

EVALUATING KEY
PARAMETERS FOR
DYE SUBLIMATION
TRANSFER PRINTING

Evaluating key parameters for dye sublimation transfer printing

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Dye-sublimation transfer printing makes up almost half of the digital textile printing industry. But what is the key to creating a quality print?

According to WTiN Intelligence: Digital Textiles, 44% of all digitally printed fabric is made by dye-sublimation (dye-sub) transfer printing. This is largely thanks to dye-sub print technology being purchasable at the lower end of the price bracket for digital textile printing technology. The technique's affordability has been to its advantage, as the textile industry has struggled with the concept of paying more for a digital print than an analogue print, despite benefits in design flexibility and time to market.

While there is always much discussion of inks and printers, the transfer paper used in dye-sub printing is often overlooked. And yet, it is a cumbersome market. As a consumable, not only is price key, but also quality. The impact a high-quality paper has on the final print is not often fully appreciated by the market. However, transfer paper can significantly impact the final fabric print and this is particularly pertinent to its use in the luxury fashion market. Dye-sub transfer printing is an area that has benefitted from the advancement of polyester substrates for fashion and sportswear, with high-end designers putting dye-sub prints on the catwalk.

Of the many dye-sub transfer paper manufacturers, Neenah Coldenhove, Felix Schoeller and Beaver Paper are among the most prominent. WTiN spoke to Ron Sportel, manager innovation & development, Neenah Coldenhove, Rob Repasi, VP & global sales director, Beaver Paper, and Dr Knut Hornig, senior vice president research & development, Felix Schoeller Group about the key parameters for a transfer paper to produce the perfect print.

Key parameters

There are a number of characteristics that the base paper and the paper coating should have to ensure a good final print. Hornig lists air permeability and wet cockling (distortion of the paper), which involves refining the paper and its fibre orientation, as well as paper curling as parameters that need to be controlled.

Repasi adds: "We have learned over the years that several parts of the paper manufacturing process will impact the results of sublimation transfer papers. This includes the types of fibres used that can better handle/manage the impact of water-based inks penetrating the base sheet.

"Additionally, the lengths and orientation of fibres will cause the paper to react differently. And last, the coating or coatings are very critical in the way they are applied to the base sheet. The key to success in coated dye-sub papers is consistency."

The composition of the base paper is also emphasised as a defining factor by Sportel. He says: "One of the most relevant parameters is a base paper with an excellent composition that has no negative



impact on transfer. It is important that the paper is 'clean' and that it is made from virgin fibre cellulose. Furthermore, the formation of the paper needs to be even, to reach an even print."

With regards to the paper coating, Hornig says that it must have qualities that enable kinetic ink absorptivity, provide a good absorption capacity, favourable drying speed, provide line sharpness, and enable good control of ink fixation in the paper receiver layer, as well as releasing the ink efficiently on temperature increase.

Sportel adds: "With regards to unicolour and high-quality prints, a well-developed coating is key. It is the function of the coating that results in sharp print images and at the same time realises a high release of dyes during transfer."

Sportel also says that the transfer paper needs to be cost effective for application and should ensure stable quality. "In that context, it is beneficial when the production of base paper and the application of coating is done in-house," he says. "The quality can be controlled from production of base paper to end roll, resulting in consistent quality. It is important that the transfer paper is suitable on inks and printers that are available in the market."

Transfer quality

Transfer paper quality is even more pertinent for specific applications. As Hornig says, for example: "Tacky media is key for stretch clothing. On sportswear, for example, it prevents ghosting on the final fabric when using a transfer press. On fast and wide machines such as MS, Durst and EFI Reggiani [printers] the drying speed of the paper is critical. Microporous papers (such as Felix Schoeller's S-Race) offer very high drying speeds."

Every paper, even standard copy paper, can be used for transfer, according to Sportel. He says: "Nowadays we see that some parties distribute uncoated papers in the (mainly fashion) market. However, these papers absorb the ink into the sheet and this will result in a very poor transfer release of the ink. And a low transfer release means a low colour gamut and a higher total cost of the print image. When it comes to high quality print result, the use of coated papers is key. Coated papers result in a high transfer yield, a sharp print image and a consistent quality from badge to badge."

Repasi concurs that achieving a good colour gamut with dye-sub transfer printing is only possible with a good-quality coated paper. He says: "The coatings are what can/will provide the more colour through the transfer process. This can also impact the colour gamut available to the client. Better coatings, better inks, better profiles equal better colour gamut's. High release and high speed is now the benchmark for digital dye-sub papers. All our [Beaver Paper's] new grades of papers meet this criterion giving our customers several options for their use."

Paper weight

As well as base paper construction and coating formulation, the weight of a paper is a key parameter for dye-sub transfer printing, particularly when it comes to cost. Repasi says: "Digital ink-jet printer technology has been the driving factor in pursuit of higher speed, lower cost printing. The digital print world is chasing the lower costs associated with analogue printing such as rotor gravure and rotary screen dye-sub. To get there, dye-sub ink manufacturers are having to increase the amount of dye particulates dispersed by higher-speed ink-jet print heads. Part of lowering costs is to do this on thinner grades of paper."





“Thinner paper has its advantages and disadvantages,” says Repasi. “The advantage is of course cheaper cost per square metre. More paper per roll on a printer equals fewer change overs. Quicker transfer times equal more through-put and higher productivity.”

Repasi adds that despite the cost benefits of lighter-weight paper, there are challenges associated with thinner grades. For example, he says: “Unless transfer machines are well calibrated and have good belts on them, it will be harder to get through. Thinner grades also require better inks and not all inks can be used on thinner grades. Thin grades can’t handle the heavy ink loads that some inks require due to the performance characteristics of inferior inks.”

There has been a shift in the supply chain whereby printer manufacturers who once only had direct-to-fabric printers are now offering printers for paper, Repasi says. He adds: “This indicates that the output achieved by transfer is superior to that of direct textile printing. More people see the advantages of the final output. [Moreover] increased costs of fabrics in the DTF process offset the additional costs of transfer papers used in the transfer process using lower cost uncoated fabrics.”

For Coldenhove, the weight of paper recommended to a customer is largely based on application. Sportel says: “Every application has its own optimum paper. In most situations the following applies: the more ink you use, the heavier the paper. Papers with a higher grammage will still perform well under high ink volumes. In the fashion industry, we see a growing demand for lighter-weight paper. Most of the time, this demand is only price driven.

“It is not the light weight that defines the success of industrial digital textile printing, but it is the application and its business model that does. For example, heavy ink load and high runnability is not efficient on light weight papers. It results in cockling and head crushes on the paper, sometimes it results in ink penetration causing ghosting images. A bad print quality will be the consequence.

“A lower weight paper would be beneficial when sending printed rolls over the world. It would save transportation costs for example. We think that this system is outdated as most of the manufacturers like to print local.”

Felix Schoeller’s Hornig concurs: “For special applications, lightweight paper seems to be quite important – in fashion, for example, where lower colour densities required. For better quality, higher grammages are preferable (signage, banner, sports clothing). At least depending on paper machine availability, you either produce very thin or thick papers. Thin paper handling gets more complicated (waviness, cockling). However, the main driver for lower paper grammages is cost especially in high volume applications such as fashion.

Sustainability

As dye-sub transfer printing is a dry process, it is often considered favourably compared to direct printing on synthetic fibres. However, the production of the paper itself needs to be considered when assessing the overall eco-friendliness of the process. Comparing the water used in the wet phases of direct printing production to the amount of water used in paper production is, as Hornig says, ‘hard to judge.’ However, he adds that an “important point is that paper mills have a strict waste water treatment system and therefore only clean water gets into the environment.” With small direct printing plants, Hornig says that while many will treat their wastewater, there is high likelihood that cost savings will take precedent over environmental aspects due to the need for economy.





Hornig adds: "Paper manufacturing on our side is working with closed loops. The amount of wasted water is limited as much as possible. An important factor is use of virgin fibres compared to use of recycled pulps. This enables much higher quality and performance of papers."

Coldenhove's Sportel concurs: "At Coldenhove, we make use of a closed loop system. More and more water is being re-used in our production process. For example, the re-used water is converted into steam and this is used to cool the production process. Furthermore, Coldenhove is working on a continuous improvement programme to reach an optimum production process levels. This leads to a reduction of waste and water consumption."

Source: Tansy Fall - WTIN

