with approximately the

following formula: 0,300 % CI Direct Blue 80 and 0,015 % CI Direct Violet 47 based on the mass of the fabric.

Both the control fabric and the reference of fading shall be kept in a suitable container or enclosure to protect them from possible exposure to oxides of nitrogen and other contaminants which might be present in the atmosphere during transportation and storage and which could cause a colour change.

The control fabric is sensitive to other atmospheric contaminants such as ozone. Its fading rate will vary considerably at different humidities and temperatures and its use in natural or end-use testing as a measure of exposure to oxides of nitrogen is not recommended. The colour change produced on the control will reflect the combined effects of the atmospheric contaminants present and the effect of temperature/humidity variations, not just the effects of exposure to oxides of nitrogen.

8.3 Oxides of nitrogen

Use bottled gas which contains approximately 1 % nitrogen dioxide in nitrogen, in cylinders equipped with the proper reducing valves. For safety, chain the cylinders to a wall so that they cannot fall or be knocked down.

8.4 Urea after treatment

The use of this treatment is optional.

Experience has shown that colour change after removal of specimens from the exposure chamber is negligible. The urea treatment itself will often cause a colour change in specimens. Therefore, if this procedure is used, it is essential that both the exposed and unexposed control specimens be treated in an identical manner.

Use urea solution containing 10 g of urea per litre of water, buffered to pH 7 by addition of 0,4 g of sodium dihydrogen orthophosphate, 2,5 g of disodium orthophosphate and 0,1 g or less of a rapid-wetting surface-active agent (for example, sodium dioctyl sulfosuccinate).

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