A PROPER CUPPA

Henri Coeme discusses the production steps, quality considerations and volume expectations when sublimating on drinkware in various forms

Do I sublimate on curved substrates such as drinkware in the same way as on fabric or on other flat non-textile surfaces like metal or wood? What tools should I use for these projects?

Sublimation printing on drinkware and other rounded products requires the same software, printers, ink and paper as printing on flat textile and non-textile products. But once the sublimation transfer has been printed, printing on drinkware takes a decisively different route, requiring different equipment and expertise.

The principles of applying the transfer onto the final surface remain the same: pressure, time and temperature are required for the image to migrate from the carrier paper to the substrate. However, those three variables are delivered by a few very specific tools.

Pressure is provided by first firmly wrapping the transfer around the substrate and taping it down with some heat-resistant tape. By itself, however, this is insufficient to produce a crisp image on the mug surface. Additional pressure is required, which needs to come either from a mug press or from a tool called a mug wrap. Along with this pressure, a timed quantity of heat is delivered by a mug press, a 3D vacuum press, countertop-type batch oven, or a conveyer-type oven.

THE MUG PRESS

The original way to sublimate on a mug is with the help of a mug press. The press consists of a closing/pressure mechanism, wrapping firmly around the substrate. Heat is provided by a heating element which consists of a metal filament sandwiched between two heat-resistant silicone pads.

Example of a slanted-wall wrap

The advantage of this process is that it is simple (requires just this one tool) and is inexpensive for small one-off projects. For runs over a dozen, however, the press becomes quite time-consuming. The three-minute intervals between mugs are too long for the operator to idle, but too short to do anything else significant that may distract away from the project.

Another disadvantage is the lack of versatility. Although there are a few presses in the market that come with a few attachments of different shape, mug presses are typically limited to straight-walled 11oz to 15oz mugs. Swapping between different shape attachments, while hot and when available, is cumbersome at best.

A further downside is the heater band. At 400F [204°C], heater bands are fragile while being squeezed between substrate and metal housing of the press. As a result, heater bands tend to fail frequently – they are not cheap and are seldom easy to replace.

Separating the pressure-action from the heating source is the solution to these shortcomings.

3D VACUUM PRESS

The 3D sublimation vacuum press is an all-in-one machine, combining vacuum pressure and heat to wrap sublimation transfer paper around curved shapes to permanently fuse the decoration onto any curved surface. The press can be used to customise many types of substrates like sublimation blanks, mugs, latte mugs, cell phone covers, curved plates, etc.

Because of its size, the press is not suited to large production volumes. However, for irregular surfaces, a vacuum press is the only solution on the market. Vacuum presses can also do drinkware and mugs, but for the

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The HIX two-step manual no-tools wrap

Conveyer-type sublimation oven

Large-capacity sublimation oven

straight-wall or slanted-wall drinkware products, there are more economical and scalable solutions available: enter the mug wrap and the sublimation ovens.

THE MUG WRAP

Mug wraps are simple pressure devices, consisting of a clasping mechanism and a silicone pad that wrap and lock around their substrate, providing a close fit between transfer and substrate. There are a variety of wraps in the market which can be divided up in the following ways:

Tool-less wraps vs tools-required wraps: Some wraps will need tools such as drills with special drill bits to open and close the wrap at each cycle. This costs time and effort and delays the process. When closed correctly, they do provide good pressure. However, overtightening can also easily snap the mug's handle. Some mug wraps do not require tools but are clumsy to open and close, wasting time as well. The best choice for a wrap opens and closes quickly and easily, without additional tools.

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Welded wraps vs wraps with removable silicone: Welded wraps are permanently attached (welded) to the steel holding pins or the wrap assembly. This effectively turns the entire wrap into a disposable tool.

Since good quality silicone has an average life-span of about 100–150 cycles, the welded wrap, although cheaper to acquire, may end up being the more expensive investment because they are made to be disposable.

Wrap mechanisms with removable silicone can be detached from the silicone with four simple screws. The clasp assembly itself sustains no wear-and-tear and has therefore a near indefinite life expectancy. Since silicone is the least expensive component to replace, the replacement-silicone option may offset a higher initial investment.

Wraps for straight-walled vs wraps for tapered substrates: Straight-wall wraps cover mugs with parallel walls. Tapered-wall wraps cover slanted walls. Both straight and tapered-wall wraps can have different heights, depending on the height of the substrate. Ideally, the wrap needs to provide about $^{1}/_{4}$ ins to $^{3}/_{8}$ ins of overhang over the edges on both sides of the mug to provide a good and firm fit for the transfer.

Wraps for small, medium and large substrates: Although the majority of drinkware in the market is the standard 11/15oz mug, a growing variety of substrates seem to appear on a regular basis, requiring different sizes of wraps to sublimate. Sizes may vary from the very small shot glass to the tall travel cooler and from narrow pint glasses to wide dog or cat bowls. Each shape and size requires a different mug wrap. Any inconsistency in the slanting angle will result in uneven pressure on parts of the mug's surface. The wrap's height needs to be sufficient to cover and even overlap the printing surface. Some companies will custom-manufacture wraps for any non-standard shape or size upon request.

Variation in silicone quality and durometer: Quality and durometer of the silicone directly relate to flexibility and longevity of the wrap. A good quality silicone can last 100–150 cycles. Keeping the wraps in a dry, cool place, allowing them to cool between cycles and not loosely throwing them in boxes, but instead hanging or laying them to cool, are all tips that will promote silicone longevity.

Durometer (hardness) of the silicone is important as well. Too soft and the wrap will provide insufficient tension. Too hard and the clasp will be difficult to lock and open. A 'Goldilocks' solution provides the best trade-off between tension/pressure on the one hand and user-friendliness/ease of manipulation on the other.

Straight-wall wrap

SUBLIMATION OVEN

Batch-type or conveyer-type ovens can be small enough to accommodate no more than 2–4 mugs or large enough to hold as many as 400 mugs at any given time. A few key features are critical for a quick, complete and even sublimation in an oven. Ideally, the oven is a convection-type model. The forced air inside the oven chamber allows for a quick and even heating of the mugs regardless of their precise location inside the oven, so that all mugs are equally and completely sublimated, top-to-bottom and handle-to-handle. A quality convection oven features strong airflow and sufficient heating capacity to quickly heat up the cooler mugs as they are placed inside the oven.

Convection ovens used in food preparation are generally too small to make the process economically feasible; they are insufficiently powerful to provide the required air velocity or heating speed needed to achieve a quick and even sublimation of all mugs in the oven.

Equal air distribution inside the oven is even more critical in the case of larger conveyer-belt type oven chambers. Without proper regulated air flow, sublimation will be unfinished, and substrates wasted. A proper temperature differential is within +/-5ºF

A non-welded wrap: detachable silicone

across the belt and within 15ºF top to bottom of any substrate. For these types of ovens, accurate belt speed control is also critical, so that all drinkware lingers equally long in the oven chamber. Differences in heat quantity will result in differences in colour outcomes.

For the larger conveyer-belt units, an appropriately sized cooling tower is no small luxury, allowing for mugs to be picked off the belt and packed into boxes at the exit side of the belt. An integrated cooling facility may be superfluous for a smaller countertop oven, in which case a table fan can easily do the job.

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Since conveyer-belt units can hold many mugs at any given time, the belt will need to be sufficiently strong to support the weight of the drinkware. Do not attempt to place mugs on a standard fibreglass belt of an oven used for screen printing: the belt will be unable to support the weight of the mugs and will rupture. A chain-linked stainless-steel belt with a weight-support capacity of 6lbs[2.7kg]/ft^2 is ideal for drinkware. Support reels are needed to carry the belt without sagging.

Customers have a choice between smaller batch-type countertop ovens and larger conveyer-belt ovens. Typically, a customer that has outgrown their mug press will first look at a smaller batch oven because of its increased capacity and labour-efficiency. For even larger capacity and efficiency, different sizes of conveyer-belt convection ovens are available.

Because of the demand-volatility of drinkware during the year, companies often use a combination of ovens side by side: a countertop oven for off-peak days combined with a conveyer-belt oven for peak season. Larger companies may have several size conveyer units side by side for the same reason. ■

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