Hybrid Ink Technology

By Anthony Bean

Hybrid ink technology has found a place in the sheetfed lithographic printing industry. Since its inception in the late 1990s, it has continued to grow and evolve. The technology has brought UV curing into many printing shops that would not have anticipated being UV printers just a few short years ago. The technology has also led to the improvement of general UV/EB-curing inks for lithographic applications.

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Background

Prior to discussing the current situation and future for hybrid inks, a brief explanation of the technology and its short history is in order. The introduction of UV coatings four decades ago, created a new standard in the printing industry for high gloss and excellent scuff resistance. UV-coating application provided results similar to lamination but offered much lower costs, improved efficiencies and higher productivity. For the printer equipped with UV compatible rollers and the ability to print and cure UV inks, the in-line application of a UV coating provided the printer with significant market opportunities.

Most printers did not possess this capability and could not justify a fully UV-equipped press for the amount of UV work they had. Alternatives for the typical printer included printing conventional inks and applying a water-based primer at the end of the press. The primed print could then be passed through another press or coater to have a UV coating applied. The other option was for the primed material to be sent to another business that specialized in UV coating.

Water-based primers eliminated the need for spray powder so that the UV-coated product did not have the pebbly appearance caused by starch particles present during coating. In addition, the primer eliminated compatibility problems between the UV and oil-based conventional inks. At the same time, the primer adds costs and can cause drying problems if heat, air flow or moisture conditions are not correct leading to blocking, waste and increased costs.

Equipment suppliers quickly recognized an opportunity. Since it was possible to prime in-line and then off-line UV coat, they built presses with two coaters to eliminate some of the steps. Although the press would be more complicated, longer and more costly, the ability to do the priming and UV coating in-line as one pass would save handling and time. This translates to productivity and profitability.

On paper, this made a lot of sense and many saw this as opening for other opportunities. With a double coater press, two coatings might be applied during the single pass allowing the

printer to add special effects such as dull/gloss or spot coating with other combinations. The problem was that the drying of the water-based primer at desired production speeds was not always acceptable. The limited space in the press meant that the ovens for the primer were not always adequate. On humid days, the water-based product would often not dry sufficiently to avoid problems such as blocking or gloss-back.

Gloss-back is seen in a coated printed area where the surrounding areas are noticeably higher in gloss. When the sheets are pulled from the press, the gloss is uniform and high. As the primer and ink continue to dry (if not totally dry when UV coated), the UV coating can lose gloss in the areas where drying was not sufficient. For printed jobs with light ink coverage, this usually is not a problem since the light coverage will not show the problem. Sometimes even heavy coverage jobs do not have issues. However, the heavily printed areas often will significantly lose gloss compared to the way they look when they first come off the press. Gloss readings have dropped as much as 40 points, beginning as quickly as 20 minutes after printing. When a print buyer desires high gloss and is paying for it, loss of gloss is a problem. The lack of predictability also leads to problems where one job may be acceptable and the next is not.

To improve the situation and lower costs, some enterprising inventors thought they could improve the situation by adding UV materials into a conventional ink. This would, potentially, have several effects. First, the UV material would dry under the UV lamps when the coating is cured. This would reduce the drying needed for the conventional ink. Secondly, since the UV material was in the ink, it could act as a bonding agent to eliminate compatibility issues between the two different chemistries. Although this did not eliminate gloss-back, some improvement was noted and hybrid inks were born.

The results obtained by these entrepreneurial spirits pushed development in a new direction. Ink makers had attempted to blend UV and conventional materials, trying to incorporate the better lithographic properties that oils, alkyds and resins offer. The compatibility issue prevented this and continues to be a limiting factor.

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Hybrid Ink Development

The development of hybrid ink is not a matter of simply blending conventional ink materials and UV materials. Since UV inks do not dry until they see UV light, the addition of conventional materials must not compromise this or cause skinning like conventional ink. Likewise, hybrid inks should be "dry" at the end of the press since printers expect this of UV inks. A major concern for the formulator of hybrid inks is that these inks are targeted to print on conventional presses on which roller compounds may not be UV compatible. Many UV materials cause rollers to swell. This results in improper settings and destroys print quality. In some cases, excessive swelling actually caused the rollers to self destruct. Of course, shelf stability of the ink cannot be compromised either.

As mentioned, hybrid inks began with curing achieved by end-of-press coater lamps. Later a lamp was added after the last printing unit to dry the inks prior to UV coating, resulting in elimination of gloss-back. However, with high speed printing and heavy coverage, gloss-back returned. It is now recognized that high-press speed and heavy in coverage require more lamps. Typical set-ups are three lamps after the coater and three lamps in the press, on a 40-inch, six-color press. These lamps are typically docked, meaning they can be moved to the unit that requires curing.

Eight-color presses will have a minimum four lamps in the press. Most printers find that more is better. Although the added lamps drive up costs, they add significant flexibility. If printers have a job that requires heavy coverage or traps, they can now position the lamps between the units of the heavier coverage inks and dry them to create better traps and controlled dot gains.

Most printers using hybrid inks have found new markets to pursue because the inks dry instantly. With more lamps in the press, they can now go after UV jobs such as a job on a foil that normally would be printed with the white down first. The sheet would be allowed to dry and then would be sent back through the press to have the remaining colors applied over the white. With hybrid inks and the proper number of lamps, the white can be printed in the first unit and dried before other colors are applied in-line. With enough units and lamps, the white can be applied in the first two units for higher opacity and still have other colors applied prior to coating as the sheet exits the press. In many cases, this one pass through the press was being done as a three-pass operation at considerably higher costs, slower throughput and with higher waste.

Hybrid inks also can be used in printing on impervious substrates. The UV components adhere to many plastics and foils. It must be remembered that

these inks were not designed for these applications and must be evaluated prior to printing. The fact that the application worked once, does not negate the need to evaluate new substrates or new batches of substrate prior to running the job. Pure UV inks still have an advantage in this area because the materials used in UV inks to enhance adhesion will also cause problems with the conventional rollers used where hybrid inks are typically implemented.

Although hybrid inks were designed to be coated with UV coatings, many printers have found that water-based products work quite well when the higher gloss is not needed. Another unanticipated use for the hybrid inks is the printing of uncoated stock without applying a coating. Again, an entrepreneur discovered that the hybrid inks sit up on top of the uncoated stock when cured. The conventional oil-based oxidizing inks slowly sink into the uncoated sheet as they dry. Although the two inks appear equivalent immediately upon printing, the hybrid ink ends up with better color and better print definition. The conventional ink loses color density as the material absorbs into the uncoated sheet and the sharp dots and fine details are lost as the chemicals spread.

Since hybrid inks are relatively new, they continue to go through considerable transition, and the offerings from various companies may be significantly different. For this reason, one should not mix competitive inks. In addition, hybrid inks should not be blended with conventional or pure UV inks.

The desire to eliminate reduced gloss has led to a coating application where the gloss-back is actually created for special effects. The use of dull and gloss coatings to create aesthetic impact has long been known. This is usually accomplished by completely coating the sheet with a dull coating and then spot coating with a gloss coating. To accomplish this, a second pass is normally needed and a costly spot plate is required to properly print the gloss coating. Registration of this spot coating is always an issue. A recent development using the last print unit allows the printer to lithograph a special conventional dull varnish on top of the dry hybrid ink (must have the proper UV units and enough lamps) and then flood coat with the gloss UV. Where the special dull varnish is, the UV-gloss coating will create dull areas while the remainder of the sheet stays glossy. The advantage to this approach is that a low-cost conventional litho plate that is usually one-fifth the cost of a raised spot plate applies the dull varnish. The fact that the dull is lithographically printed also improves registration. Any printer who has ever tried to spot apply a coating with a raised plate knows how difficult it can be to register the plate to text, fine lines and other demanding subjects.

Just as the hybrid technology has spawned a new coating approach, it is also impacting general UV inks. Hybrid technology can actually surpass the litho performance of similar conventional inks. This has led to improved litho performance for conventional UV inks. As the technology moves forward, the difference between hybrid and UV is likely to blur. Technically a hybrid ink is only a UV ink that runs on conventional rollers. Once UV technology can run on conventional rollers or conventional rollers are developed that will allow for UV ink usage, the line between hybrid and UV will disappear.

Future of Hybrid Inks

Where is the technology going? One plausible scenario is that most new presses will be equipped with multiple UV lamps and will be able to run conventional inks, conventional inks with water-based coating, hybrid inks, hybrid inks with water-based coating or hybrid inks with UV coating. This flexibility will create the press of the future.

Conclusion

As technology changes and evolves, one thing continues to be constant. Any printer interested in adopting the technology should gather suppliers into one room at one time to review need, expectations and design specifications. All too often the "hybrid" press is put together piecemeal at the lowest cost. This approach might work but usually leads to a compromised press that cannot run at desired speeds without gloss-back. This situation leads to a displeased printer, who might mistakenly conclude that the technology does not work. ◗

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