In the quest to achieve new levels of brand promotion, demands on marketing materials are constantly increasing. The combination of graphic design, finishing techniques and innovative shapes gives a product enhanced appeal and recognition. It is essential that designers and converters understand the interaction between paperboard properties and converting efficiency. The choice of paperboard will affect crucial conversion factors like printability, flatness, dimensional stability and creasing/folding properties, and thereby influence the ultimate design of the product. As a basic rule it is fair to say that the consistency of the paperboard product is the key to high efficiency.

Printing presses, finishing and converting machinery can accept a wide range of paperboard types at acceptable levels of productivity. However, tolerance for irregularities in critical parameters diminishes as speeds and complexity increase.

Handle the paperboard correctly and you will achieve first-class results from all available printing and finishing techniques. For general information on how to handle paperboard before, during, and after the printing and finishing processes, please refer to the chapter “Handling”.

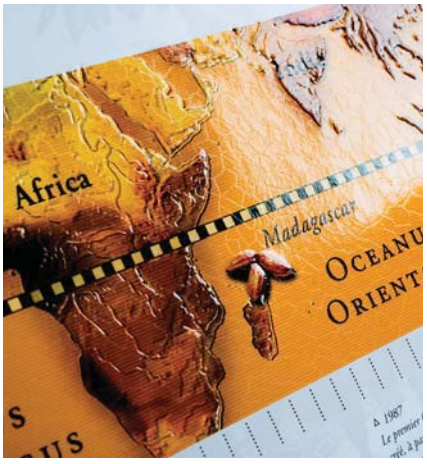
Excellent print quality

Paperboard for graphical applications must provide excellent print quality. To achieve this, the paperboard must meet stringent requirements in terms of its appearance and its performance during the printing process. The ability of the board to fulfil these requirements is referred to as printability. On the whole, high print quality is characterised by uniform print results, high ink gloss, and true colour reproduction.

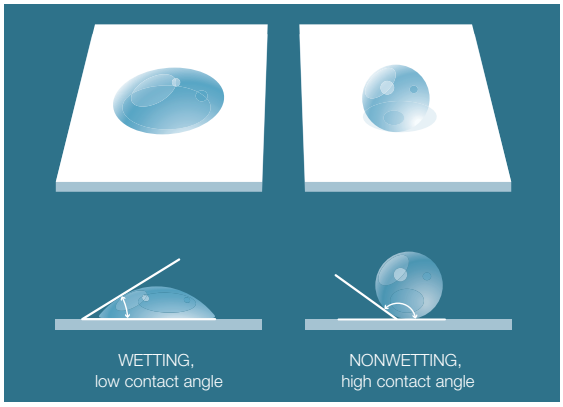
Uniform print results

To achieve a good print in both half and full tones it is essential that both the ink transfer and ink setting be uniform.

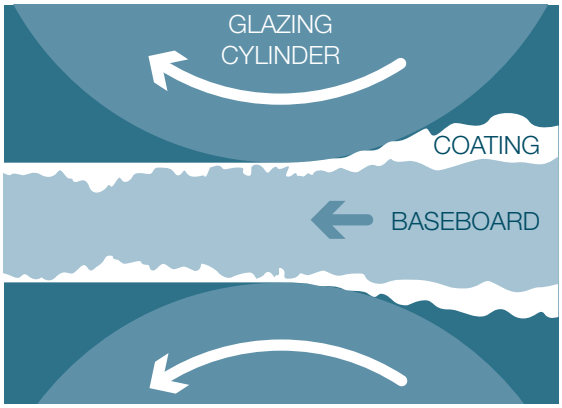
- Good ink transfer from the ink carrying surface to the paperboard is essential. A uniform surface tension enables sufficient wetting of the surface by the ink. This is particularly important in flexo applications, digital printing (liquid toner), or when printing on extruded plastic surfaces or surfaces coated in some other manner prior to printing.
- Good ink setting is important regardless of the printing process used. This is achieved by ensuring the uniform absorption of oil and/or water (depending on the ink solvent used). For oil-based inks in conventional offset printing, the absorption of both water and oil is required as ink transfer can be obstructed by the presence of fountain water on the substrate surface. In offset printing, irregularities in ink setting can cause mottle or ink dry back (back trap mottle).



To achieve uniform ink transfer and setting it is important that the paperboard has a coating layer with an even thickness. A well monitored coating operation during the paperboard-making process contributes to uniform print results by ensuring an even coating weight and a controlled coating composition.



Good wetting properties enable sufficient ink adhesion and subsequent setting.

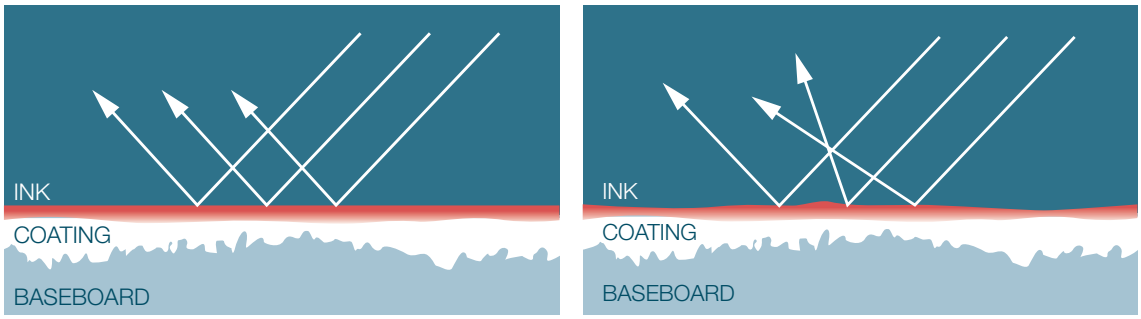


An uneven thickness distribution may lead to variations in coating amount as well as density after glazing. This will affect the absorption properties.

High ink gloss

High ink gloss is a property of a very flat, levelled ink film. This is true for any ink film and should not be confused with the term “high gloss inks”. Three key factors are involved in achieving high ink gloss: the thickness of the ink film, the ink levelling process, and the ink setting speed. Because a thicker ink film can fill cavities in the paperboard surface, the thicker the ink film, the more likely the ink is to form a smooth surface. It is for this reason that the thick ink films in screen printing often result in high ink gloss.

The ink film will level better if the paperboard surface is very smooth because the levelling process will be faster and easier. It is also very important to have a paperboard coating with uniform absorption properties so that the same amount of ink is absorbed over the entire surface. In addition, a paperboard coating with large pores will absorb ink more slowly, giving the ink more time to level better.



A well levelled ink film gives uniform specular gloss thereby enhancing the degree of gloss.

A factor that contributes indirectly to achieving a high ink gloss is the ink setting speed. The uneven surface of the ink film just after leaving the printing nip levels better if it is allowed to stay wet for a little longer. If the ink sets too quickly the irregularities in the ink surface do not have enough time to level out, so instead they become “frozen” in place. For this reason, slow ink setting helps to ensure high ink gloss. To slow down the ink setting process, look for a paperboard coating with a somewhat slower absorption rate (which is determined by the absorption properties, pore size and pore volume).

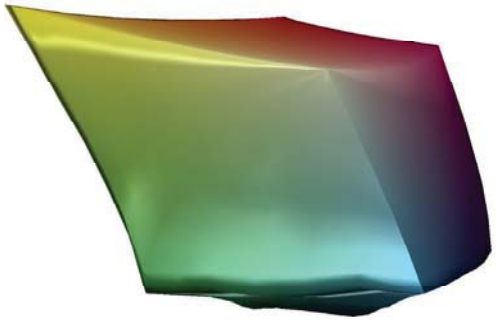
Usually printers want quick ink setting because it leads to fast ink drying, which speeds up the production process and reduces risk of set-off, etc. A desire for high ink gloss must therefore be balanced against a desire for quick ink setting/drying and some compromise may be necessary.

True colour reproduction

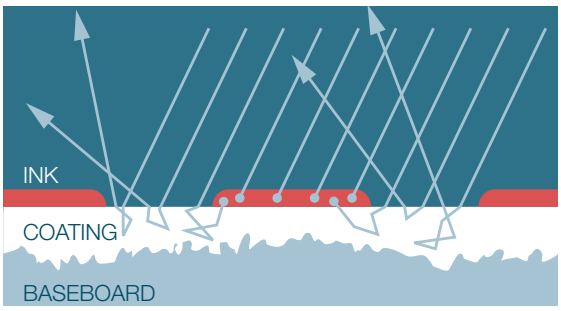
The factors that have the greatest impact on true colour reproduction are high ink density, control of dot gain (mechanical and optical), and the magnitude of the colour gamut that is possible to obtain with a given set of inks.

The ink density is a direct result of the amount of ink pigments transferred to the paperboard surface, depending on the water and oil absorption of the coating layer. Too much moisture on the paperboard surface may result in poor ink transfer for an oil-based ink (this is known as ink refusal). This moisture may be due to condensed water from a cold paperboard pallet, or excess fountain water from a previous print unit in multi-colour printing or excess fountain water that has not emulsified correctly with the ink.

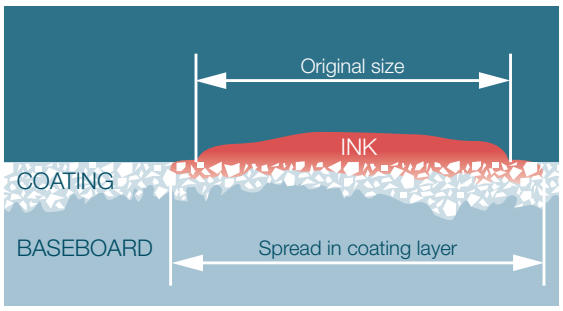
There are two kinds of dot gain: mechanical dot gain and optical dot gain. In offset printing most of the mechanical dot gain occurs before the ink hits the paperboard surface, so it is seldom necessary to consider the paperboard surface as a factor. However, in flexo applications or digital printing (liquid toner) the surface tension and permeability of the paperboard surface could cause the ink to spread more or less on the surface or inside the coating/baseboard structure. Optical dot gain is influenced by the light absorption of the coating and baseboard and their light-scattering properties. Good surface smoothness is considered to have a positive effect on optical dot gain.



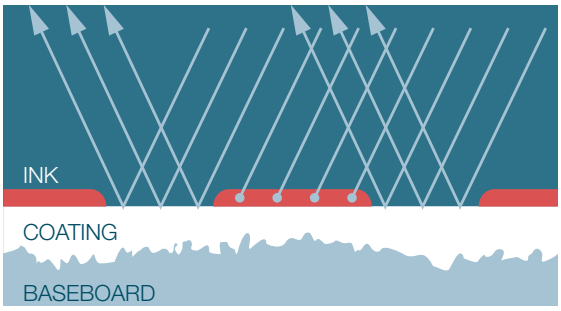
Fountain solution that is either non-emulsified or non-absorbed may obstruct ink transfer to both printed and unprinted surfaces.



The concept of optical dot gain, in which the amount of light is restricted through scattering and absorption compared to the ideal reflection.



Dot gain through spread in the coating layer.



Ideal reflection and absorption of light on a printed surface.

The reproducible colour gamut depends primarily on the ink quality, ink layer thickness, and ink density achieved. Other factors that affect the colour gamut are high ink gloss and the whiteness of the paperboard surface. For the secondary and tertiary colours the ink trapping properties are crucial. Good clean trapping will enable the reproduction of a larger colour gamut. It is essential that as much as possible of the second and third ink layers are transferred in an even pattern on top of the first ink with no irregularities in ink density. The ink setting properties and ink tack of the various ink layers influence each other; for this reason the colour sequence may be important.