Transfer printing – Identifying and resolving problems

Holger Beck, SEF - The digital transfer printing market has been growing for years. While this has to a certain extent displaced classic screen printing, it has also opened up new opportunities and markets. The barriers to entry are low: all one needs to get started is a small investment into a plotter and a transfer printing press. The potential problems have remained the same, but new problems are caused by the new process fabrics. A multi-part series of articles is designed to help users to identify problems and to develop possible solutions. There are no silver bullets for every issue, but users can develop a recom-mended set of actions by having an understanding of the background. As a result, the work can proceed faster and more cost-effectively, while also avoiding customer complaints.

1. Cutting & Weeding

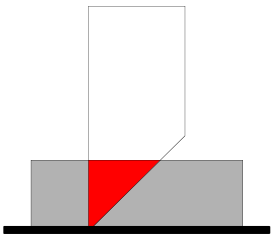
Normally cutting and weeding causes no problems. However, there are two problems that are well worth considering: thick films, such as flock film and thin, elastic flex films.

Thick films

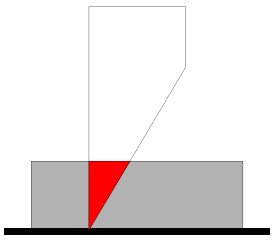
The problem with thick films is that the knife gets trapped within the material and cannot turn or not turn easily. This results in creased corners and makes it difficult or even impossible to cut smaller motifs. The solution for this is a knife with a sharper angle at the tip. These are usually called flock knives. With 500µ flock is indeed a quite thick material.

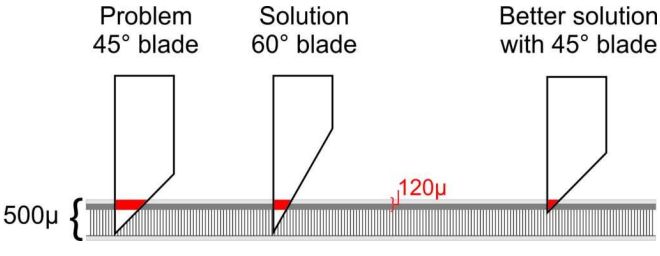
This is certainly a simple solution for resolving the problem with flock. However, this is no longer the best solution. And this is because of Greenpeace. In their campaign against organostannic compounds in ship coatings Greenpeace discovered that these organostannic compounds are also used as a catalyst in hotmelt films. Since these catalysts are no longer used, the hotmelt films of flock are now less brittle and a bit more elastic. Therefore, the films are more difficult to cut with an obtuse-angled blade.

But do we have to cut through the entire 500µ of the flock film? Rather not. Only the hot-melt film and the flock adhesive must be cut. They are insignificantly thicker than a normal flex film. Because of that, the best solution is to adjust the depth of the knife so that only what is really necessary will be cut. This also allows the cutting of flock



Problem with thick films



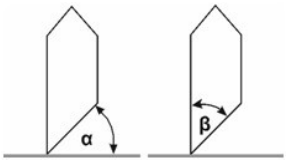


Cutting flock film

films with a high flock density, such as VelCut Evo, more easily with a 45° standard knife than with a flock knife.

Thin, elastic films

The thinner and more elastic a flex film is, the more comfortable is the decorated garment to wear. However, it is also more difficult to cut the film. The film will tend to escape instead of being cut. You should use a rather flat knife in this



Angles of a plotter knife

instance.

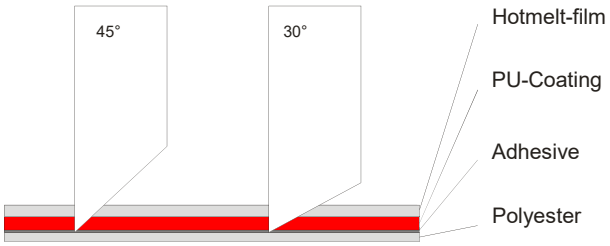
The measurement in degrees is not always clear; for most knives the free angle α is indicated, but for some knives it is also the cutting angle β. If the cutting angle β is specified, then a 60° knife is a flat knife.

Depth of the knife

The adjustment of the knife depth is also important for thin and elastic films, such as FlexCut Advance. This is not only for the result but also for the durability of the plotter parts: knife holder and cutting bar. If the knife


The correct depth of the knife

stands out more than necessary from the knife holder, then the lever force that impacts on the bearing at the end of the knife is considerably higher. The bearing is worn out more quickly and will exhibit axial play.



Thin, elastic flex films cut easier with a low angle

Knife holder

When the knife holder has too much axial play, the knife will bend at every change of direction towards the side, instead of turning. This is the cause of typically uncut fine areas at the corners, which will complicate the process of weeding or make it impossible. With brittle, thick films, this is not so noticeable, especially not when the carrier has a high adhesion.


The knife should turn easily without axial play

However, with thin and elastic films it is very noticeable. This is not a problem of the film but a problem of the knife holder. Some drops of oil in the bearing can help to reduce the axial play. Sometimes, however, it is necessary to invest in a new knife holder in order to make the weeding simpler and quicker.

OverCut

A further feature that helps prevent problems during the weeding process is to use the OverCut function of the plotter. If your older plotter does not have this function, an investment in a new plotter may pay for itself quickly. The better the cut, the quicker is the weeding.


OverCut

Cutting speed

Many users tend to reduce the cutting speed continually lower, when finding out the correct cutting speed. This is certainly the correct approach with thicker and harder materials – craftspeople know: the thicker the board, the lower is the sawing speed. However, with thin and elastic films it is easier to cut them with higher speeds.

Weeding

Also for weeding, there are tricks to work more quickly. These may be self-evident, but for a beginner they can be helpful:

- Set a weeding frame around every text line so you can weed line by line.
- Remove first the inner parts of the letters so parts that may fall down will not stick on the polyester film.
- Weed from the left to the right; most of the letters are open to this side.

2. Transfer parameters for Flock & Flex

Many users see the transfer parameters specified by the manufacturer as the only option for applying the transfer to the fabric. But this is far from true: the manufacturer's specifications are recommendations. In all likelihood, everything will work just as intended and there will be no issues with wash fastness when relying on these. But what should be done when plate impressions are caused, the employed fabric is not rated for 165 °C, or the process does not work in spite of the specified parameters?

Inspecting the press

Heatpress problems

One problem could be the employed fabric. The transfer press could also present a problem. In all likelihood, defective or poor quality presses are the main cause for adhesion problems. The digital press indicates 165°C and suggests that everything is in order. But whether 165°C is applied is far from certain. Checking the press should therefore be the first priority.

If this reveals significant differences between the indicated and actual temperature, you will need to increase the temperature on the press based on the difference or invest into a new press. The transfer press should be the last place where users cut costs; it is the most important resource for transfer printing.

Protective foil problems

Protective foils could also present a problem. Many users place Teflon foils or paper over the transfer to be pressed in order to either protect the heating plate or the temperature-sensitive fabric. But these protective foils insulate the heating plate; it therefore takes longer for the temperature to reach the required location. If this is further exacerbated by a heavy fabric that needs to be heated up and/or the press does not have sufficient heat output, the hotmelt foil is not heated adequately, cannot melt, and is also unable to adhere to the fabric.

In this case, the protective foil must either be omitted or the temperature needs to be increased. In my opinion, protective foils are not really required in most cases. Neither the polyester frame for the flock or flex foil, nor any previous layers left uncovered in multi-layer applications will contaminate the press. This of course assumes that aqueous PU foils, such as FlexCut Advance or VelCut Evo are used instead of PVC foils.

°C \ s	5	10	15	20	25	30
180						
170						
160						
150						
140						
130						

Low pressure

°C \ s	5	10	15	20	25	30
180						
170						
160						
150						
140						
130						

Medium pressure

°C \ s	5	10	15	20	25	30
180						
170						
160						
150						
140						
130						

High pressure

Temperature-sensitive materials

What can be done to address plate impressions or temperature-sensitive materials? Fabric transfers systems generally always consist of two layers. The applied layer that renders the colour and the hotmelt layer. This hotmelt layer becomes soft during the transfer process, fully conforming to the fabric surface or even penetrating into the fabric, and thus providing the adhesion to the fabric.

The desired wash fastness is assumed as a basis for developing transfer systems. If a wash fastness of 60°C is required, the selected hotmelt must have a melting point that is at least 30°C higher, that is to say at least 90°C in order to achieve the wash fastness.

Given that most flock and flex foils appear to have an official melting point of 100 °C and 115 °C, you might certainly wonder why the recommended temperature is then 165°C?

First of all, because at 100-115 °C, the foil only begins to get soft but is not yet sufficiently soft to penetrate into the fabric, and secondly, because users do not want to wait until everything under the transfer press has reached a temperature of 130 °C. At 165 °C on the heating plate, it takes the hotmelt foil 17 seconds to reach the 120-130 °C required to become sufficiently soft.

This shows you the available options: you need to achieve 120-130°C at the point of application on the hotmelt foil. Exactly how this is accomplished is irrelevant, at least for the hotmelt. For instance, in order to minimize plate imprints, you can certainly reduce the temperature to 140 °C or even 130 °C if the time is increased to 30-40 sec. Conversely, you can also reduce the time by 10 sec, for instance by selecting 180 °C.

Holding up in the wash

How can you now be certain that the combination you determined not only looks good but will also hold up in the wash. A straightforward test for this has never failed me:

stretch the test fabric to its maximum

If no adhesion problems appear along the edges while doing so, this will certainly hold up during the wash.

No problem for washing

However, if such adhesion problems show up along the edges, the temperature or time will need to be increased slightly.

If there are defects, it will most likely not hold up in the wash.

Extremely sensitive materials

Out-of-the-box thinking is required in particularly difficult situations - for instance on fleece jackets - where even 140 °C are insufficient to prevent a plate imprint. While the surface of the fleece jacket cannot be exposed to excessive temperature, the hotmelt must nevertheless see 120 -130 °C. This can be achieved by placing the transfer on the fabric and securing it with the adhesive backer or with additional tape strips and then reversing the jacket and ironing from the rear. The plate impression is then on the interior where it does not matter; the outside will at least look dramatically better.

I plan to address the issue of adhesion on problematic fabrics in the next part of the series.

Summary

- Do not cut costs on the press - it is the most important resource for transfer printing
- Regularly check the temperature of the heating plate
- Omit protective paper or adjust the parameters
- When required, think outside of the box and apply the transfer from the rear.

Left: a noticeable imprint is left with the standard parameters Right: no imprint when the transfer is made from the "rear"

3. Adhesion on problematic fabrics

Since we looked at the influence that the quality of the press, and the thickness of the fabrics and the protective films, have on adhesion of the transfer parameters in the last part, I would now like to have a look at the influence of the surface of problematic fabrics on the adhesion of Flock & Flex.

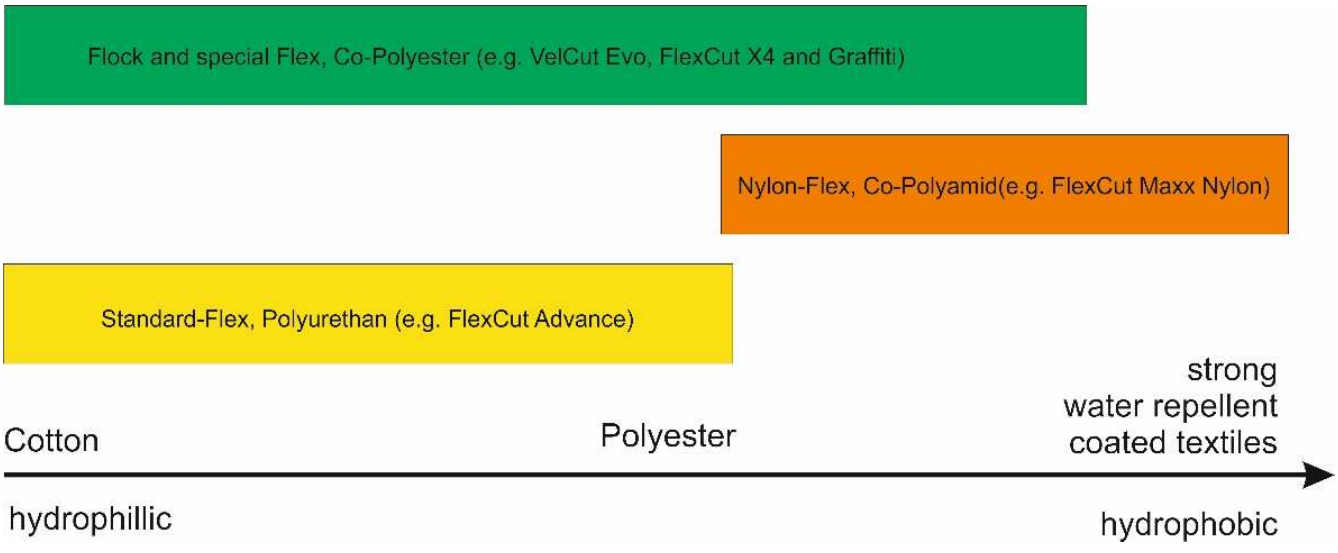
The composition of the weave/knit is always indicated for fabrics. You will be able to tell if a fabric is pure cotton, polyester, a mix of this or even nylon is concerned. If this was the only issue then you would have no problems, since even all flock and flex films adhere to pure nylon. Nylon if for all intents and purposes the trade name of DuPont for Polyamide 6.6, which alone is not a problem. The problem with nylon is that it is in most cases coated with a water and/or dirt repellent material. Substances are applied to the surface of the fibres which repel water and dirt, therefore making it hydrophobic. Hotmelt adhesive cannot stick to this water-resistant surface. Here you require a special nylon flex film such as for example FlexCut Maxx Nylon.

FlexCut Maxx Nylon, in contrast to FlexCut Advance, has a copolyamide hotmelt adhesive rather than a polyurethane hotmelt adhesive. It is substantially more hydrophobic and can therefore also adhere to hydrophobic surfaces.

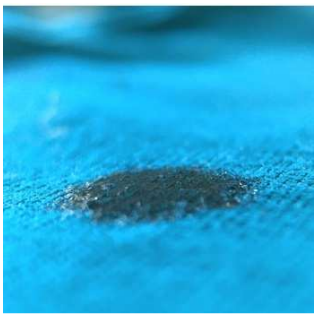
And why then is there not also a special "Nylon" Flock? For Flock films, a further third variant of hot-melt adhesive is used - copolyester. This copolyester is less soft and less elastic than polyurethane and is therefore easier to cut. Additionally, copolyester has a substantially large adhesive spectrum and sticks to more surfaces than polyurethane - it therefore already covers a large majority of various protected fabrics.

Unfortunately manufacturers give no information on whether their fabrics are covered, or even with what their fabrics are covered with. There is a variety of different coverings including wax, acrylates, polyurethane, silicon or even fluoro-carbon. Additionally, not only "Nylon" fabrics are covered. There are more and more so-called "functional fabrics" coming onto the market, which provide firstly a covering or finishing of the fabric, and then influence the adhesion of the Flock and Flex. A specific statement of which film is to be used for which fabric can scarcely be found by us as manufacturers of transfer films.

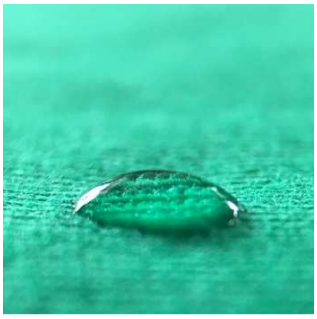
How can you deal with this? With an easy test you can at least roughly determine which surface is concerned, and therefore assess the type of film which should work on the fabric with this. Place the smallest drop of water possible on the fabric and assess the form of the drops.



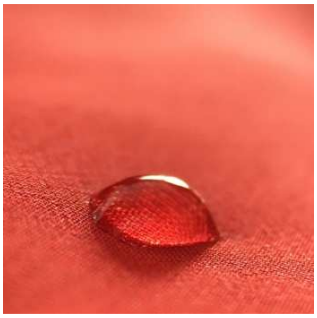
Adhesive spectrum of various types of hot-melt adhesives



If the water disperses into the fabric more or less instantly, then the fabric is hydrophilic and you can work with standard Flex films such as FlexCut Advance with polyurethane hotmelt adhesive.



When water remains on the fabric and a flattened drop forms, the surface is also sufficiently hydrophilic. You are advised to use Standard Flex.



When the drop however starts to become spherical, you should move to VelCut Evo or FlexCut X4 with copolyester hotmelt adhesive.

If the water forms a very round drop, FlexCut Nylon with Copolyamide hotmelt adhesive must be used.

If the drop is very round and is so easily movable that it immediately rolls off the fabric, then the transfer will probably not hold if you have it at an angle. You should attempt a solvent direct transfer print or embroidery.

The extent to which pre-pressing with washing with solvents or similar helps adhesion is often discussed in forums. This can all help but is not a must. The variety of possible cover-ings mentioned does not allow a clear opinion to be established. “Nothing ventured, nothing gained” or rather, annoy the fabric suppliers until they give a statement on the covering. This then makes it easier to assess what may help.

Luckily, another effect occurs rarely. It may occur that “Nylon” Flex or Flock film appears as if it will hold after pressing. After 2-3 weeks it falls off again. The reason for this is “recrystallisation”. After cooling, the hot-melt adhesive is not immediately in its final form. The molecules lie almost flat next to each other, and the hot-melt adhesive is softer and stickier than in the final state. The hot-melt adhesive sticks to very hydrophobic surfaces in this way. In time the molecules move around and get “tangled”. From this, the hot-melt adhesive gains its final properties, becoming less soft, less sticky and then it can no long adhere to the waterproof surface. As a result the film falls off. Polyurethane films recrystallise within around 24 hours, for copolyamide and copoly-ester it can take 2-3 weeks. Unfortunately, I do not know of any simple test methods for this, only waiting helps in this case.

Summary

- For the question of which Flex or Flock film adheres to the fabric, it depends more on the covering/finishing of the fabric than on the composition.
- The drop test can help with the assessment.

In the next part of the series I would like to deal with “resublimation”, or properly expressed, with dye migration.

4. Dye migration

I would like to devote this part to a subject which is often called “Resublimation”. In my view this description is not correct. The term Sublimation is used to describe the process whereby a solid substance turns into a gas or vapor without passing through the intermediate stage of liquefaction. Resublimation is the other way round, gas becomes solid without getting liquid.

When transfer films become discolored on polyester fabrics it should be called dye migration. I would like to try to explain how dye migration occurs and what you can do to counter it and to what extent.

Problems with dye migration can be divided into 4 categories, the simplest of these is: no polyester, no dye migration.

Sublimation dying

The second category is sublimation-colored polyester. You can see that the fabric is colored on the outside and white inside.

Then it is colored through sublimation for certain. This means that an intermediary carrier, usually paper, is printed with pigments which can be sublimated and at 190 °C the pigments turn into a gaseous state, sublimate, disperse and dissolve into the polyester fiber.

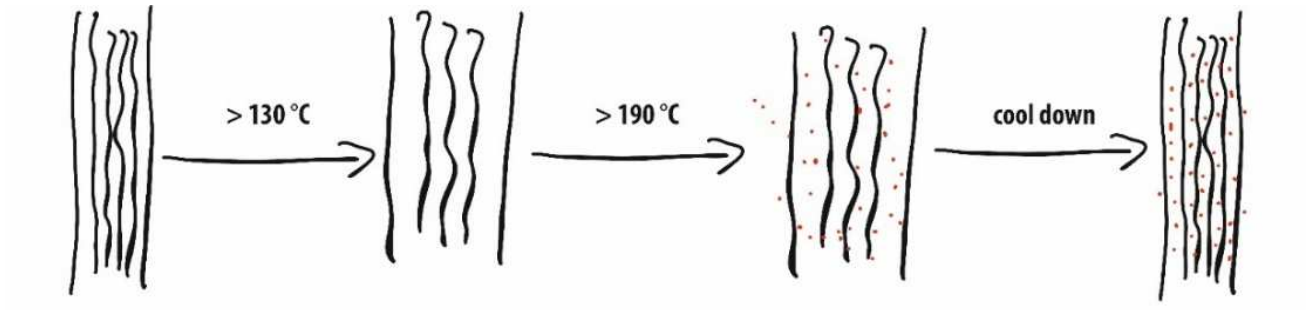
After cooling, the largest part of the pigments is trapped in the polyester fiber and can in fact no longer migrate, at least as long as it is kept below 130 °C. Only a few pigments remain on the surface and you can usually ignore these. However, if you now heat the fabric to over 130 °C during the application of a transfer, then the polyester fibers will open up again and pigments can migrate to the surface of the fiber in solid form, without becoming gaseous. And they remain there even after the cooling process. These “free” pigments on the surface can now also migrate at room temperature. This leads to dye migration; the transfer becomes discolored. Because the pigments for polyester which has been colored through sublimation are very small, this happens very quickly, within hours or days, often you can see it straight after the pressing process.

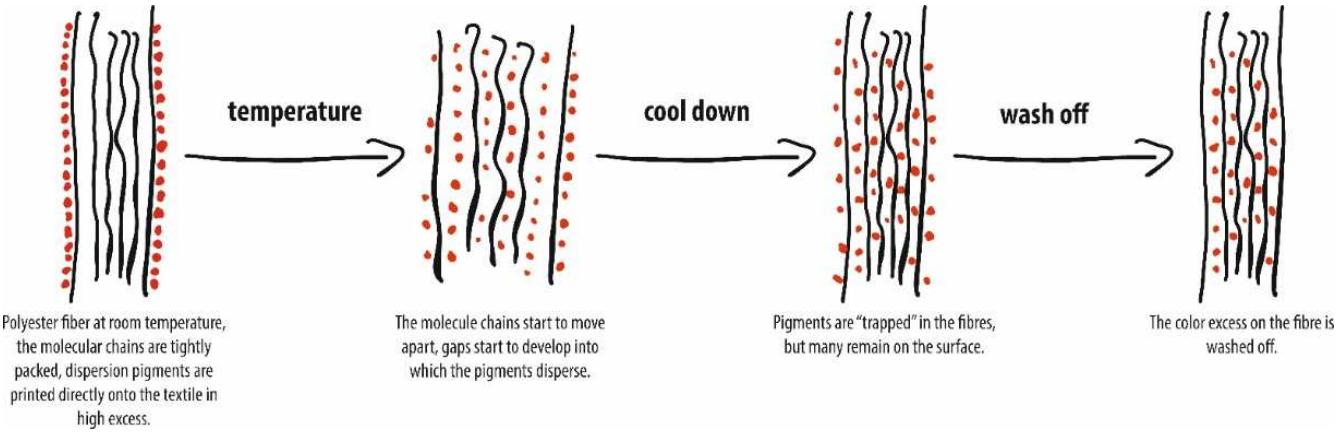
This dye migration can be avoided for sublimation-colored polyester, if transfer temperatures lower than 130 °C are used (e.g. FlexCut X4). If you do this the polyester fibers remain tightly closed, you do not activate any additional pigments and the few pigments which are already on the outside of the fiber do not cause any damage.

Disperse dying

As well as the option of coloring polyester using sublimation there is also a second option - coloring through dispersion. Polyester which is colored through dispersion is the third category of dye migration problems. You can see that the fabric is colored on the outside and inside.

When doing this, similar pigments are used to those used in sublimation, only here the pigments are larger and cannot sublimate. You therefore print the dyes directly onto the fabric, using excess dye. The following fixing process is similar to





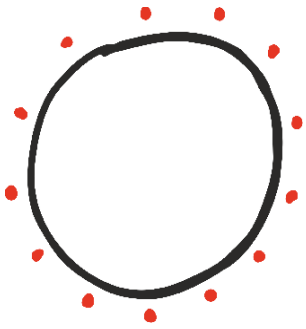
that for sublimation. The fiber opens due to the heat, the pigments disperse and dissolve into the fiber, the fibers close up again and the pigments are trapped.

But a lot of pigments remain on the outside of the fiber. These are usually washed off in a repeated industrial washing process with specially adapted detergents.

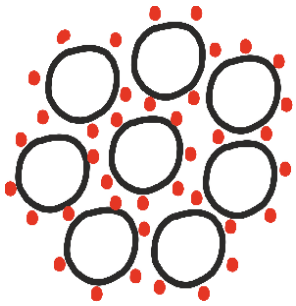
To avoid dye migration, theoretically it is sufficient to keep transfer temperatures below 130°C. However, if the fabric manufacturer has skimped on the washing process, then pigments remain on the surface of the polyester fiber which can migrated even if you keep the transfer temperature below 130 °C. Dye migration will only become visible after a few weeks, as the dispersion pigments are really large and therefore need a longer time to migrate to the surface of the film. To avoid migration, you definitely need a block film (e.g. FlexCut SBB Maxima).

Softshell

Unfortunately, there is also a fourth category, softshell fabrics. These are also colored using dispersion, but there are two other things to complicate matters. On the one hand they are made of microfibers whereby the surface of the fibers, onto which pigments could stick is increased.



Standard fibre



Microfibre

On the other hand, they are not made solely out of polyester, but most also have a greater or smaller proportion of elastic fibers such as Lycra or Elastane. These fibers can also be colored with dispersion pigments, but the pigments are certainly not trapped as with polyester at temperatures below 130 °C. Here the pigments detach from the fiber composite even at lower temperatures and start to migrate. This explains the typical speckled damage which looks like mold which you get with softshell jackets. Sometimes the elastic fibers are on the top and the dye comes quicker, sometimes the polyester fibers are on the surface and it takes longer. With softshell jackets the pigment excess on the fiber can be so great, that even "Subliblock film" no longer helps. The barrier layer in such films must be seen more as a sponge, which absorbs the excess pigments and does not let them reach the surface. If the sponge is full, because too many pigments are migrating, then it overflows. And the surface then also becomes discolored.

What can the user do now? There is a really simple test which helps to assess how many pigments are on the outside of a fiber. That will help to answer the question as to which film should be used, low temperature films or migration block

In the case of elastic fibers such as Lycra or Elastane, dispersion pigments dissolve from the fiber composite even at low temperatures.

films or whether it would be best to do without the transfer entirely and embroidery would be better.

To do this, place a polyester strip which is half covered with paper carrier on the fabric to be tested, at 130 °C for 30 s. At this temperature, as already stated, no new pigments are “activated”, but any pigments which are on the surface of the fiber will, for the most part, go into the polyester film. Using the color difference between the covered and uncovered areas you can assess how many pigments there are on the surface of the fiber which are likely to migrate.

Even if, with the help of the test, you have now selected a block film, you still can’t be absolutely sure. The free dyes can migrate not only from the fabric through hot melt adhesive and coating, they can also migrate with folded fabrics directly onto the upper side of the transfer. Then even the best block film cannot help at all. This happens particularly if the fabrics are folded when they are still relatively warm or if they are stored folded for a long period of time. In order to avoid this, you should place separating paper between the transfer and fabric.

Another question which arises from time to time in connection with this is the question as to why you get pink patches when you use a white film on a black fabric... the film must be to blame! No, it is not. There are no pure black sublimation or dispersion pigments. In both cases, black is mixed from CMY and because the red/magenta pigments are smaller than the other colors, they come through first.

Summary

- A first indication of how whether migration is likely is down to the way the polyester has been colored: If the fabric white inside, it is colored through sublimation, if it is colored inside, it is colored through dispersion.
- It is preferable to use low temperature films such as FlexCut X4 on colored polyester.
- To assess which film is to be used, test fabrics with a polyester strip on “free” pigments.
- With lots of “free” pigments, use separating paper when folding.

no staining, no free pigments on the surface - use low temperature film (e.g.

slight staining, few free pigments on the surface - depending on the quality, low temperature film can be used (FlexCut X4

clear staining, lots of free pigments on the surface - you must use block film (e.g.

severe staining, large numbers of free pigments on the surface - transfer is probably not possible, better to use embroidery

bout the author

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13 years busy with CHT Beitlich GmbH in the area of Screen printing / Flock / Transfer. 10 years in technical service, also responsible for the project management digital products. 3 years Head of Development Screen Printing / Flock / Transfer.

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