SERICOL Hints & Tips

Advice from Textile Technical Service

Fibrillation in plastisols

What is 'fibrillation'?

'Fibrillation' is commonly know as 'fibre show through'. Abrasion of the print area can cause fibres of a fabric to break loose from the surface of the ink film, giving the print a 'washed-out' appearance. It is typically seen after washing thin films of dark ink on light garments, and is often mistaken for ink washing off.

Is 'fibrillation' caused by the ink washing off?

No. Washing is simply the most common form of abrasion test applied to garments, and it is this abrasion which causes the fibres to break from the ink film. For this reason, the phenomenon is more common where prints are required to satisfy 'Twin Tub' wash tests, or other such highly abrasive resistance tests. True wash test failure caused by poor cure is not as regular as 'fibrillation', and shows as a random blotchiness of the print. To distinguish between the two, re-cure half of a problem print at around 160°C for 3 minutes, and wash both halves. If the re-cured section of the print is not significantly better, then what you are seeing is 'fibrillation'.

Why does 'fibrillation' seem more common these days?

Over recent years, the imprinted sportswear and T-shirt market has become increasingly sophisticated, requiring more complex, detailed designs with as little handle as possible. Printers have moved towards finer and finer mesh counts to gain definition and handle. Pressures of delivery can often mean jobs are not always fully proofed and tested before production, so when 'fibrillation' occurs, it causes the rejection of the job, rather than a resample. The industry is often walking the fine line, between the best possible print, and print rejection.

Why do I only get 'fibrillation' on some prints and not others?

'Fibrillation' is dependant on many variables. If the film weight for any particular design is high enough to prevent the fibres breaking the surface of the ink film, 'fibrillation' will not occur. Each design should be taken as a separate case.

Does the garment affect 'fibrillation'?

Yes. Some fabrics have far more loose fibres on the surface than others, and so will contribute to 'fibrillation'. The weave of the fabric will govern the amount of ink sinkage into the garment, and so this will also have a bearing on the resistance to 'fibrillation'.

Are water-based inks more resistant to 'fibrillation'?

Water-based inks are far more effective at coating each fibre. Should fibres break loose on washing or abrading, they are still coated with ink and so are less likely to show the 'washed out' look typical of 'fibrillation'.

So how do I stop 'fibrillation' happening on my prints?

There are many ways to reduce 'fibrillation', some more effective than others. Garment manufacture is not our field of expertise, so for these guidelines we shall deal only with potential solutions based around print setup, and ink usage.

Method 1 – Flash cure groundcoat

This is the most effective means of completely removing 'fibrillation'. The flash cure groundcoat can be printed through quite fine meshes, acting as a platform, preventing the sinkage into the fabric of the overprint colours, effectively preventing 'fibrillation'.

The use of this method does however usually lead to an increase in handle of the print, and the inclusion of the two print stations required for flash curing may limit the number of colours available on the machine. ***(Recommended)***

Method 2 – Coarser mesh counts

This will produce a thicker film blocking the fibres and eliminating 'fibrillation'.

Once again this leads to an increased handle, along with a possible reduction in definition. It is by far the simplest, yet often an unpopular alternative. ***(Recommended)***

Method 3 – Thinning

Do not add any thinners, or bases to the inks. Most thinners and bases will reduce the viscosity of the inks leading to a reduced printed deposit, and also a weakening of the ink film, allowing fibres to break away more easily.

This is unlikely to be a solution in itself, but should be borne in mind as a contributing factor to the overall 'fibrillation' problem. ***(Recommended)***

Method 4 – Use of a cross-linking catalyst

Catalysts of this type are often used to improve adhesion of plastisols to some synthetics. As with the athletic plastisol, the addition of catalyst hardens the ink film and improves the ink's resistance to abrasion. Again as with Method 3, it will not always work as a solution in it's own right.

Addition of catalyst often causes a thinning effect, which can counteract the improvements made by it's addition. The other downside to the use of a catalyst, is that catalysed ink has a short shelf-life, usually needing to be discarded at the end of the working day. Recommended addition for testing purposes is 5%.

Method 5 – 'Athletic' ink

Increase the toughness of the ink film by using an 'athletic' type plastisol. These types of ink systems usually have a high resin content and form much stronger films than most conventional plastisols. This being the case the abrasion is simply not as effective in knocking the fibres from this film, and so reducing 'fibrillation'.

This does give an improvement but at the cost of reduced printability, and harsher handle.

Method 6 – Thicker stencil

As well as mesh count, ink deposit is also dependant on stencil thickness. By adding one or more extra emulsion coats print-side, the deposit will be increased, reducing 'fibrillation'.

This is a fairly clumsy way of achieving the same effect as using a coarser mesh, though potentially without such a drop in print definition. It will of course increase exposure times, and increase emulsion usage. The variability of coating methods leads this to be a potentially hit-and-miss solution.

Method 7 – Overprint plastisol clear

Print the whole design as usual, flash, then overprint at the last station with a plastisol clear. The clear covering prevents the fibres at the surface of the coloured ink film from being abraded.

This also certainly works, but has all the disadvantages of a flash cure groundcoat, plus a glossing/mottling effect. Not recommended for lovers of print quality.

Method 8 – Water-based overprint clear

Print the whole design as usual, flash, then overprint at the last station with a water-based clear. The clear covering prevents the fibres at the surface of the coloured ink film from being abraded.

Once again this is a clumsy method, but is very effective. There tends not to be the mottling/glossing seen with Method 3, however flash cure units and water-based inks are not a happy marriage, and printability can be a problem. This is perhaps the best recommendation for reclaiming rejected prints, the overprint being barely visible if printed with care.

Method 9 – Addition of transfer adhesive

This can be done by either the addition of transfer adhesive powder, or mixing with a printable adhesive.

The benefits of this method appear to be negligible, and indeed whether it works at all is not clear. Improved results may be due to the increased viscosity of the ink (caused by the addition of adhesive), leading to a thicker ink deposit, and so improved resistance.

Method 10 – Addition of a water-based binder to plastisol

Some improvement can be achieved, however finding a combination which is compatible, and also works, can be a lengthy process.

It's a good theory, but the level required to produce a significant improvement, reduces printability/shelf life/screen stability to an unacceptable level, and destroys all the reasons for using plastisol inks in the first place. Better to use water-based inks from the start.

Method 11 – Wet plastisol groundcoat

One problem with flash cure groundcoats is the machine space required. This method only requires the use of one station, and so has a certain appeal.

Though it may be possible to produce a sample print with improved resistance using this method, the chances of maintaining this over a production run, given the variables of wet-on-wet printing, are considered extremely unlikely. More likely to cause more problems than it solves.

Summary

As you can see from the recommended methods listed here, the art to reducing 'fibrillation' is to get the film weight right. This may mean a reduction in print quality on some jobs, but that's the way it goes. The way to avoid having to make such quality sacrifices, is to get the right combination of garment, design and print set-up from the start. 'Fibrillation' tends to be seen as a function of the production environment, whereas this is simply the place where it is currently solved, but not necessarily the root cause. Buyers and designers must start taking their share of the responsibility to produce a product which has had 'fibrillation' designed out, at every stage.

The best recommendation is to test and then test some more. Sampling should be done thoroughly, and under as near as possible the actual production conditions. Set some time aside to evaluate where 'fibrillation' occurs under your own conditions, evaluating over a range of mesh counts, garments and print setups. A little time spent now, could save a lot of time in the future. 'Fibrillation' can be easily tested in-house, sometimes in a matter of minutes, using the relevant wash test. Compare the cost of such testing equipment, with the cost of a rejected job.

There are no magic answers, but with a little time and effort spent on finding out what works for you, 'fibrillation' can be something only other people have to worry about.

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