Thomas Frizelle, EFI Inkjet Solutions senior applications engineer, offers some helpful tips and tricks for printing on specialty materials.

Several factors must be taken into account when you’re printing to special materials. For example, heat sensitive materials may limit the amount of lamp power that can be used to cure the ink and, in turn, affect adhesion. This guide outlines suggestions to assist you in printing on some of the more common specialty materials.

Printing on 3D Objects

When you’re printing to 3D objects, or materials thicker than approximately 3mm, the potential exists for stray UV light to bounce up to the heads and cure ink before it’s jetted. This is especially true for highly reflective metals and thick pieces of clear acrylic and glass whose edges refract light directly up to the heads. Care must be taken to mask the edges of clear material with something opaque, like painters tape, and also to block off unwanted light reflecting off the bed. Ideally, jigs made of opaque material with pockets cut to the size and depth of the material to be printed should be used. You can also surround the printed piece with wooden blocks to neutralize the effect of reflected UV energy.
Ink restrictions may be necessary
To achieve good adhesion on some materials, you may have to change the ink coverage, use an adhesion promoter, or, in some cases, both. Since UV has a harder time penetrating higher ink density, re-profiling with lower ink restrictions may be necessary. If printing with a white backing or undercoat, lowering the white density may allow enough UV penetration to improve adhesion to an acceptable level. When this isn’t possible or if it doesn’t work, an adhesion promoter may be required. Also, switching to a higher pass count may help adhesion. Higher pass counts allow for greater UV penetration and may, therefore, help adhesion.

Watch the dimensional stability
Some materials will flex or warp under the intense heat of UV lamps. Materials such as Coroplast, foamcore and acrylic may need to be cured with significantly less UV power to avoid warping the material to the point of a head strike or carriage crash. When printing bi-directionally, try turning off the leading lamp entirely and print with only the trailing lamp. When printing pieces that are smaller than the full bed width, turn off the unused vacuum chambers and mask off any unused vacuum holes. Reducing lamp power due to dimensional instability is another variable that could make the use of an adhesion promoter necessary.

Adhesion promoters may do the trick
We have tested three different adhesion promoters: BondAid I, BondAid II and InkFuze. All three can be applied as a wipe with a lint free cloth or sprayed on with an airbrush as long as proper ventilation and breathing protection is used. When wiping on, be sure to wear gloves and wet a lint-free cloth (polyester cleaning wipes work well for this) and wipe the surface in one direction applying as evenly as possible. For most uses, just wetting it down with the adhesion promoter is enough. You don’t need to fully saturate the surface. Allow to dry, and use within 30 minutes of applying.

With optically clear materials such as glass and acrylic, or highly reflective materials such as polished metals, you may notice a leftover film from the adhesion promoter. Clean this off as soon as possible after printing because it gets more difficult to remove as time passes. Isopropyl alcohol may be used as long as care is taken not to wipe over the printed image. Glass cleaner can also be effective and has less tendency to remove the printed image.

Notes on white printing
The white density on the EFI Rastek H652 can be controlled by the dpi, level selection and white coverage. A higher dpi and level will result in a greater white density. Also, changing white coverage from the default selection of “Linearization” to “White Flood” in Fiery XF will give you the maximum white coverage for your resolution and level selections.

The white density on the EFI Rastek T1000 is controlled by the pass count selected for color printing. For maximum opacity on subsurface prints and dark substrates. Choose the highest pass count – 16 pass for 600x600 dpi and 24 pass for 1200x900. For first surface prints and lighter substrates, start with normal – 8 pass for 600x600 and 12 pass for 1200x900 – and adjust from there.

Standard ink vs. metal optimized ink
EFI Rastek printers are offered with two different ink sets: the Rastek T Series standard inks and the Rastek T Series metal optimized Inks. Each offers different benefits depending on the type of work you do:

The T Series standard inks offer greater flexibility and resistance to cracking when compared to the metal optimized inks. They’re a good choice for printing membrane switches, vinyl signs and other flexible materials. Flexible materials that will be rolled up after printing, such as soft signage, also are a good choice for this ink set.

The T Series metal optimized inks are the better choice for nonporous rigid substrates, like acrylic, glass, and of course, metals. Outstanding adhesion to many acrylics can be achieved without an adhesion promoter. Glass and various metals also get excellent adhesion with proper cleaning and applying an adhesion promoter.

Printing on Metals
Metals can present adhesion and reflectivity challenges. While printing to thin sheet metals is unlikely to cause an issue, printing to thicker pieces, or irregularly shaped metal, can create a lot of reflected light, which may cause the ink to cure to the face of the head. The use of a jig will be necessary for those thicker metals. Metal sheets may have bent corners that will need to be flattened out before printing.

When printing to bare, uncoated metal, pre-clean the surface with either Isopropyl alcohol or a 50/50 mixture of Isopropyl alcohol and acetone (we recommend using alcohol of at least 90% purity). When using alcohol alone, the higher the purity the better. This will remove oils used in manufacturing and make it easier to apply an adhesion promoter.

When printing to coated metals, the surface should still be pre-cleaned to remove dust and finger oils, for example, that could show up in the final print and affect adhesion. Try Isopropyl alcohol or a glass cleaner to start if you don’t know the composition of the coating. Test a scrap piece first to make sure the cleaner you are using doesn’t adversely affect the printing surface.

BondAid I and InkFuze adhesion promoters work well with different metals. The metal optimized inks are the ideal choice when your primary substrates are unfinished metals. However, in some cases, the standard inks will work with an adhesion promoter. Below is an example of Dibond printed on a T1000 with the standard ink.

In almost all cases when printing to metal, even with the metal optimized inks, BondAid I or InkFuze will be required. Switching to higher pass counts and/or unidirectional printing also may be necessary.
Printing on Plastics

Two of the biggest challenges in printing to plastics are its tendency to build up static and its dimensional stability under the intense heat of the UV lamps.

Pre-treating sheets of plastic materials, such as acrylic or coroplast, with a glass cleaner or alcohol-based cleaner will help dissipate static. First, make sure the piece is placed in the position where it will be printed and that the vacuum holds it solidly. Sliding the piece around on the table after cleaning it will cause the static to build back up. Mask off any unused vacuum holes on the table to get better suction. Anti-static cloths are also available. They are chemically treated, so use care not to apply too much pressure when dusting off the piece or it may put streaks onto the printing surface. An inexpensive alternative is dryer sheets, but they also can cause streaking.

Thick pieces of clear plastics, such as acrylic awards, may also cause problems with stray UV being reflected back up to the heads. When the UV lamps hit the edges of the material, light is refracted up to the head, causing ink to cure to the face of the head and/or the nozzles. To help minimize this problem, mask off the edges with an opaque material such as painter’s tape. This has enough tack to stay on the piece, but is easily removed after printing and does not leave a residue. When printing smaller pieces multi-up, a jig that’s flush or slightly (.2-.3mm) recessed from the top of the piece, and made from an opaque material or painted flat black, is ideal. In addition to blocking stray UV, using the jig will give you accurate placement for consistent printing.

BondAid II is formulated specifically for acrylic, Lexan and styrene, and also helps with adhesion to coroplast. If flexibility of the final piece is not needed, our metal optimized inks provide excellent adhesion to acrylic. If you are using the standard inks for their flexibility but need adhesion to these substrates, using BondAid I and BondAid II is a good way to achieve that without having to switch ink sets.

Printing on Glass

Adhesion to glass can be a difficult task for UV curable inkjet printers. However, when using the metal optimized inks and BondAid I adhesion promoter, outstanding adhesion can be achieved at normal production speeds.

To successfully print on glass, the surface must be pre-cleaned with any standard glass cleaner. Wearing gloves while doing this will maintain the cleanliness of the glass. As with acrylic and other clear materials, the edges of glass should be masked off with an opaque material, such as painter’s tape, to minimize light being refracted up to the print heads. Once the glass is free of debris and oils, and masked off, you can apply the BondAid I adhesion promoter. Wet a lint-free cloth (polyester cleaning wipes work well for this) and wipe across the surface of the glass always going in the same direction to avoid re-depositing any dust or debris that may have landed on the surface after cleaning. Try to evenly coat. You’ll see streaking where the primer has been applied, but this will clean off after printing. When cleaning off residual primer, use a glass cleaner being careful not to get too much on the inks as some smearing of the color inks can occur. Streaking can also be buffed off with a lint free cloth. A combination of quickly going over the residual primer with a cloth soaked in cleaner, then buffing the rest, off will take longer, but is less likely to compromise the printed image.

When using the metal optimized inks and BondAid I, adhesion can be obtained in normal production speeds of 600x600 dpi and 8-pass mode. The standards series inks are not recommended for glass printing if adhesion is critical.

Printing on Wood

Although adhesion is not an issue when printing on unfinished and untreated wood, it does present a few challenges. Depending on the thickness, if the wood isn’t flat to start, the vacuum table may not be able to hold it down. Thicker pieces of hardwood or strong veneers that are already warped may not be able to flex enough for the vacuum to be effective. Double-sided tape may keep the piece in place, but you will need to set the head gap to the highest point. Image quality may suffer, depending on the severity of the warping.

Notes on white printing

Since wood is naturally porous, white ink tends to soak in before it’s cured. This results in a lower density white. Running at a higher pass count to get more density out of the white will help, but you’ll likely get some of the wood color through the white.

When printing white ink at 600x600 dpi, 16-pass is usually necessary. When printing 1200x900 dpi, 24-pass will give the best white quality. Lower pass counts can be used if more wood tone and visibility of the grain are desired.
Printing on Lenticular Sheets

HumanEyes lenticular software has been successfully tested on the Rasktek T1000. Direct printing to lenticular sheets instead of printing to paper and laminating saves time, materials and labor. The fixed 6pL drop, high 1200x900 resolution printing capability and the lead screw driven gantry provide the precise dot placement needed for successful lenticular printing.

To achieve the best possible results, the 1200x900 print resolution should be used. This produces excellent results when printing up to 60 LPI lenses. For the higher resolution lenses, such as 60 LPI and above, consider printing unidirectional to further increase the accuracy of the dot placement.

We have tested lenses from two different manufacturers: Micro Lens Technology, Inc., and Pacur. Micro Lens Technology makes four different resolution lenses for 3D use and four lenses for animation. The 3D 15 and 20 LPI lenses are made of acrylic, which will require an adhesion promoter when using the standard inks. The 3D 40 and 60 LPI lenses are made from PETG, which do not require an adhesion promoter when using the standard inks.

The Micro Lens animation 10 LPI lens is made of acrylic and also will need an adhesion promoter when using the standard inks. The 15, 20 and 30 LPI lenses made from PETG do not require an adhesion promoter.

Pacur lenses are all made from polyester resin in resolutions from 40-100 LPI. More information on specific lenses available can be found at www.pacur.com.

Sources and Links

**Adhesion Promoters**

- **BondAid I & II**
  - Triangle
  - INX Digital International Co.
  - San Leandro, CA
  - 800-895-8001
  - 510-895-8001
  - www.INXdigital.com

- **InkFuze/InkFuze Plus**
  - Paradox Solutions
  - 175 Dupont Drive
  - Providence, RI 02920
  - 401-228-0666

**Lenticular Software**

- **HumanEyes Technologies Inc.**
  - 366 North Broadway Suite 410-C1
  - Jericho
  - New York, NY 11753
  - 1-800-552-7344
  - www.humaneyes.com

- **Pacur**
  - Pacur, LLC
  - 3555 Moser St.
  - Oshkosh, WI 54901
  - 920-236-2888

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