Test results

about light stability tests of 2 glass embedded test samples

Ordered by: On Site Solution
Jan van Rongen
Tappersweg 49E
2031 ET Haarlem
Nederland.

Image Engineering Dietmar Wüller
Augustinusstr. 9d
50226 Frechen
Germany
Tel.: +49 2234 912141
Fax: +49 2234 912142

ver1.1

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Content

1 Details of test conditions

This report shows the results of the light fading test of two samples under below described test conditions. Two different types of test samples as delivered by the manufacturer have been tested. They consist of a transparent film and are embedded between two glass plates, each of 4 mm thickness. Two samples of each type have been measured and averaged.
Sample A: Radiant CM
Sample B: Radiant CM reinforced
The results refer to the exact same type of film and lamination combination.
Version 1.1 of this test report was finished after the first test period of 30 days (38124 klux-h).
This report shows the test results after a total test period of 78 days which refer to 50,3 years of average indoor conditions of 450 lx per 12 h day.

The lightfading test as performed in our lab is based on the current work of ISO technical committee 42 to revise the Image stability test described in ISO Standard 18909 ('Photography-Processed photographic color films and paper prints- Methods for measuring image stability').
Image degradation caused by irradiation of light is in scope of two standards in draft status:

- ISO 18937: Imaging materials - Photographic images- Methods for measuring indoor light stability
- ISO 18940: Imaging materials - Reflection color prints - Specification for consumer-indoor stability

Image Engineering is participating in the development of the standards which address this issue. For further information see our 'whitepaper for printer and print life tests" available at www.image-engineering.de.

Image permanence concerns environmental factors and how they degrade prints over time. These include temperature and humidity, light with its spectral distribution (parts in the UV) and pollutions like ozone. Accelerated permanence testing is the common method to predict image stability to environmental influences, giving insight on how long prints will last without significant fading in average room conditions. When a print is exposed to light the energy of the absorbed light destroys the colorants. To perform accelerated aging, prints are exposed to a high intensity light source.

Since the light-induced fading depends on the spectral energy distribution of the light source the test method should use an illuminant that matches the actual-use conditions as closely as possible. In the 'Survey of environmental conditions relative to display of photographs in consumer homes', D.E. Burger et al., (Eastman Kodak Company) have studied the spectral distribution of indoor light. UV-filtered xenon lamps, match the window-filtered daylight pretty well but these light sources are not easy to handle and lead to significant running costs. Our search for alternative light sources lead to high-efficiency, discharge lamps produced by Philips (CDM-TD 150W/942). The spectral distribution is not as close to the daylight as the Xenon lamps but it seems to be close enough for the tests. The big advantage in using the discharge lamps is the lifetime of 6000 hours and the efficiency which is with app. 70% close to the one of fluorescent tubes.

The green curve in Figure 1 shows the spectral distribution of the illuminants we use in our test lab.

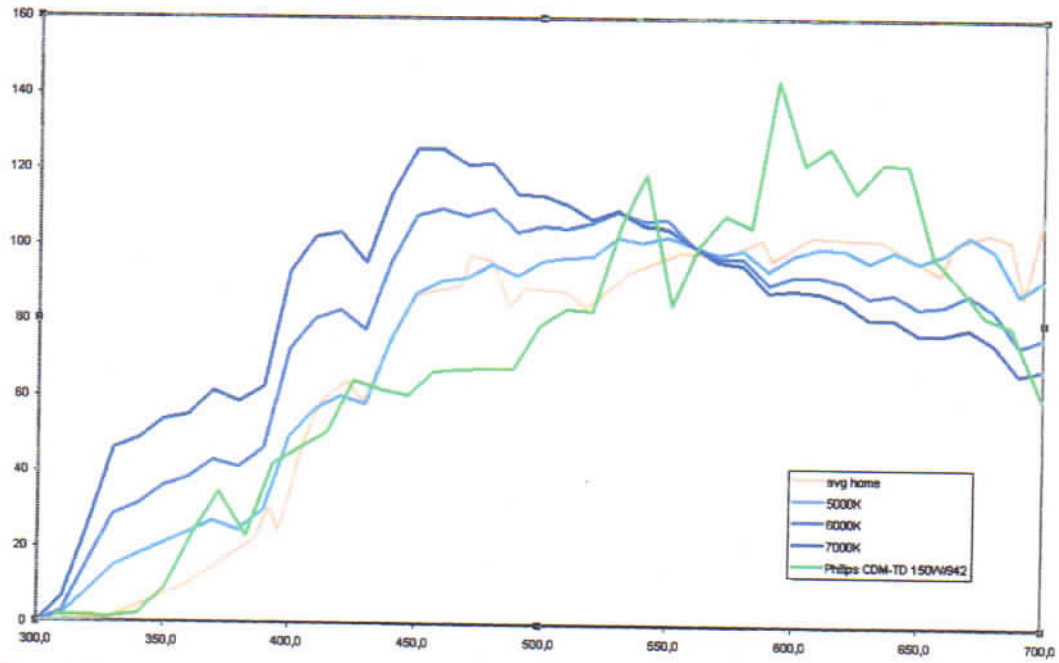

Figure 1: Comparison of different spectral distributions

The light fading unit consists of 25 devices, each with 150 W output arranged in an array of 5 by 5 and surrounded by aluminum plates to achieve a uniform illuminance. See figure 2:

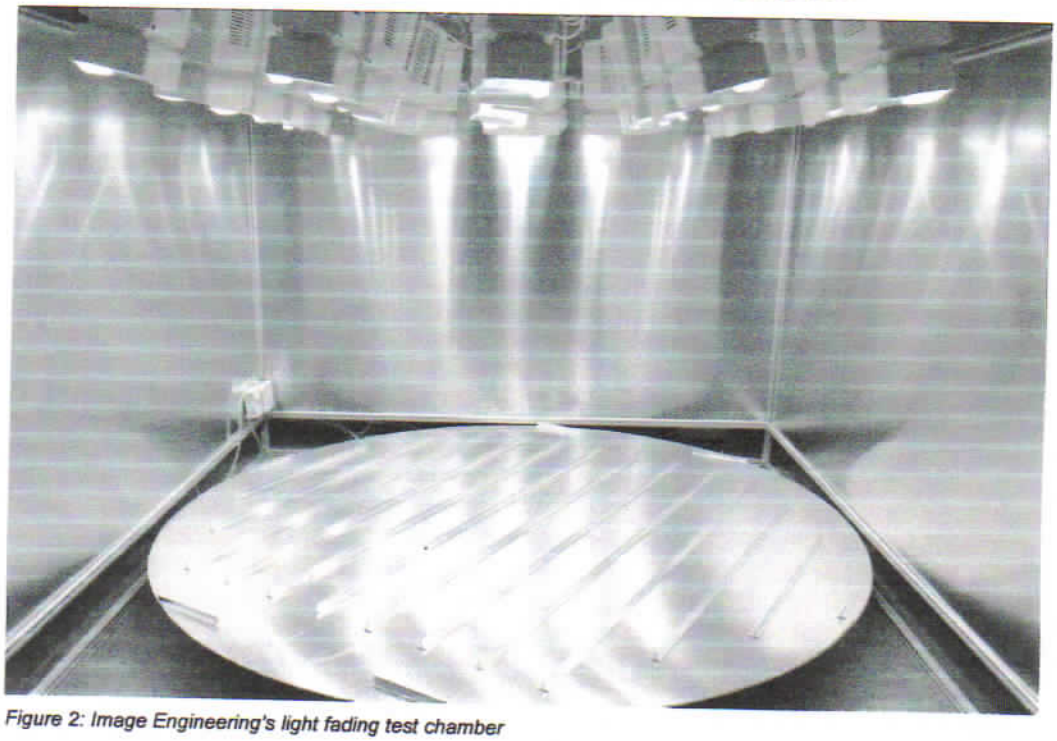

Figure 2: Image Engineering's light fading test chamber

The test samples are illuminated at a level of approx. 50 Klux at specified temperature and humidity (23°C and 50% RH). The test period was 78 days which simulates 50,3 years of average indoor room conditions (450 lux illumination per 12 h day).
For average indoor light conditions of 800 lux per 12 h day the total klux-h exposure of the test period simulate 28,3 years.
Weekly measurements have been done by a calibrated X-Rite 310 densitometer with an error tolerance +/- 0,02 D (as specified by the manufacturer).

2 Test results

Table 1 shows percentage density change of sample A and B as mean of two tested specimen of each type. Listed are visual density and color densities for red green and blue after exposure of 99353 Klux-hours.

	Density deviation [%]			
	Vis	Dr	Dg	Db
Mean A		-0,9	-1,0	-2,7	-2,2
Mean B		-4,9	-2,8	0,0	-1,9

Table 1: Percentage density change after 78 days of exposure

Figures 3 and 4 show the density values during the test period for sample A and B.

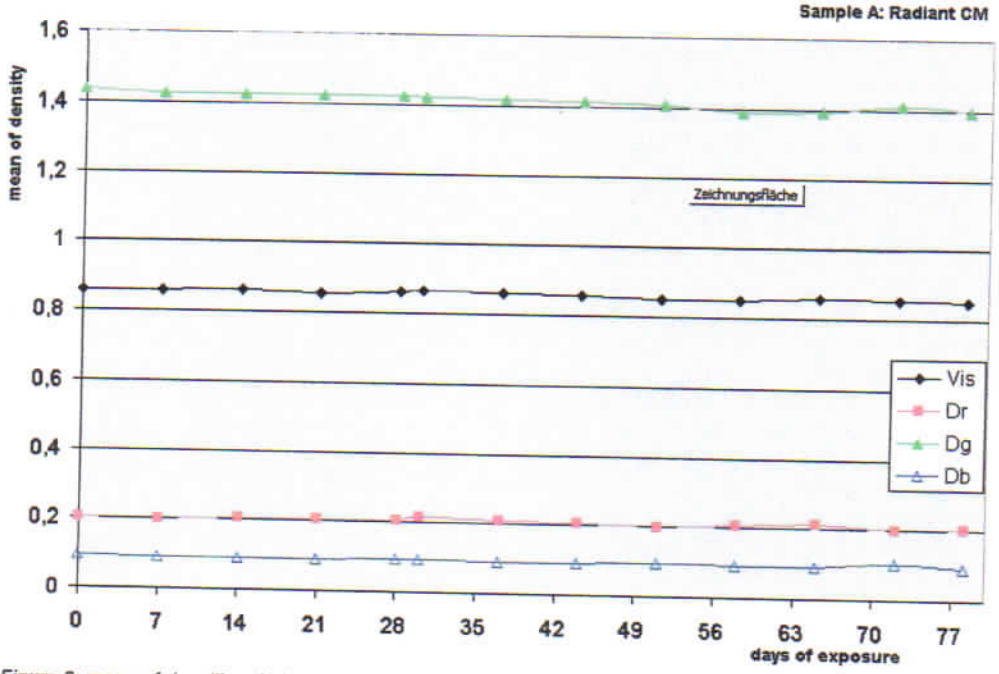

Figure 3: mean of densities during test period of sample A

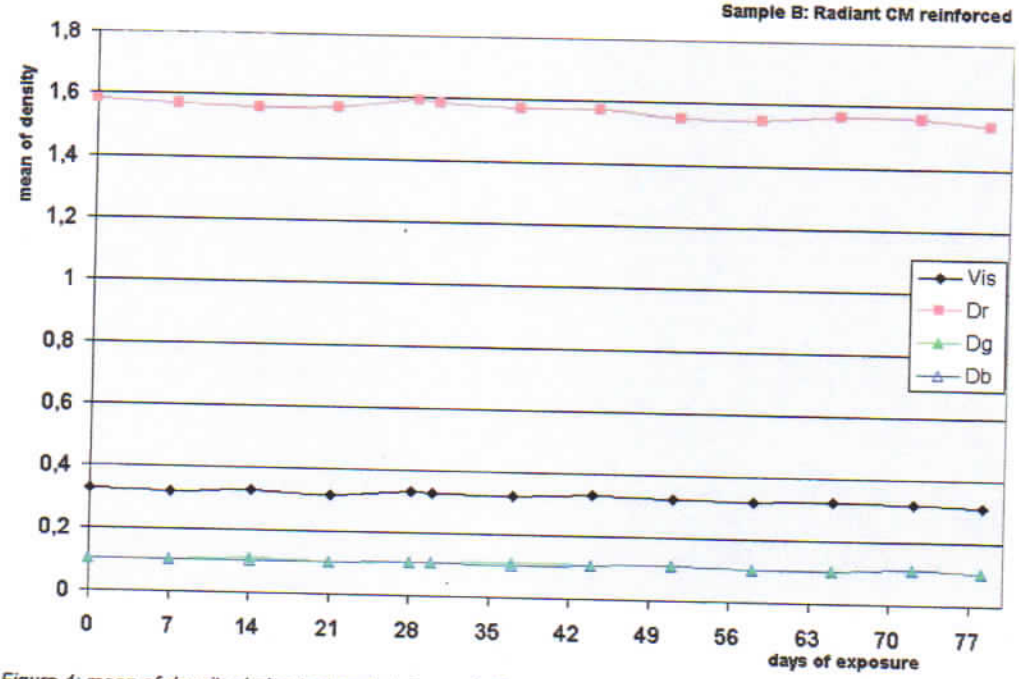

Figure 4: mean of density during test period of sample B

3 Assessment of the results

As can be seen from the test results, no important change in density can be measured for both samples after the test period of 38124 Klux-hours. The densities values behave stable and no color loss or shift can be determined.
The test period represents approx. 19 years of average room conditions of 450 lux per 12 h day. Due to the fact that the samples are embedded between glass degradation effects caused by gaseous pollutions like ozone are assumed to be negligible. An evaluation of degradation caused by temperature or humidity increase has not been carried out.

Frechen, 26.06.07

A. Etzkorn

Agnes Etzkorn

Image Engineering
Dietmar Wueller
Augustinusstrasse 9 d
50226 Frechen-Königsdorf
Tel.: (0 22 34) 91 21 41
Fax: (0 22 34) 91 21 42
web: www.image-engineering.de

Expert:
Agnes Etzkorn
Image Engineering Dietmar Wueller
Augustinusstr. 9d
50226 Frechen
Germany
Phone: +49 2234 912141
Fax: +49 2234 912142
E-mail: a.etzkorn@ivent.de

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Jan van Rongen
Tappersweg 49E
2031 ET Haarlem
Nederlands

Image Engineering Dietmar Wüller
Augustinusstr. 9d
50226 Frechen
Germany
Tel.: +49 2234 912141
Fax: +49 2234 912142

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3 Assessment of the results

As can be seen from the test results, no important change in density can be measured for both samples after the total test period of 99353 Klux-hours. The densities values behave stable and no color loss or shift can be determined.
The test period represents approx. 50 years of average room conditions of 450 lux per 12 h day. Due to the fact that the samples are embedded between glass degradation effects caused by gaseous pollutions like ozone are assumed to be negligible. An evaluation of degradation caused by temperature or humidity increase has not been carried out.

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Agnes Etzkorn

Expert:
Agnes Etzkorn
Image Engineering Dietmar Wueller
Augustinusstr. 9d
50226 Frechen
Germany
Phone: +49 2234 912141
Fax: +49 2234 912142
E-mail: a.etzkorn@ivent.de