

Research Institute:

PTS München
Heßstr. 134
80797 München

Head of the research institute:

Dr. Frank Miletzky

Project leader:

Ralf Gericke
Tel: 089 / 12146-406
Fax: 089 / 12146-36
E-Mail: ralf.gericke@ptspaper.de

Internet: www.ptspaper.de

Research area: Product aims

Paper, paperboard and board // Graphic papers

Key words:

Chemical ghosting, coated paper, sheet-fed offset

TITLE:**Chemical ghosting in sheet-fed offset printing: substrate effects, reaction kinetics and measurement description****Background/Problem area**

The term chemical ghosting in sheet-fed offset printing describes contact phenomena occurring particularly during printing on coated papers. Reverse side yellowing and matt / glossy effects are typical signs of chemical ghosting.

This project dealt in detail with matt / glossy effects. These occur in uniformly dark coloured illustrations on the reverse side sheet image as matt or shiny areas having the shape and size of the print image. The term "ghosting" has been coined because of the slight but clearly visible effect on the one hand, and because of the mysterious non-occurrence of the effect under apparently identical conditions on the other hand. The Fogra research institute has completed a project on this topic (IGF 14366N) and has established an analytical understanding of the occurrence of chemical ghosting, whereas the present project realized jointly by Fogra and PTS intends to further close the gap between phenomenological description and the systematic avoidance of chemical ghosting.

Objectives/Research results

According to the research results of Fogra (IGF 14366N), chemical ghosting effects develop in the following way: After an induction period, the front side print emits aldehydes while its printing ink is drying. These aldehydes are absorbed by the reverse side of the opposite sheet. During reverse-side printing, the aldehydes speed up the drying of freshly applied printing ink on the reverse side from below, depending on the print image. This early dried bottom layer can prevent levelling processes of the ink film later on. At the same time, further aldehyde emitted from the front side can accelerate the drying process of the ink surface, leading to faster film formation in the area of later ghost images.

Moreover, the sealing of paper in the image areas of front side prints leads to longer dwell times of the aldehydes released from the reverse side ink layer, causing the surface of this ink layer to dry faster as well. Faster dried sections in a larger ink film area have smoother surfaces than the rest, causing incident light to be strongly reflected so that ghosting areas appear darker. Chemical ghosting effects in sheet-fed offset printing are thus the result of local differences in drying speed of the printing ink.

Coated papers systematically prepared on laboratory and pilot scale with recipes and properties showing the influence of coated paper on the occurrence of ghosting effects were investigated. Additionally, it was determined whether the use of additives in the coating colour can reduce the activity of aldehydes formed during ink drying.

The lab scale results indicated that coarser GCC pigments promoted ghosting especially in single coating or, in the case of multiple coated papers, in the top coating layer. This is why pigment screening was performed as a next project step. Pigment type (GCC, PCC, clay, talcum), pigment shape (aragonite, scalenohedral, rhombohedral) and particle size distribution were evaluated.

Binder type and chemical composition have an influence on chemical ghosting as well. Among the binders investigated, a tendency for chemical ghosting was observed. The worst chemical ghosting was observed with casein, followed by polyurethane, styrene-acrylate, starch dextrin and styrene-butadiene.

In order to prevent chemical ghosting, aldehyde absorbers were added to the coating colours. Depending on the chemical composition and reactivity, stabilized copolymers based on polyamide performed best. On lab scale, the polyamide additives reduced chemical ghosting significantly and reproducibly by up to 5 units in the visual ranking performed by Fogra.

To transfer these lab results to a level more relevant to production, pilot coating trials and sheet-fed offset printing trials were performed as a last project step.

It can be concluded that coated and uncoated papers can have an effect on chemical ghosting, but compared to the influences of the printing inks used and of the interval between face and reverse printing, their influence is rather low.

Application/Economic benefits

The project deals with a presently not fully understood problem of the printing industry. Deeper knowledge of the influences of paper and ink ingredients on ghosting effects will enable ink and paper manufacturers to use materials which are less likely to cause chemical ghosting and have the potential to increase the quality of production and lower the number of complaints.

This has a positive impact on their competitiveness. The possibility to forgo time-consuming preliminary experiments will lead to faster job throughputs in the printing industry and higher flexibility of production - with a positive impact on their currently tight revenue situation.

Period of time: 01.12.2008 – 31.05.2011

Remarks

The research project IGF 15882 N was funded by the German Federal Ministry of Economics and Technology BMWi and was performed together with the printing research institute Fogra.