Print finishing

Challenges of print finishing

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Print finishing

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1 Surface energy

Influences on:

- Wetting of varnishes
- Adhesion of varnishes, glues and laminated films

Objectives:

- Print surfaces must have a high value of surface energy.
- Varnishes or glues in liquid form must have a low value of surface tension.
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1 Surface energy

Equilibrium of surface energies; Example: Fluid on solid surface.
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1 Surface energy

Device for the measurement of contact angles.
Figure: Krüss
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2 Fastness of printing inks

In respect to printing inks most often (but not exclusively) there is a reference to the resistance to solvents and to the resistance to alkaline substances.

Possible result of neglect is:

Bleeding

Definition:
Bleeding is a fault that begins at the edges of contours. The edges of the printed object weaken gradually and are getting more and more diffuse because of the dissolution or migration of the pigments caused by varnishes and solvents.
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2 Fastness of printing inks

Possible result of neglect is:
Bleeding

Example:

Bleeding of a security printing ink for a serial number up to the back side of the printing paper (In this case the bleeding is on purpose).

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2 Fastness of printing inks

Possible results of neglect are:

Colour deviations
• homogeneous form or
• spotted form
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3 Special techniques for enhanced appearance

3.1 Hot foil stamping - Technical description

(Source: Allgemeine Berufskunde der Druckereitechnik)

"In hot foil stamping a heatable embossing pattern releases the pigment layer from the transfer film using heat and pressure and attaches it permanently to the substrate. This layer sticks to the substrate with a layer of hot melt glue activated by the heat of the pattern. The stamped substrate can remain flat or show a relief. Basically this process uses the heatable embossing pattern, hot foil stamping foils and an embossing machine."

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3 Special techniques for enhanced appearance
3.1 Hot foil stamping

(Source: Allgemeine Berufskunde der Druckereitechnik)
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3.1 Hot foil stamping
(Source: Allgemeine Berufskunde der Druckereitechnik)

Embossing pattern

“The embossing patterns can be letters, logos, lines, signs, vignettes or line drawings. These patterns are very often manufactured (milled) from brass or steel. Brass is cheaper, but limited to about 20,000 prints. Steel is more expensive, but lasts nearly indefinitely.”
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3.1 Hot foil stamping
(Source: Allgemeine Berufskunde der Druckereitechnik)

Embossing pattern

"For small runs zinc patterns or galvanos are also used, however, these result in less sharp embossings. For flat stampings – especially on plastics – more and more silicone patterns are used, as these adapt better to the substrate to be stamped and give better contact."

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3.1 Hot foil stamping

(Source: Allgemeine Berufskunde der Druckereitechnik)

Foil for hot foil stamping

Transfer film

“At the moment mainly very sturdy polyester films are used as transfer film. These have a thickness of about 12 microns and have an extraordinarily high tear resistance. These films do not warp and stamp even the finest contours of the gravures onto the substrate.”
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3.1 Hot foil stamping
(Source: Allgemeine Berufskunde der Druckereitechnik)

Foil for hot foil stamping

Release layer

"The release layer consists of a mixture of special waxes. It melts as it is heated by the elevated areas of the embossing pattern. Because of that the two lower layers (pigment layer and adhesive layer) are separated from the transfer film."
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3.1 Hot foil stamping

(Source: Allgemeine Berufskunde der Druckereitechnik)

Foil for hot foil stamping

Pigment layer

"Four different types of pigment layers are known":

- Pure gold layer (expensive)
- Metal pigment layer (Al, coated with coloured varnishes)
- Bronze pigment layer (cheap, can oxidate)
- Pigment layer (pigments without metallic effects)
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3.1 Hot foil stamping
(Source: Allgemeine Berufskunde der Druckereitechnik)

Foil for hot foil stamping – Adhesive layer

"The adhesive layer bonds the pigment layer to the substrate. Its chemical composition and thickness must be adapted to the respective substrate in order to achieve maximum adhesion. This layer melts only after reaching a certain temperature, but it must only poorly conduct heat so that areas in the proximity of the heat source will not melt and not stick to the substrate."

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3.1 Hot foil stamping
(Source: Allgemeine Berufskunde der Druckereitechnik)

Working with hot foil stamping technology

"Precise knowledge of the substrate and process parameters is important for the printing process. The foil for hot foil stamping must be adapted to the substrate in order to get a clean, sharp and wipe resistant stamping. Additionally the following parameters must be observed during the stamping process:

Stamping temperature, stamping time, form of the stamping pattern, stamping force.\"
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3 Special techniques for enhanced appearance

3.2 Cold foiling (Source: LEONHARD KURZ Stiftung & Co. KG)

“Commercial print jobs, magazines and wet-adhesive labels are predominantly finished with cold foils applied using sheet-fed offset printing. Cold foiling is an operation in which a cold foil is transferred to a substrate by means of a special adhesive. Mainly oxidatively/conventionally drying offset adhesive technology is employed. UV technology is expected to be used in future as well. Precise registration can be achieved with the foil transfer operation, just as with color printing on other printing units.”

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3 Special techniques for enhanced appearance
3.2 Cold foiling

(Source: LEONHARD KURZ Stiftung & Co. KG)

The process technology in detail

“In the regular printing unit of a sheet-fed offset printing machine, a standard offset printing plate transfers cold foil adhesive onto the areas of the substrate that are to be decorated. In terms of printability, the adhesive behaves like a conventional printing ink and should therefore be handled in the same way.”
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3.2 Cold foiling (Figure: LEONHARD KURZ Stiftung & Co. KG)
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3.2 Cold foiling
(Source: LEONHARD KURZ Stiftung & Co. KG)

“The sheet with the freshly applied cold foil adhesive is now transported to the next printing unit. In this printing unit, the sheet is brought into contact with the cold foil (metallized layer of the foil) with pressure between a rubber blanket cylinder and a counter-pressure cylinder. The transfer layers of the cold foil are thereby released with very good definition. The foil coating bonds securely and permanently to the preprinted sheet.”
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3.2 Cold foiling

(Source: LEONHARD KURZ Stiftung & Co. KG)

“The carrier film of the foil, with the foil layers that were not released, is rewound after the foil transfer. Overprinting with printing inks can then occur in the consecutive printing units.

All areas of the sheet, both free and metallized, can be printed. When no foil application is required, the printing unit can be used for normal printing.”
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3 Special techniques for enhanced appearance
3.3 Structural effects

Print products can be equipped with structural effects using two different approaches:

- Mechanical transformation (Embossing, Foiling) or
- Application of a dimensional layer (printing, varnishing)
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3.3 Structural effects

Embossing

• The mechanical transformation can be done using the flat-on-flat principle (e.g. Heidelberger Tiegel) or within a roller gap.

• The embossing of the substrate can be done using a rigid pair of positive and negative dies or by a rigid positive die, that is pressed against an elastic material.
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3 Special techniques for enhanced appearance
3.3 Structural effects

Embossing – Combination Foiling/Embossing

Source:
LEONHARD KURZ
Stiftung & Co. KG
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3.3 Structural effects

Embossing – Foil stamping with structure

Source:
LEONHARD KURZ
Stiftung & Co. KG
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3.3 Structural effects

Relief varnish

- The three-dimensional effect is created by the height of the varnish layer between varnished and unvarnished print surfaces.
- The biggest height differences can be reached by screen printing. Therefore, this is the preferred method of application.
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3.3 Structural effects

Structural varnish

• The three-dimensional effect is created by particles within the varnish that protrude from the surface after drying/curing.

• With screen printing, particles of a size of more than 300 microns can be applied.

Figure: Gerster
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3  Special techniques for enhanced appearance
3.3  Structural effects

Swelling varnish

- The varnish system contains ingredients that swell after printing/varnishing (different chemical mechanisms). That means these systems enlarge their volume.

- Swelling varnishes are most often mixed into printing inks, so that printed fonts appear embossed, but can also be applied separately (most often in screen printing).
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3 Special techniques for enhanced appearance
3.4 Electrostatic flock finishing (Source: J. Friedrich)

Technology of Electrostatic flock finishing

"Short cut fibres are called flock. During the process of electrostatic flock finishing millions of fibres are applied to a substrate that is coated with glue within an electric field.

The electric flux lines of the electric field cause a vertical orientation of the fibres that form a homogeneous textile surface."
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3.4 Electrostatic flock finishing

(Figure: Stainer)
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3.4 Electrostatic flock finishing (Source: J. Friedrich)

Surface

"By use of modern adhesives flock finishes are very sturdy and resistant to abrasion. Depending on the intended function, a soft or hard and abrasive surface can be created by the variation of fibre thickness and length. The surface of the substrate to be finished should be smooth or only very lightly embossed or engraved."
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3.4 Electrostatic flock finishing (Source: J. Friedrich)

Design considerations

"Screens or very fine lines cannot easily be produced, as the fibres magnify the coated area and form no sharp edges. This is also the reason why the selection of small font sizes is not advisable.

Most often electrostatic flock finishing is done in a single colour, however, multi-coloured applications are possible, but they increase costs.

Flock can be applied partially or as solid area flocking."
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3.4 Electrostatic flock finishing (Source: J. Friedrich)

Influence on further finishing processes

“Flock finished surfaces do have severe influences on further finishing processes of the sheets.

Flock with a length of more than 1 mm can impair mechanical finishing steps like punching.

Furthermore it is not possible to cut several sheets simultaneously or a stack of sheets. The flock causes the paper to float. With extremely short flock up to 10 sheets can be cut precisely.”
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3.5 Varnishes with fragrance

- Fragrances are most often micro encapsulated (diameter 2 microns up to 30 microns) and admixed to water-based or UV-curable systems (printing inks, varnishes, adhesives).

- Release of the fragrance occurs after micro capsules are destroyed by mechanical stresses (e.g. pressure caused by manual rubbing, tensile forces caused by opening a flap). With regard to permanence, using varnishes with encapsuled fragrances is more advisable than simple fragrance inks.
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3 Special techniques for enhanced appearance
3.5 Varnishes with fragrance

- Micro encapsulated fragrances on printed products have a duration of up to 2 years; during this time period the intensity of the fragrance declines constantly.
- Fragrances can become micro encapsuled only if they are waterless and free of alcohol.
- Varnishes with fragrance appear flat. However, they should not be varnished over with a glossy system.
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4 Faults in finished products

Insufficient adhesion of the laminating film is obvious because of splitting ink.
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4 Faults in finished products

Sufficient adhesion of the laminating film

is obvious through a splitting of the substrate.
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4 Faults in finished products

Insufficient adhesion of the laminating film is caused by:

- Laminating the prints **too soon after printing** (time lag between printing and film lamination too short)
- Using **unsuitable inks** (inks with wax additives for increasing resistance to abrasion)
- **Low Cohesion/bond strength of the ink layer**
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4 Faults in finished products

Insufficient adhesion of the laminating film

Counter measures in order to prevent insufficient adhesion:

- Using printing processes that do not require a long drying time of the ink (UV-curable systems, systems based on dry toner without oil fusing)
- Using appropriate inks (tried and tested systems matched with the substrate)
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4 Faults in finished products

Blocking

• Blocking means the irreversible sticking together of prints (varnished or unvarnished) on a significant portion of the printed image/product. Blocking occurs when you store prints or printing products within stacks.

• The occurrence of this fault is mainly influenced by the materials used and by the storage conditions.

• Blocking prevents the respective sheets/products from being separated without destruction of the surface. This should not be confused with reversible adhesion that allows for a non-destructive separation of the layers.
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4 Faults in finished products

Blocking
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4 Faults in finished products

Blocking caused by:

- Stacking of freshly printed or freshly finished prints/products
- Pressure during storage is too high
- Temperature during storage is too high
- Too much humidity within the stack or in the air
- Storage within stack continues too long, without destacking/ventilation of the sheets
- Insufficient curing of UV-curable layers
- Insufficient matching of ink or varnish system with conditions of use of the printing product
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4 Faults in finished products

Blocking

Counter measures in order to prevent faults:

- Sufficient curing/drying of printing inks after the printing process
- Controlled storage and climatic conditions
- Suitable storage of products (for example vertical stacking, in rigid boxes)
- Use of suitable printing ink and special varnishes (for example varnishes that are resistant to blocking)