Inkjet technology for card printing

Inkjet technology holds a distinct place in the card printing market. We take a look at where and how it is being used today for card personalization

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Imagine a small drinking straw with liquid held in it. How do you make a drop of that liquid come out? The answer to that question is the essence of inkjet printing technology. Inkjet technology has been widely accepted as a printing method for desktop and large-format applications. Now, it is also a viable method, and in certain applications a preferred method, for printing personalized ID cards. Offering ease of use, familiarity and reliability, inkjet printing provides an alternative to traditional direct-to-card printing.

Back to our drinking straw. One way to get the liquid out of the straw is to hold the end shut with your finger and let just a little bit of air in so that gravity draws a drop out. You can make that more precise by adding a piston to the end and only moving that piston forward far enough for one drop to form.

There are other ways to release that drop. One is by applying an electrostatic charge to the liquid and providing the opposite charge to the spot where you want it to go. Opposite charges attract and, like a lightning bolt seeking ground, the charged liquid is pulled out of the tube to fly across and hit the paper, thus neutralizing the charge.

Another method is applying pressure by squeezing the walls of the straw, so some of the liquid comes out of the end, or by putting a piston against the wall of the straw in order to apply a precise amount of force.

One final method of making the ink move is the application of heat. In this case, rather than applying pressure to the end, a small heating element is used. When a current is applied, the ink next to the element gets so hot that it vaporizes, creating a bubble in the straw. This bubble of pressure pushes the ink out of the end of the tube. When the heat is shut off and the bubble collapses, the cycle is ready to go again. This method is called thermal inkjet, and is the most widely used technology in inkjet card printers today.

Inkjet printing for cards

Inkjet printing was first introduced to the card market in the late 1990s with a printer called Avion. But the market timing and lack of technological refinement of inkjet printing on plastic cards didn't support the commercial release of the product. Fargo Electronics, working in collaboration with Hewlett Packard continued to research and develop the technology. The proven HP print engine, aligned with Fargo's card printing expertise was the key to the success of the launch

of the CardJet 410 Card Printer in April of 2002. The printer produces full-color, single-sided, over-the-edge ID cards. Specially coated cards are used, which are designed to accept the ink and instantly absorb it into the card surface.

CardJet, as with other inkjet printers, uses a series of dots to produce a color. Each drop of ink is 100% yellow, 100% magenta or 100% cyan. To get shades between 100% and 0%, the inkjet must dither (or disperse in a given pattern) a series of dots in an area to represent a color. Thus, to make lighter colors, the printer makes fewer dots in a given area. Conversely, it makes more dots for greater saturation. This process is called halftoning. Halftoning has been used in lithography for years, and the printing industry is very familiar with it.

Some desktop inkjet printers try to make up for the number of dots by adding more colors to them. It takes only three colors (Yellow, Magenta, and Cyan) to print all the colors of the rainbow. However, when making lighter shades (light magenta, for example) the printer must spread out the placement of drops to halftone an intermediate shade. Less halftoning (and thus smoother continuous tone) may be accomplished by using an ink that is already 50% magenta or 50% cyan. Using additional color pens such as these is the current trend. This technique also works with non-primary hues: green, orange and purple. These colors are typically obtained through
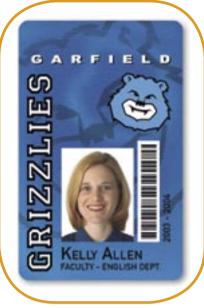
Fargo has developed inkjet printers for the card printing market designed to meet the demands of low-volume, entry-level ID card applications

extensive halftoning of the primaries. For example, green is accomplished with a mix of Cyan and Yellow. If green ink is already available, less halftoning is required. These types of printers are billed as "5 color" or "7 color" printers.

Inkjet vs. dye-sublimation

Compare this with dye-sublimation printing technology, more accurately called Dye Diffusion Thermal Transfer (D2T2). D2T2 is the most widely used method of card printing today. In D2T2, a printhead containing hundreds of thermal elements, or pixels, heats the dyes on a ribbon, which then liquefy and diffuse into the surface of the card. A separate pass is made for each of the three color panels on the ribbon. The more heat, the more dye flows and the greater the saturation. This way a single pixel can provide intermediate color shades: 23%, 39%, 52%, etc. Any intermediate shade is possible – no halftoning is required. By combining the colors of each panel, and by varying the heat used to transfer these colors, the printer is able to produce up to 16.7 million photo-realistic colors. The result is clear, high-resolution prints with true colors and accurate flesh tones.

In order to get the equivalent resolution, an inkjet printer would have to get all that color information into the same space. It would have to print at least 2400 dots per inch – something that's not currently available on inkjet card printers. Today's inkjet card

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printers use 600 dpi, so the naked-eye resolution is not as good as D2T2.

Why use inkjet for printing cards?

For many customers, the difference in resolution between inkjet and D2T2 is inconsequential. Plus inkjet printing offers distinct advantages to those who value convenience and affordability above image resolution and card sophistication. Fargo's CardJet was developed to meet the demands of low-volume, entry-level ID card applications, such as small schools, corporations of less than 1,000 employees, clubs, membership facilities, and state and local government agencies.

For members of these markets currently using D2T2, inkjet technology offers a number of advantages:

• *Ease of use*: Snap-in ink and card cartridges make for fast, error-free loading of consumables.
• *Reliability*: Minimal maintenance is required and the printheads are integrated into the ink cartridge and so are replaced with each re-supply. They never reach the end of their life expectancy, which adds to the reliability of the printer.
• *Quiet operation*: The whisper-quiet operation is quiet enough for any office or reception area.
• *Familiarity*: Inkjet technology is universally accepted and understood.

Another significant opportunity exists for users currently printing cards using the composite or film-based method. This method involves taking a person's photo, cutting it out, and laminating it onto a card-sized piece of paper containing the person's name,

ID number and any other personal information. For this market, inkjet offers even more advantages:

• *Speed*: Inkjet technology can create cards in half the time of the laminated pouch method. That means less time standing in line for cardholders and lower labor costs in creating the cards.
• *Security*: Laminated pouches are more easily tampered with than a digitally printed, inkjet card.
• *Professional image*: Edge-to-edge printing with no bubbles or gaps produces high-quality, professional photo ID cards.

But the market possibilities extend even farther. With security concerns growing worldwide, more organizations are looking to ID card programs to provide a first line of defense in their overall security program. Many of these organizations aren't currently using personalized ID cards, and are looking for an affordable, easy-to-use digital system. For first-time users of card printers, inkjet is an excellent option.

What's ahead for inkjet card printing?

Improved resolution and color quality (through greater DPI and more color pens) are going to take inkjet to the next level, surpassing D2T2 in the "indistinguishable to the human eye" category of image production. These improvements have already been seen in the home office and large-format inkjet printers; as research and development continues, it's likely that the same level of innovation will be reached in card printers. As the markets become more mature, users will demand more options – a variety of card stocks, encoding (magstripe, contact and contactless smart cards, RFID) and lamination, to name a few.