Plateless Digital Offset Printing with Agfa LiteSpeed

Jo Vander Aa, Joan Vermeersch, Eric Verschueren, and Johan Van hunsel
Agfa-Gevaert n.v.
Mortsel, Belgium

Abstract

Agfa LiteSpeed is a patented lithographic coating liquid (US0603750, EP00849091, JP03122717) for application on-press. It is an enabling technology for plateless digital offset printing. It is fully compatible with the CreoScitex SP™ process. LiteSpeed offers new perspectives for high quality, short runlength applications.

On press, it is first sprayed onto a hydrophilic substrate, then imaged, and again cleaned after the print job is finished. LiteSpeed forms a thermally fusable coating : during imaging, fine thermoplastic particles are fused together and onto the substrate to form the printing image. The technology is strongly related to the Agfa Thermolite processless plate. No processing device, and no development chemistry are needed. A wash-off step is required after imaging, which is carried out on press during roll-up.

The uniqueness of LiteSpeed technology lies in its combination of following characteristics :

- the coating liquid is aqueous
- it can be imaged with standard 830 nm thermal imaging technology
- it is a non ablative technology, so no vacuum or other cleaning provisions are required for debris removal
- it offers the press latitude of a conventional printing plate, because it prints from a highly hydrophilic substrate

LiteSpeed is presently in the development stage, and a few years away from product implementation.

Introduction

In this **a**era of digitization, ever increasing productivity and shorter turnaround times, offset printing is confronted with challenges and opportunities at the same time. Challenges are presented by new communication media technologies and by new printing technologies. Opportunities are offered by radical changes in printing plate technologies and plate preparation. Digitization is radically changing the offset environment. Still, offset as a printing technology remains extremely flexible and versatile in terms of quality, runlength, substrate to be printed, inks, …

This paper takes a closer look at a technological evolution that impacts the nature of the printing press and of the printing process in a very significant way : printing form preparation on press. The focus will be on technologies beyond the horizon : plateless digital press technologies. Specifically, one technology will be highlighted and explained in detail : Agfa LiteSpeed.

What is Digital Offset Printing ?

In digital offset printing systems, the imaging process is integrated in the press. This implies that the printing form is mounted prior to imaging, and that it needs no or only a very simple treatment after imaging, as opposed to the traditional chemical processing of conventional plates.

The latest technological evolutions go one step further, and apply the active lithographic coating onto a reusable substrate on-press, thus eliminating the plate change.

It can be assumed that at some point in the future, plate-based and plateless systems will co-exist, each with their merits and limitations. It should be noted that each direction, plate-based and plateless, has its proponents and its opponents in the industry.

An Overview

Plate-Based Systems

The first practical digital offset press embodiement was the Heidelberg GTO-DI, which was introduced in ‘91. In its earliest version, it used (spark discharge) electro-erosion technology, later laser ablation.

Then came the Quickmaster DI at Drupa in ’95, an instantaneous success. In the meantime some 1500 have been installed, and it still seems to be doing very well.

Other press manufacturers immediately understood the importance of this development and since then, a series of digital press products have been introduced.

The list includes :

- Omni-Adast ‘705C DI’,
- Karat - the JV between KBA and Scitex that now is being resolved, with the activities being continued by KBA ‘74Karat’,
- Dainippon Screen ‘TruePress 544’,
- Sakurai ‘Oliver 474 DPII DI’,
- Komori ‘Project D’,
- Ryobi ‘3404 DI’,
- Adast ‘557-DI’,
- PAX (= Presstek-Adast-Xerox) ‘PAX DI’.

Several of these were followed by other models. In addition, announcements were made by Akiyama (J-Press DI), Didde, Shinohara.

Plateless

Plateless does not necessarily mean that no metal sheet substrate is used. It does imply however, that the substrate is not changed between jobs, but rather reused for a substantial number of jobs.

Goss Graphic Systems demonstrated its Adopt/CP technology publicly at Print '97. More than a plateless digital press technology, it also comprised other innovative press developments. But for our discussion the digital printing form changeover technology was the most important feature. In this concept, an erasable copper image is written onto a nickel-crystal coated cylinder to form the lithographic surface.

In the meantime, MAN Roland continued work on its DICO concept, presented it in a technology demonstration at Drupa '95 in 2 versions - offset and gravure, and opted for the offset version to be implemented in a product development. DICO uses a laser ablation transfer (LAT) technology. It drew a lot of attention during its succesful demonstration at Drupa 2000.

Another development that caught a lot of interest in the industry is Agfa's LiteSpeed digital press consumable technology, which was first announced at Drupa 2000, and then demonstrated live during GraphExpo 2000 together with CreoScitex on their SP™ technology demonstration.

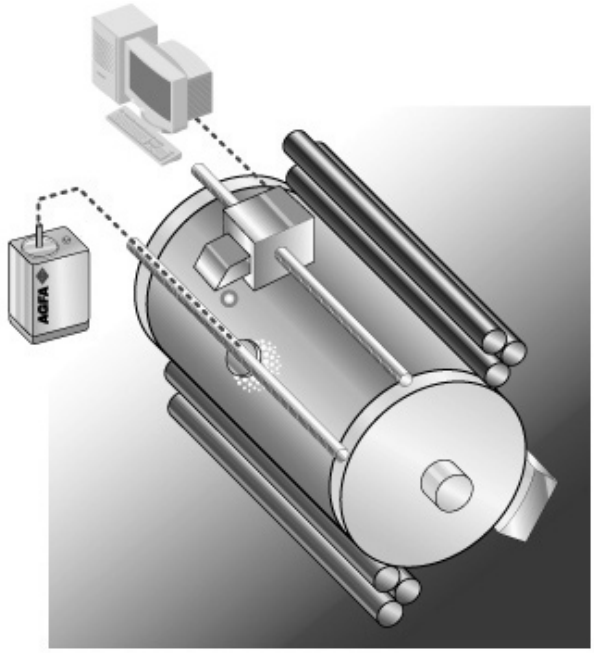

Figure 1. LiteSpeed Concept

The LiteSpeed liquid, which is sprayed onto the substrate, forms a thermofusable coating that is imaged using state-of-the-art 830 nm laser diode technology.

The nature of Agfa's LiteSpeed comes close to that of a conventional printing plate, in which a hydrophobic image is formed onto a highly hydrophilic substrate. This is one of the main features of the technology, which gives the printing form its outstanding press latitude.

LiteSpeed is strongly related to Agfa's Thermolite processless plate.

Other technologies under development are so called "switchable polymer" technologies and reversible switchable surface technologies.

Why Digital Offset ?

The major advantages of digital offset (as compared to computer-to-plate) are in setup time (job cycle time) - mainly because registration corrections are eliminated - and in overall workflow organization and control.

This makes digital presses interesting especially in environments with high job change frequency and short runlengths.

Why Plateless Digital Offset ?

The obvious answer to this will be : cost reduction. We believe it is realistic to expect that there will be a cost benefit from consumable related savings. Another attractive element may be productivity. It is believed that the cleaning and spraying cycles can be very fast, and that plateless digital presses can offer very short job changeover times, and thus very high productivity.

On the other hand, it remains to be seen to what extent plate quality, flexibility, versatility can be matched, and it seems likely that plate-based and plateless digital presses will co-exist in the future. Applications that focus on productivity may be best served by plateless solutions, applications that focus on highest quality and flexibility may be better served by plate-based solutions.

Media Technologies

Again, we must distinguish between plate-based and plateless systems.

Plate Technologies

In general terms, the plate technologies that are used for digital offset, are processless, and suitable for external drum imaging.

Two main types that are in use : ablation and (ablation-free) wash-off.

The major representative of the first category is Presstek's Pearl Dry material on polyester. It is used in the Heidelberg Quickmaster DI, as well as in several other systems.

This is a waterless plate material, where the image is formed through release by thermal ablation of the abhesive, i.e. oleophobic (silicon) top coat. It is called processless because no chemical processing is needed, but still a cleaning cycle is necessary after imaging, to remove the ablation debris from the plate surface.

Presstek also has a Pearl Gold conventional (wet) offset plate, which is also suitable for on-press imaging, and is also based on an ablative imaging process.

A representative of the second category is Agfa's Thermolite. It uses a thermo-fusable coating on a

conventional aluminum substrate. Thermal imaging melts thermoplastic particles in the coating together and fuses them onto the aluminum substrate, thus forming the printing image. Imaging is non ablative. There is no chemical processing. The wash-off cycle, needed to remove the non-image parts of the coating to free the aluminum substrate, happens during plate roll-up without any extra step, i.e. a normal press start.

Plateless Technologies

The technology developed by Goss Graphic Systems (partly in conjunction with Rockwell International), and used in its Adopt/CP (**A**dvanced **D**igital **O**ffset **P**rinting **T**echnologies **C**oncept **P**ress) concept, generates an erasable copper image from a solution under laser excitation, onto a nickel-crystal coated cylinder. The copper forms the printing image, the nickel-crystal coated cylinder is the hydrophylic surface. The image is very durable and can last for millions of impressions. When the job is finished, the copper image is removed and the copper reused. It is unclear whether this development work is still ongoing at present.

MAN Roland's DICO (**Di**gital **C**hange-**O**ver) concept uses a proprietary donor ribbon, that is coated with a thermal wax type of layer. Heat from the (830 nm) laser energy during imaging releases the layer from the ribbon imagewise, and it is transferred to the hydrophylic substrate which is in close contact and with respect to which the ribbon travels synchronously.

It is a laser ablation transfer (LAT) technology to apply a wax type of image from a donor ribbon onto the reusable hydrophilic steel substrate.

Agfa's LiteSpeed

Agfa's LiteSpeed is a thermally fusable lithographic coating. It is patented by Agfa. It is strongly related to Agfa's processless Thermolite plate, from which its formulation is derived.

LiteSpeed comes in a press-ready liquid form. It is sprayed onto a highly hydrophilic substrate and dries almost instantly. It thus forms a sub-micron thermo-fusable layer that can be imaged using state-of-the-art 830 nm laser diode technology. The image formation is as follows. The coating contains fine thermoplastic particles, that are melted together and fused onto the substrate by heat generated upon absorption of the laser energy. The printing form is then ready for roll-up. During roll-up, the coating is wetted by the press dampening system, then removed in the non-image areas by the inking rollers and blanket. No waste is generated, no contamination of the press dampening and inking systems occurs.

After the printing job is finished, the inked-up image parts of the coating are removed, after which the substrate is ready for a new job cycle.

The LiteSpeed formulation is fully aqueous, operator and environmentally safe, most suitable for use in a press environment.

As with Thermolite, a major advantage of the concept is that it combines ablation-free imaging with printing from a highly hydrophilic surface. Indeed, the hydrophilicity is obtained from a highly hydrophilic substrate. In fact, in today's experiments, electro-chemically grained and anodized aluminum is used. Therefore, LiteSpeed prints much like a regular conventional printing plate.

Agfa LiteSpeed was developed in cooperation with CreoScitex, and it is fully compatible with the CreoScitex SP™ process. It was demonstrated live at the GraphExpo show in Chicago in September, 2000.

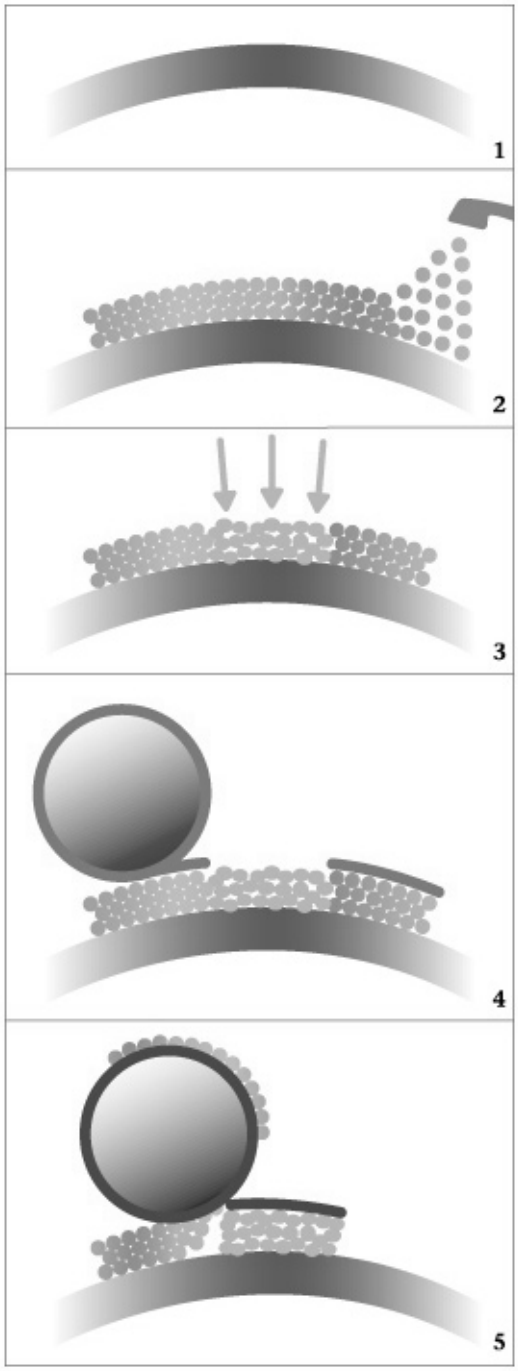

Figure 2. LiteSpeed Working Principle

Agfa LiteSpeed has following appealing properties as a technology for on-press application :

- it is aqueous (solvent-free)
- it is operator and environmentally safe

- almost instant drying (sub-micron layer)
- non-ablative imaging
- high sensitivity
- 830 nm sensitive
- wide exposure latitude

as a printing form technology :

- printing from a highly hydrophilic substrate
- fast roll-up
- excellent lithograpic latitude
- 20…30K runlength
- high image quality : 2…98% @ 200 lpi

Switchable Surface Technologies

Several companies are believed to be working on so called "switchable polymer technologies". A more generic and more precise denomination is "(non-reversible) switchable surface technologies". With these technologies, the transition from hydrophilic to hydrophobic (or vice versa) is made at the surface of the coated layer. No material is ablated during imaging, no material is removed as in a cleaning cycle. There is an immediate and irreversible conversion by thermal (laser) energy. An attractive concept because it offers truly processless printing form preparation and the lithographic properties do not depend on the substrate, there are also serious challenges to overcome. To obtain a significant enough lithographic differentiation to enable offset printing is one, to keep a strong enough differentiation for practicle runlengths is another.

Reversible Switchable Surface Technologies

One last category consists of reversible switchable surface technologies. The ultimate goal in digital offset is to eliminate the need to replace the printing form with every job. Reversible switchable surface technologies reuse the same form by erasing the previous image and replacing it with a new one.

Here, no coating is applied with every job. The printing form consists of a high number of individually selectable and switchable micro-elements. These are "switched" to obtain the necessary lithographic differentiation. When the job is finished, the micro-elements are reset to their original state, after which the process can be repeated with a new image. MAN Roland and Eastman Kodak have put work in this, whereby several directions have been explored, including the use of Zirconia alloy substrates. But a practicle implementation does not seem to be possible in the near future.

Conclusion

Plate-based digital offset presses are increasingly being accepted and adopted by the industry.

It can be expected that next-generation plateless digital offset technologies will offer high productivity at attractive cost.

Therefore, these technologies can complement plate-based systems, and offer a further possibility for offset to strengthen its position against non-impact printing and alternative media technologies.

In this scenario, plate-based and plateless systems will each have their merits and limitations, and co-exist to address their specific areas of application.

Agfa LiteSpeed combines attractive coating and imaging characteristics with excellent lithographic performance - characteristics that are of great value especially in the targeted application areas.

Implementation in actual digital press products is probably still a few years away.

Sources

Agfa US0603750, EP00849091, JP03122717
Heidelberg web site
http://www.heidelberg.com/
Goss (Rockwell) US5333548
MAN Roland web site
http://www.mro.man.de/
Creo US5713287
3M WO9209934
Asahi US5569573
Eastman Kodak EP872339

Biographies

Jo Vander Aa : holds an engineering degree in electronics. He has been involved in the development and market introduction of new digital printing plate products for over 10 years. His current position is in Strategic Marketing. His main field of activity is digital printing plates and digital offset technologies.

Joan Vermeersch : PhD in polymer chemistry and for many years has been involved in development of computer-to-plate technologies. In the last few years he focussed on thermal and processless technologies.

Eric Verschueren : holds a degree in chemistry and is for 10 years involved in the research and development of digital offset printing systems. He specialised in hydrophilic surfaces and physical properties of printing plates.

Johan Van hunsel : holds a PhD degree in physical chemistry. For over 10 years now he has been involved in the development and market introduction of new digital printing plate and press chemical products, first within Agfa's R&D and since 1997 within Applications, where he now is responsable for the technical support and market introduction of new digital offset systems.