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Imaging materials — Pictorial colour reflection prints — Comparison of image degradation observed between ISO 18930 accelerated weathering test method and outdoor exposure

Matériaux pour l'image — Réflexion des impressions photographiques en couleurs — Comparaison de la dégradation de l'image observée entre la méthode d'essai de vieillissement accéléré de l'ISO 18930 et l'exposition extérieure

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 42, *Photography*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Printed digital images are used in many applications in which they are exposed to outdoor weathering. ISO 18930 provides standardized test procedures to evaluate image stability both in real-time outdoor weathering tests and in accelerated laboratory simulations of the weathering process. Accelerated laboratory weathering tests have been developed as a result of the desire to obtain test results faster than would be obtained by actual outdoor exposure. However, accelerated weathering tests only have value if they can be correlated with actual outdoor performance.

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Imaging materials — Pictorial colour reflection prints — Comparison of image degradation observed between ISO 18930 accelerated weathering test method and outdoor exposure

1 Scope

This document describes the experimental framework, results, and conclusions from a round robin test that was performed in order to establish correlations between accelerated weathering according to the ISO 18930 test method and outdoor weathering at nine outdoor sites.

The types of digital printing technology that were used in this round robin test are aqueous inkjet, solvent inkjet, UV curable inkjet, digitally-exposed silver halide, and thermal mass transfer. The image print stability data and correlations of this document are to be considered illustrative of the performance of these classes of materials. Extension of these correlations to other classes of materials, such as dye sublimation, is verified by appropriate experimentation.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
digital printing media
recording elements used by digital printers to receive inks or pre-formed colourants

EXAMPLE The substrate may be paper, plastic, canvas, fabric, metal, or other ink-receptive material; the substrate may, or may not, be coated with an ink-receptive layer. The category of digital printers includes inkjet, electrophotographic, and thermal transfer.

3.2
laminate
overlaminate
layer of material that goes over the top or bottom of a specimen

Note 1 to entry: Usually to provide water-resistance, physical, and/or ultraviolet (UV) light protection of the specimen during a weathering test. A layer of protective film is applied with a pressure-sensitive or heat-activated adhesive.

3.3
accelerated laboratory weathering
simulated weathering where instruments (weathering devices) are used to obtain very controlled conditions that simulate, to some degree, and generally accelerate, the outdoor weathering results

Note 1 to entry: The use of such instruments is described in ISO 4892-1[2] and ASTM G151[16].

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3.4
outdoor weathering
actual placement of specimens outdoors in specific locations

Note 1 to entry: This is differentiated from simulated weathering where instruments (weathering devices) are used to obtain very controlled conditions that simulate, to some degree, and generally accelerate the outdoor weathering results. Use of such instruments is described in ISO 4892-1[2] and ASTM G151[16].

3.5
reciprocity failure
non-equivalence in weathering results between a long exposure/low-intensity experiment and its short exposure/high-intensity counterpart with an equivalent intensity-time product

3.6
daylight filter
optical filter or combination of filters that modifies the spectral power distribution of a light source to better represent some defined daylight spectrum

Note 1 to entry: These filters are not related to the blue filters used in the photographic industry for the change of correlated colour temperature of light sources.

Note 2 to entry: Adapted from ISO 18913[5].

3.7
coefficient of variation
standard deviation of a variable divided by the arithmetic mean of the variable

3.8
Pearson correlation coefficient
statistical measure of the degree of linear correlation between two variables, with value between –1,0 and +1,0 inclusive, where a value of +1,0 represents perfect positive correlation, a value of 0,0 signifies no correlation, and a value of –1,0 represents perfect negative correlation

3.9
acceleration factor
ratio of the time required to reach an endpoint in an outdoor weathering test to the time required to reach the same endpoint in a laboratory accelerated weathering test

3.10
colour fade acceleration factor
acceleration factor for which the bases of comparison are the ratios of reflected optical density during the test to the initial reflected optical density prior to the start of the test

4 General considerations for accelerated weathering tests

The ability to accurately predict the long-term outdoor performance of materials and printed images is essential to many industries. Since many of the relevant products are designed to last years or decades, accelerated weathering test methods have been developed to more rapidly assess outdoor performance and to investigate failure mechanisms associated with outdoor exposure. Unfortunately, this is an extremely complex task.

The three key components of accelerated weathering tests are heat, light, and water. The primary determinant of the degree of correlation for between outdoor weathering and an accelerated test method is the degree to which the spectral power distribution (SPD) of the light source in the test chamber matches the SPD of sunlight[7]. This is so critical because material photodegradation mechanisms are very specific to certain wavelengths of light[8]. The UV spectrum between 295 nm and 400 nm is responsible for most of the damage to polymers and colourants. The current state-of-the-art light source is filtered xenon arc lamps. In a comprehensive study of the accelerated weathering of polyester gel coats, Crump[9] found that xenon arc weathering gave higher correlation coefficients than

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