Eastman Kodak Company
343 State Street
Rochester, NY 14650-0238
USA

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Contact Name:
Pam Patterson
WW Product Marketing Manager, Plates
Kodak
Pamela.patterson@kodak.com

Innovations in Printing Plate Technology to Address the Challenges of UV Printing

Arguably one of the biggest changes affecting offset printing over the last couple of decades has been the trend toward UV. As the technology continues to develop and as more printers invest in UV presses, both challenges and opportunities have appeared.

This paper will discuss some of those issues with digital printing plates.

Brief Overview of UV Printing

UV curable inks were introduced as an alternative to solvent-based products to provide improved print quality and higher speed to a dry print. Conventional heat- and air-drying works by solvent evaporation, a process that shrinks the initial wet-coating and additionally can release environmental pollutants when organic solvents are present (VOC's). In UV curing, there is little or no solvent. Instead, the inks comprise liquid reactive components. These reactive components can be hardened rapidly through the application of UV light, which causes chemical crosslinking (or hardening). Because there is little or no solvent to evaporate, there is no volume lost from the wet coating, resulting in higher ink densities and higher gloss on the print. In addition, there are no environmental pollutants from any organic solvents. Through the use of photoinitiators, it has been possible to cure the inks using UV lamps.

Advantages of UV

- Fewer emissions of VOC's
- Inks can dry on plastic and other non-porous substrates
- Inks do not have to absorb into the stock / dry fast
- If you can get it through the press you can print on it
- Ink dots are left sitting on the substrate, reducing contamination and delivering more vibrant colour and detail.
- Higher gloss levels as well as superior rub resistance are possible

Conventional UV lamps consume a lot of power, take up a lot of space and generate a lot of heat. Together these factors limit the application to print shops where the value of the print product would pay for the equipment and cost of running the UV. More recently, with the advent of higher powered and cheap UV

sources, e.g. Light Emitting Diodes (LED's), it has been possible to provide the same amount of energy to the wet sheet but with a lot less power, heat and space. Equipment and running costs can now be reduced, and old presses can be more easily modified with the smaller equipment. The ink suppliers have been able to alter the ink compositions, primarily the photoinitiator system, to match the output of the new UV light sources. This less expensive, smaller system is allowing the use of UV curable inks in wider applications. Commercial printers currently using standard inks can now take advantage of faster turnarounds, less maintenance through use of less anti-setoff powder, a wider range of substrates and higher print quality.

Challenges for Printing Plates

Switching to a UV system requires a complete review of all current components that go through the press. Not only will a printer be changing their inks, they must also look at compatibility with press chemicals, blankets, substrates and more. A UV system may require a change in printing plates, and plate manufacturers have had to take UV into account when designing new plates.

In order to understand the challenges that UV brings to the plate designer, it is important to understand a little of how a litho plate is made. The coating on a printing plate comprises from as few as 5 to as many as 15 different compounds, including colour dyes, infra-red absorbing dyes, binder resins and surfactants. During the plate manufacture process, all these individual components are dissolved in a solvent mix to intimately mix them together. This solution is then applied to the web of prepared aluminium substrate, and the solvents are removed in a hot air drying process to leave the 1-2 micron thick, dry coating that the printer receives on a plate.

Once the plate is in the printer's hands, the primary function of this coating is that it accept ink on press! The whole litho print process is based on the principle that "oil and water don't mix;" oil is non-polar and water is polar. Necessarily the coating on the plate needs to like ink so it must be a non-polar composition. The solvent mix used in plate manufacture must also be non-polar to dissolve all of these non-polar components.

So how does UV ink printing challenge the printing plate?

The liquid reactive components of the UV curable inks have different solubility properties to conventional inks. They have higher solubility in non-polar, organic solvents rather than polar solvents, such as water. Downtime for cleaning on press costs money, and to remove these inks from the press quickly and efficiently, special blanket washes are required. These washes typically use a non-polar organic solvent, such as 2-butoxyethanol.

As a result, a printer using UV curable inks is required to clean his press with essentially the same solvent that is used to dissolve the plate coating for plate manufacture. It is an obvious consequence then that if equivalent solvents are used in a press chemical, and that press chemical gets on the plate, it will result in image attack!

The traditional solution to this problem was to bake the plate, prior to mounting on the press. For instance, baking KODAK ELECTRA XD Plates gives them excellent chemical resistance on press. The extensive

hardening that is promoted by the high temperature treatment prevents solubilisation by any solvent, including the blanket wash. However, the baking process adds cost and uses energy, and it is not even feasible in many smaller shops. In order to remove the necessity of post baking without compromise for conventional UV printers, and now for mainstream commercial printers discovering the benefits of the fast curing UV inks, new plates were required.

Plate Technology Innovations for UV

In order to achieve a no-post bake solution for UV inks, plate designers have had to come up with new plate components and technologies. Kodak has two solutions to the challenges of these inks and their associated press chemistries, one for positive working plates, and another using a negative working technology.

Positive Working Plates

The technical challenge for positive working plates has been to develop new resins that are less soluble in the typical coating solvents previously used. Resins make up 70% or more of the positive coating and provide many of the key properties of the plate, including ink receptivity, developability in the processing chemistries and the physical resistance to wear on press. Now we needed to add in chemical resistance to these challenging solvents without compromising any of the other features.

Resin design was not, however, the end of the challenge as the resins were designed not to be highly soluble in the coating solvents used for decades. For example, it was necessary to design new solvent blends to dissolve the coating components but still allow them to dry in the same way to achieve good coating cosmetics on the existing manufacturing lines.

Kodak's initial offerings in this area were the SWORD ULTRA and SWORD EXCEL Plates, which exhibit good resistance to these chemicals through careful design of new resins. These plates were acceptable for conventional UV printers to achieve the benefit from a no-post bake plate. However, the new resins came with a number of compromises compared to plates for non-UV commercial printers. For example, the developer consumption of SWORD ULTRA Plates was higher than commercial plates such as ELECTRA XD Plates and had a limited resolution capability.

The ELECTRA MAX Plate is Kodak's latest processed plate offering that provides a no-post bake, positive working solution for printers using conventional UV and new fast curing UV inks. ELECTRA MAX Plates provide these features without compromising the level of performance expected of a CTP plate in mainstream commercial applications. With the ELECTRA MAX Plate, Kodak's R&D team were able to combine the chemical resistance features of SWORD Plates with the high resolution and low developer consumption features of ELECTRA XD Plates, so printers are now able to use a high-performance plate on their UV press, while reducing their environmental impact by eliminating post baking and using less developer.

Negative Working Plates

The majority of commercial CTP plates are positive working, as this has been the simpler technology to develop for CTP. However, negative working systems have been used for many years in newspaper applications as the technology lends itself to higher imaging speeds and good run lengths, but not without compromises. Newspaper plates typically require preheating and prewash in processing and have limited resolution, making them unsuitable for the commercial printer.

The challenge for the plate designers with negative working plates was to maintain the good chemical resistance of the crosslinked image while removing the compromises to suit the expectations of the commercial printer. Again, through careful design of resins and the initiating system used, Kodak have achieved a negative working mainstream commercial plate that is suitable for conventional UV and fast curing UV printing. Kodak's processed plate offering is the negative working TRILLIAN SP Plate, which takes advantage of the chemical crosslinking that occurs on exposure of these plates to help resist chemical attack.

Kodak is also leading the industry in process free plate technology that is suitable for UV applications. Many printers are using the popular KODAK SONORA XP Process Free Plate for UV printing applications, and in 2018 Kodak launched the new KODAK SONORA X Process Free Plate, which extends the run lengths for UV applications even further.

Conclusion

The printing industry continues to evolve, and as improvements are made in one area, scientists are innovating to keep up with the changes and then push the improvements even further. Thus we see that the improvements delivered by UV, such as faster drying times and better print quality, are joined by improvements in plate technology that not only enhance the chemical resistance of the plate on press, they help printers reduce developer consumption and remove their postbake ovens.

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