HEAT TRANSFER APPLICATION

There are three key factors necessary for a successful heat transfer application. Michael Kammann examines the role each plays in the process and the effect it has on the final transfer result

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Airless dispensers printed with DIGITRAN digital heat transfers

When it comes to applying a heat transfer onto cosmetic packaging, glass bottles, textiles or any other product, there are three key factors that everyone should know about. These are heat, time, and pressure.

Independent of the printing technology behind it, which can be screen, offset or digital printing, you should know about the effects of these parameters and how a transfer is affected by them. Moreover, it is just as important how these three interact and what this means for the final transfer result.

Formed by Kammann Spezialmaschinen und Steuerungstechnik GmbH (KSM), iTech and DekorTech, the DIGITRAN brand provides solutions for heat transfer applications. These range from the contract printing of cosmetic tubes to a fully automatic heat transfer machine for textiles. Therefore, anything from digitally printed heat transfers to application equipment and contract decorating services, can be found with the DIGITRAN team.

HEAT

The first and most important component of heat transfer applications is, unsurprisingly, heat. A transfer is non-adhesive at ambient temperatures, but it gets sticky when heated up. The inks and adhesive materials that make the transfer stick are thermoplastics. These plastics are solid and non-sticky at ambient temperatures but turn into a liquid state when heated up.

> *"A transfer is non-adhesive at ambient temperatures, but it gets sticky when heated up"*

But this change from solid to liquid does not happen within a 1°C temperature change. Moreover, it is a process where the material goes from solid to a rubbery state and finally to liquid. The name for this 'rubbery plateau' middle range comes from an effect where the speed in which the viscosity or 'fluidity' changes is slowed down over a range of a few degrees; during this period the material has a rubber like consistency.

The temperature range of the rubbery plateau and for how many degrees it exists depends on the materials used and can be anywhere from below 60°C to over 130°C (see **Figure 1**).

Summed up, with heat we can control how 'fluid' the transfer will become, from solid to rubbery to liquid. However, adding further temperature beyond the melting point can lead to decomposition, oxidation, or other significant changes to the material itself.

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Digital heat transfer printing for cosmetic packaging

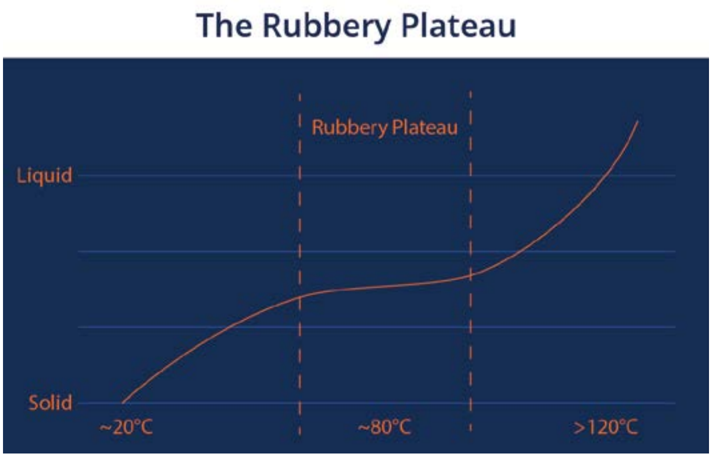

Figure 1: The rubbery plateau: viscosity changes over temperature

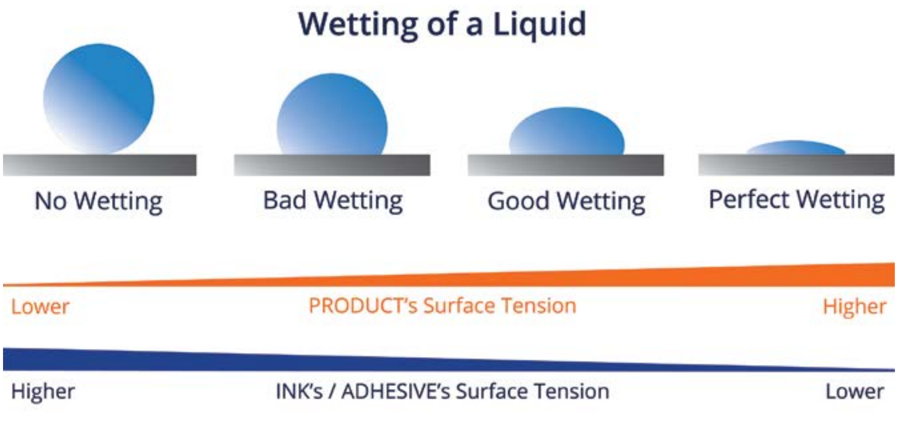

Figure 2: Wetting behaviour of a liquid on a solid surface: "Wetting is the ability of a liquid to maintain contact with a solid surface, resulting from intermolecular interactions when the two are brought together"

Cosmetic tubes printed with high-quality, digital heat transfers

PRESSURE

The second parameter to adjust is the pressure. As we just learned, with heat we can make our transfer become sticky due to 'melting' it. But how liquid do you want it to be, and how much heat can your t-shirt, cosmetic tube or pen take?

"If you want to compensate for missing heat, add more pressure"

Most plastics exhibit a similar melting process to our transfer, which means that too much heat will simply destroy the product. If this is the case, there is a limit to how much heat you can apply. And this is when pressure comes into play.

When the transfer is melted to a degree where it is 'rubbery' it can be compared to a self-adhesive tape. To understand the effect of pressure, take a piece of tape and place it very carefully on a piece of paper (not pressing it on!). Can you blow it off? The answer is yes. Now press it against the same piece of paper. Can you still blow it off? No!

This is the result of pressure. As the transfer is in a soft, rubbery state it can still flow and wet a surface (see **Figure 2**), creating a better bond. But as the transfer is not a liquid, it needs some pressure to force it into this behaviour.

Textile transfers applied with a TURBOTRAN 6.1 heat transfer machine

An example of bad wetting is when you apply water to a freshly waxed car, while good wetting can be experienced when you spill water on a piece of kitchen paper.

Therefore, if you want to compensate for missing heat, add some more pressure. Accordingly, a pressure-sensitive product can be printed by applying more heat.

TIME

The last and final value is the time. By this we mean the dwell time, during which the heat and pressure do their work on the transfer. This value is most important for production speed. The less time it takes to apply a transfer, the more output can be generated.

So, the big question is, how much time is needed to apply a transfer properly? The theoretical answer is: "When the transfer has wetted the surface to a sufficient degree." And just as heat and pressure are connected to each other, dwell time is, too.

"A good heat press with a powerful heating plate or roller will reduce dwell time"

First: dwell time and heat. The more energy in the form of heat you apply to the transfer, the faster it will reach its desired transfer temperature, soften and create a bond with the product. Therefore, a good heat press with a powerful heating plate or roller will reduce your dwell time due to a faster increase in the transfer's temperature. A similar effect can be experienced with a preheated product.

DIGITRAN digital heat transfers for cosmetic, promotional and industrial product packaging

Secondly: dwell time and pressure. These two work in a way that is a little more complicated and which correlates with heat, too. Let us assume we have a product that is heat sensitive, so we cannot crank up the heat as much as we want. In this case, we would simply apply more pressure and force the rubbery adhesive to wet the product this way. Well, the product we imagine is thin walled and therefore sensitive to pressure.

As we can neither melt the transfer sufficiently, nor push it against the surface to wet it, we must give it more time to achieve a good wetting. Imagine the transfer's behaviour is like that of a very dense dough that slowly spreads on the parchment paper. This is what the transfer will do now, but it takes time.

All in all, this means that dwell time is the last tool to deploy when you have reached your limits with heat and pressure. The most important thing that you should keep in mind is that you can compensate each one of these three values with the other two and that they are always acting together. ■

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