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# “Diasec” – and other Finishing Techniques – Investigation of Light induced Aging

Sabine Zorn, Sebastian Dobruskin, Bern University of the Arts Berne, Switzerland

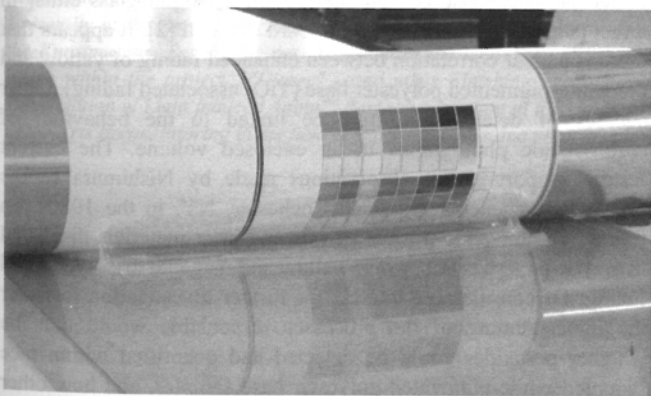
## Abstract

The research on light induced aging of finishing techniques such as face mounted colour photographs aims at the question whether yellow and magenta dyes fade more rapidly within face mounted colour photographs. Furthermore an investigation into the chemical mechanisms of the degradation processes should provide insight into the potential problems associated with the face-mounting of print.

## Project Objectives

There have been wide reaching developments in the field of art photography since the mid 1980ies. Contemporary artwork, be it photography or digital graphic design, are increasingly produced in large formats. The presentation of oversize prints often no longer involves classic framing but rather the so-called finishing techniques, whereby the print is being fused with the back support and/or with the front covering. This includes laminating, varnishing and face-mounting techniques.

Besides the purpose of mechanically protecting the image, the different processes were also intended to have a positive effect on the longterm stability of printed artwork. However, according to first results on the research of the lightfastness regarding „Diasec“, a face-mounting technique, light induced degradation of some materials is rather enhanced than slowed down.



**Figure 1** Face mounting technique with silicone rubber. Acrylic sheet and print are automatically pulled through the cylinder press, whereby the print is firmly pressed onto the acrylic sheet and the uniformly dispensed silicone rubber at the nip is evenly and thinly squeezed out between the two materials to form a film.

To achieve a better understanding of the origin and extent of such phenomena, a selection of different finishing techniques is currently being researched. Of particular interest are the

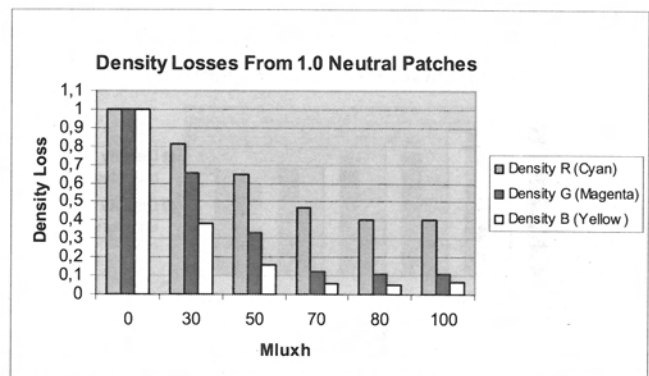
lightfastness of different compound sandwiches and the potential factors controlling the resulting behaviour. The longterm stability of face-mounted printed artwork is a very important criteria since the separation of compound printwork is not possible without damaging the printed surface as these face-mounting techniques are irreversible.

## Project Overview

Samples of both unmounted and face-mounted chromogenically (Ilfoflex™) and chromolytically (Ilfochrome Classic) processed photographs were examined. For the mounting on an acrylic sheet silicone rubber and primer as well as double-sided adhesive film (PSA) was used. They were then subjected to accelerated light ageing tests following procedures described in ISO10977:1993 (E). The Experiments were carried out at ILFORD Imaging Switzerland, Marly in collaboration with the Bern University of the Arts. The optical densities of the colour patches were quantified colorimetrically (GretagMacbeth Spectrolino) before, after and at regular intervals during the experiment.

## Results

After a the total amount of 100 Megaluxhours exposure to light, all Ilfoflex™ samples displayed strong dye fading (almost 100% loss of yellow and magenta dye) whereas Ilfochrome Classic samples suffered only very little from exposure to light (less than 30% loss of yellow and magenta dye), see Figure 2 and 3.



**Figure 2** Ilfoflex™ Digital (RA4), face-mounted, white-pigmented polyester base (Melinex by Dupont)

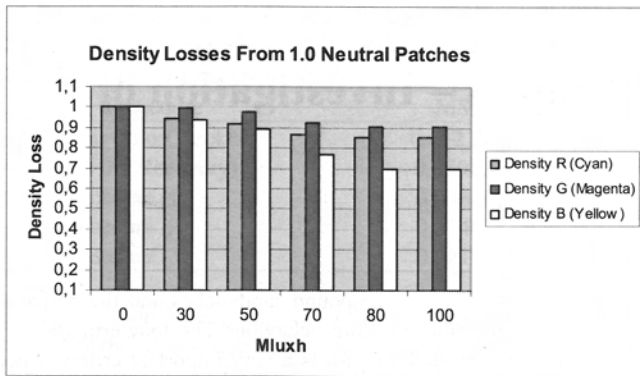


Figure 3 Ilfochrome Classic (P3X), face-mounted, Melinex base

In general, the face-mounted Ilfoflex™ photographs exhibited stronger fading than the unmounted samples, whereas the face-mounted Ilfochrome Classic photographs displayed weaker fading than the unmounted samples, see Figure 4 and 5.

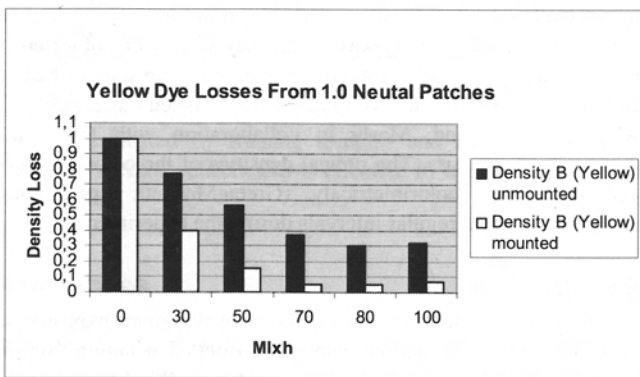


Figure 4 Ilfoflex™ Digital (RA4), unmounted and face-mounted

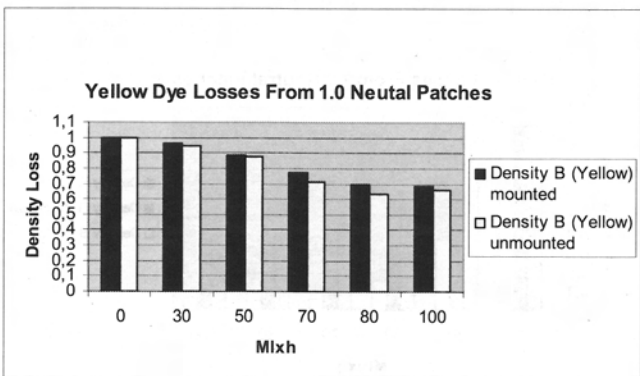


Figure 5 Ilfochrome Classic (P3X), face-mounted and unmounted

Furthermore, all Ilfoflex™ photographs showed significant changes such as bluish appearance, caused by strong yellow dye fading especially in high- and maximum-density areas, which Wilhelm [1] described as indicators for the "Picture Frame Effect" or "Enclosure Effect".

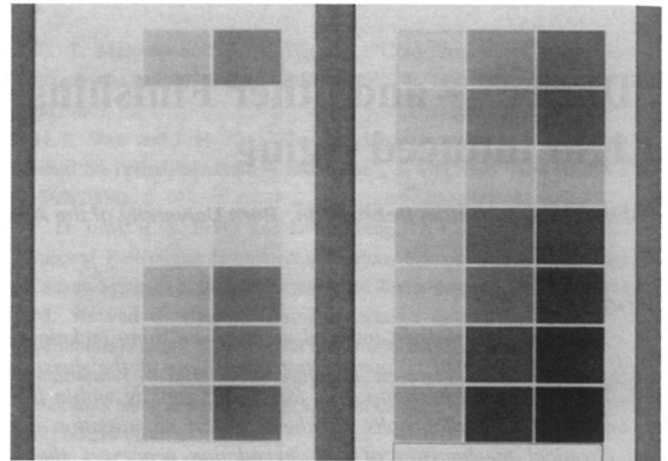


Figure 6 "Enclosure / Picture Frame Effect" caused by strong yellow dye fading in face-mounted colour photographs on white-pigmented polyester

Acetic acid released by silicon rubber adhesives used for face mounting does not appear to have an influence on fading since there was no difference in the fading behaviour between samples mounted with silicone rubber and samples mounted with double-sided adhesive film (PSA).

### Conclusions

Framing or enclosing chromogenic print materials has been observed to have a detrimental effect on colour fastness and staining when exposed to typical indoor illumination levels. The "enclosure effect" visible on chromogenic prints describes the progressive fading of yellow dyes which becomes most prominent in areas with the highest concentration of the yellow component. The disproportionate reduction of yellow eventually causes the image to suffer a pronounced shift towards the blue tones. The effect has been observed on prints framed behind glass either in direct contact or spaced by a cardboard overmat [2]. It appears that there is a clear correlation between enhanced fading of yellow and the white-pigmented polyester base (TiO<sub>2</sub> associated fading). Other sources of deterioration may be linked to the behaviour of chromogenic photographs in an enclosed volume. The current results support earlier observations made by Nishimura of the Image Permanence Institute in Rochester, NY, in the 1980s, on framed chromogenic print materials and print materials displayed in acrylic paperweights, where yellow and magenta displayed rapid fading. Of considerable interest for further investigation to foster the understanding of the processes responsible would thus be whether peroxides could be detected and quantified within face mounted white-pigmented polyester base samples, and how other finishing techniques compare with respect to colour fastness behaviour and staining.

Preliminary results applying chemiluminescence (CL) analysis do suggest a possible correlation between the peroxide content in chromogenic colour materials and the degradation of yellow dye: one sample of a face-mounted print exhibiting strong fading of yellow contained distinctly less peroxides than a non mounted sample with minimal fading. Further research is yet required to prove this initial observation.

## References

- [1] WILHELM, Henry (1993): *The Permanence and Care of Color Photographs: Traditional and Digital Color Prints, Color Negatives, Slides, and Motion Pictures*. Grinell, Iowa: Preservation Publishing Company
- [2] Norm ISO 10977: 1993(E) Photography - Processed photographic colour films and paper prints- Methods for measuring image stability.  
Genf: ISO

## Project Team

Bern University of the Arts Berne: Prof. Sebastian Dobrusskin,  
Prof. Dr. Stefan Wülfert, Dipl. Rest. Sabine Zorn

ILFORD Imaging Switzerland:  
Dr. Jean-Noël Gex, Dr. Rita Hofmann

Swiss Federal Institute of Technology Zürich:  
Prof. Dr. Walter Caseri

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## Author Biography

*Sabine Zorn received her Diploma degree in Conservation & Restoration, specialising in graphics, books and photography at the University of the Arts Berne. Employment as a conservator & restorer at the Kunstmuseum Berne. Research assistant at the University of the Arts Berne within the project „Diasec“ - and other Finishing Techniques - Investigation of Light induced Aging“. Part-time assistant at the University of the Arts Berne, tutoring in the field of graphics, books and photography.*