Introduction

This article is produced as part of an international graphic arts industry collaboration between Digital Dots, its publishing partners and its clients.

It is part of a special project to address business and technology issues crucial to digital print media production. The series of educational articles explains print media technologies, business issues and market drivers for print media production, in both existing and new markets. These articles will be published as a series of individual Technology Guides, due for print publication in April 2006.

The Guide to JDF

The Guide to Colour Management & Proofing

The Guide to Digital Printing & Direct Imaging Presses

The Guide to CTP

The Guide to Preproduction Data Management & Quality Control

Further information is available at:

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Computer-to-plate production is no longer just a possibility for the printing industry, it’s a proven reality with over 26,000 of these engines estimated to be in use worldwide. Many printers are investing in second and even third generation technologies, having benefited from improved returns on press investments, improved print quality, tighter deadlines, cost savings, and the benefits of a digital workflow. CTP is about process automation and improving the competitiveness of print in a media market that is both overcrowded and unpredictable.

For most printers it is the digital printing plate requirements that shape platesetter choice. Plate performance is crucial to the success of the CTP output. Current digital plate sales are around 170 million square metres annually, and the market potential is some 480 million square metres. The market benefits from a wide range of suppliers, high volume manufacturing, keen prices and technology advances, especially for processless plates.

Plate Perfection

There is no such thing as the ideal plate for all purposes, because performance requirements vary according to the sector. Printing plates put dot patterns onto a final substrate, without distortion and with accurate, consistent placement. They must be precise, easy and stable to work with, economical to use and last as long as the print run demands, if not longer.

Virtually all metal plates are based on grained and anodised aluminium, coated with UV, visible, or heat-sensitive layers. Presstek use what they call an ‘equivalent’ hydrophilic layer. When imaged the plate is exposed with either thermal energy or visible light. During processing, the non-image area is removed leaving just the image area which is ink receptive, or oleophilic, and the non-image area which is water receptive, or hydrophilic. Silver halide and light sensitive photopolymer based plates are imaged with visible light from 405 nm to 680 nm. Silver halide plates have a hydrophilic (water loving) anodised aluminium base coated with a high speed emulsion. Visible light photopolymer plates are coated with a film speed photopolymer and these are most commonly imaged with blue or violet light.
A thermal plate has an aluminium base with a heat responsive, possibly multi-layered polymer coating. For many years all digital plates have required chemical processing to develop the laser exposed coating and prepare the plate for use on press. Chemical processing takes production time and introduces a whole series of process variables, which must be controlled, not to mention chemical costs and environmental issues. The availability, after many years’ anticipation, of processless and so called chemistry-free plates is one of the most significant advances the printing industry has seen in years. However these new plate technologies are still heavily outsold by digital plates that require processing.

Silver halide

Since their introduction in the early 1990s, silver halide plates have been successfully used in all sorts of printing applications, from newspapers to commercial print. Critics state that silver content makes a plate vulnerable to chemical interactions with processing chemicals, fount solutions and even ink and substrate materials. However this is really only an issue in harsh environments such as on highly corrosive UV presses, where baked plates are more suitable. Eroded silver in the processing chemistry requires disposal however and this involves cost and some environmental impact, albeit small.

Silver halide plates, imaged with red or green light, are extremely sensitive to light and require red light handling in a darkroom. Violet plates can be handled under yellow light, so they are much more convenient than alternative visible light imaged plates. Most manufacturers are seeing a significant shift to violet.

Silver halide visible light plates cannot be baked for long runs, however used on a wide range of presses, from small B3 to newspapers, they have a reputation for robustness, stability, consistency and reliability. They support high resolutions and can render a wide tonal range. Economies of scale keep silver halide plate prices very competitive, even though Agfa is the only manufacturer offering this technology.

Photopolymer

High speed photopolymer plates, imaged with violet or green light are, like silver halide plates, sensitive to visible light so in a manual CTP system require darkroom handling. Photopolymer plates are very consistent and durable, and well able to compete on run lengths with thermal. Some can be baked for even longer runs. Their surface content is polymer based and so immune to undesirable chemical interactions. Photopolymer plates have the added benefits associated with visible light imaging and are particularly popular for newspaper printing. Photopolymer plates can now support
equally high resolutions as silver halide and print a tonal range from 1–99%. Some photopolymer plates need a pre-heat stage prior to development in order to complete the photo-initiated polymerization process.

The latest generations of violet imaging plates are taking market share from those imaged with red and green light. Violet plates are sensitive to shorter wavelength light present in the blue area of the visible spectrum. Because of the low energy requirements the plates are suitable for internal drum platesetters. The mirrors in the platesetter’s optical system can be very small – small mirrors can spin extremely fast, helping to improve productivity and imaging precision for sharper dots capable of rendering a wide tonal range.

**Thermal plates**

Thermal plates consist of an electrochemically grained and anodised aluminium base coated with polymers. Once exposed and processed the plate surface is extremely hard so it’s suitable for long runs, especially when baked. Because most are only sensitive to thermal energy of more than 800 nm these plates can be handled in daylight. Some thermal plates image at a minimum threshold temperature and require some time at that temperature before exposure takes place. Processing is simple and the plates behave like conventional plates on press. Some require preheating prior to processing and baking afterwards in order to achieve really long runs.

On a thermal plate each pixel is individually exposed until it reaches a specific temperature. At that point chemical bonds rearrange to form a very sharp image spot. The spots on a thermal plate, as is the case with some photopolymer plates, have straight sides and flat surfaces and can be very small. Thermal plates can support 1–99% dots for the widest possible tonal range, and provide impeccable plate image quality, supporting line screens of up to 300 lines per inch and stochastic screening. Increasingly this is true of photopolymer technologies. Thermal plates are popular in commercial CTP environments because they are tough, long lasting, and can be baked for longer runs or used in UV environments.

**Processless and Chemistry-free**

Processless plates is by far the area of most excitement at the moment. CTP is all about automation and efficiency, and processless plate production supports this concept. It helps eliminate process variables including the problems inherent to chemical processing and the difficulties of maintaining a stable environment. It also partially solves the chemical disposal conundrum, since there are fewer chemicals involved. Processless production might even help improve the cost of ownership for platesetters,
since with exposure times coming closer to those of existing plates, more plates can be produced in the same amount of time. Currently only Fuji’s Pro-T technology can be imaged in roughly the same time as processed plates, most of which take around 30 to 40% longer. Like photopolymer and thermal processed plates, some processless plates can hold 1–99% dots and 200 lpi screens so there is a quality consideration, especially if FM screening is required.

Processless plates use either thermal or violet light energy to expose the plate surface, with limited processing – some can be put straight on press. Processless plates save considerable amounts of time, hassle and cost because they don’t need processing equipment or chemistry. Processless plates remove the non-image area either with ablation, phase change or wash off technology.

Ablation plates are exposed with a high powered laser which causes the plate surface to burst away from the base. This technique can require some means of debris collection and disposal in platesetting devices where dust could settle on mirrors and lenses. This has to be built into the device, which can add to its cost. With a wash off or chemistry-free plate, laser energy causes the coating to change its solubility. Subsequent water washing, gumming or fount solution removes the soluble areas either in a special bath or on press.

**What Cost a Plate?**

Plate costs are difficult to identify independent of capital equipment costs and quantity discounts. Prices vary with plate volumes and the nature of the contract, including support and maintenance. They even vary with geography. Although the price of a digital plate has been substantially higher than its analogue equivalent, prices have been coming down. Even though the major manufacturers recently announced price rises, in relative terms the cost of digital plates has fallen. Rising platesetter sales and increased digital plate usage have lead to economies of manufacturing scale benefiting individual customers and the market as a whole.

**Plate Characteristics**

Choosing a plate depends on what the plate is for and the press it will run on. Once the format and performance criteria are clear, it’s a matter of working out production constraints, and identifying quality and reliability expectations. Quality can be measured using screening, output resolution and line screen requirements, the need for FM screening and so on. Performance requirements can be based on average run lengths for the presses, the range of substrates printed, plate production speed, platesetter and press availability.
Consider also the working environment and space available for a new plate line, as well as temperature controlled storage of plates (20–25 degrees Celsius). Processing issues include equipment and chemistry, cost, chemical storage and disposal, and support – especially where deadlines are tight. Support costs are an important part of annual plate contracts. Make sure to check call out costs, and penalties for not fulfilling the plate contract if plate requirements change, either for volumes or product choices.

What’s what?

The major international suppliers of digital and analogue plates for commercial printing applications are Agfa, Fuji and Kodak. Plates are also available from a number of other companies, such as Ipagsa, which offers two digital plate products, Presstek, whose focus is on direct imaging presses and its own CTP technologies, and Citiplate, which operates exclusively on an OEM basis serving the US market.

Agfa

Agfa has the industry’s broadest portfolio of plate products, and its bestseller is Lithostar Ultra. This visible light silver halide plate is available in several versions according to the user’s preferred imaging technology. The Lithostar Ultra-V is used in devices imaging with violet light at 400 nm. Lithostar Ultra-O is sensitive to light from 488 to 532 nm. The Lithostar Ultra-R is for red laser devices imaging at 650 to 680 nm. All three are rated for run lengths of around 350,000 impressions and support resolutions of 1–99% at 200 lpi.

Thermostar is Agfa’s thermal plate. This positive plate is used in commercial applications of all kinds, especially for 8-up and Very Large Format (VLF) applications. Thermostar lasts for up to 150,000 impressions without baking and up to one million if baked. Resolution is 1–99% at 200 line screens. These plates require no preheating and there are options for use in external and internal drum devices, the Thermostar P970 (830 nm) and the Thermostar P971 (1064 nm).

The Thermolite processless plate is designed for on press imaging with a suitably designed digital press and uses the dampening water on press to loosen the nonprinting areas of the plate. Thermolite plates last for up to 100,000 impressions.

Azura is a new latex coalescence plate with wash off chemistry-free coating that is suitable for 100,000 impressions. Based on Thermolite, it has an aluminium base coated with small thermoplastic particles that laser energy causes to melt together and stick to the base. A gumming process cleans out the non-image areas. Azura is apparently tough, consistent and has a wide latitude on press. The plate can’t be baked.
It is positioned for 2-up and 4-up and lower volume 8-up CTP, producing up to 8000 m² annually and there are now approximately 600 companies using this plate.

Amigo is Agfa’s next generation, bakeable, chemistry-free plate based on its Thermofuse technology. It is structurally the same as Azura with latex layer added to a grained and anodised substrate. A thermal laser imaging at around 830nm melts the latex pearls and fuses them to the substrate. With Azura, the unexposed areas of the plate are removed during gumming, however Amigo is designed for longer runs and needs a little more help to achieve durability. The plate uses a ‘Clean Out’ solution, which removes the non-image area. Agfa describe the technology as developer free, since it involves no conventional plate image development.

Agfa also offers the negative working N91 photopolymer plate, mainly for newspaper applications. There is also a violet version of this very popular photopolymer plate, the N91V, which is available for commercial applications too.

Agfa acquired Lastra and its commercial printing products. The DiamondPlate LY-8 photopolymer plate is imaged with 532 nm YAG light. The DiamondPlate LV-1 is a negative photopolymer plate for violet exposure around 410 nm. The DiamondPlate LT-2 is a positive working thermal photopolymer plate imaged with 830 nm IR light. It requires no prebaking. The Diamond 2G is a thermal plate suitable for 100,000 impressions or one million baked.

**Fujifilm**

Fujifilm’s Brillia digital metal plates are suitable for numerous printing applications, including UV printing, with both thermal and violet photopolymer options. For newspapers there are three options. The LP-NN2 photopolymer plate is imaged with green light and is good for runs of 300,000 as is the LP-NNV violet imaging photopolymer plate. The LH-NN thermal plate lasts for 200,000 impressions, and is rated for resolutions of 1–99% rather than the 2–98% of the photopolymer plates.

For commercial applications the LP-NV2 is a violet photopolymer plate, and LH-PJE and LH-PCE are thermal plates. These two differ in that the LH-PJE can be baked for runs of 1,000,000 whereas the LH-PJE is suitable for 300,000 impressions. All of these plates are rated for 200 lpi and 1–99% output resolutions. Fuji’s next generation Brillia High Definition CTP plates, the LP-NV2 and LH-PJE, are based on the same new emulsion as is used in Fuji’s processless plates.
Processless

Fuji has two negative working processless plates, the Brillia Pro-T thermal and the Brillia Pro-V violet. The violet plate is currently a technology rather than a product announcement, but this plate will have comparable performance to the Pro-T thermal plate. Both will compare favourably to the performance of Fuji’s other digital plate offerings: production speeds equal that of the other Brillias, and they can image FM screens. Run length and on press performance are equivalent, so printers won’t have to make any compromises in order to move to processless output.

Fuji’s processless plates are based on micro-etch technology that creates a multigrained surface capable of better on press performance than was previously possible with processed plates. Fuji has developed a high definition emulsion for better quality, and a high sensitivity polymerisation technology for fast imaging.

The Brillia Pro-T is a no bake 830nm thermal plate based on Fuji’s high sensitivity polymerisation technology. It is developed on press, rated for run lengths of 100,000 and will be available in the first quarter of 2006.

The Brillia Pro-V violet imaging plate will be commercially available one year after the Pro-T. It is based on the same technology, but works for runs of around 200,000 and requires gumming. It will be able to print aggressive UV inks without baking, and support longer run lengths if baked. Because of the gum processing there is no need for yellow light.

The Pro-V images at around 405 to 410nm and requires a higher powered laser than is currently available, hence the delay in its introduction. The violet diodes generally come from Nichia, one of the earliest developers, and the current technology can be driven at up to 150 milliwatts, albeit compromising the life of the diode. A 200 mW diode currently has an estimated two year life, but higher powered diodes that last five to ten years are coming along. Fuji expects to see 300 mW within the next couple of years with acceptable life, although they are understandably coy about what exposure the Pro-V plate will need.

Fuji has tested its new plates for throughput on all the major CTP devices on the market.

Ipagsa

Ipagsa has a small but healthy share of the consumables market, with two digital products. The Rubi T50 thermal plate images at 830nm and customers like it for its excellent resolution (this plate is certified for Kodak’s Staccato 20 screening
technology) and resilience. It can handle very high run lengths of well over 300,000 without treatment, one million baked, even with UV inks.

Ipagsa’s Arte IP-21 830 nm thermal plate is for markets needing fast imaging, such as commercial printing. Arte IP-21 is suitable for run lengths of up to some 150,000 impressions and much more when baked. With Arte, Ipagsa sacrifices run length for speed, so the plate is a logical complement to the Rubi. Arte technology is Ipagsa’s foundation for a chemistry-free or processless plate in the future.

**Kodak**

Like Fuji and Agfa, Kodak offers both thermal and violet plates. Kodak does not sell any violet imaging platesetters for commercial platesetting but it does have a violet newspaper device.

Kodak has a substantial number of digital plates, including thermal and rather more recently, violet. Since Kodak’s first digital plate came onto the market in January 1996, the Thermal Printing Plate/830 has been tried, tested and proven for accuracy, reliability and repeatability. It is popular with both high quality commercial sheet-fed colour printers and heatset web publication printers and there are over 1,200 platesetters around the world imaging it. This negative working 830nm thermal plate requires 150–175 mJ/cm² to image and is suitable for run lengths of over 150,000 unbaked or over one million when baked. In Europe, the Middle East and Africa, TP-830 plates have been superseded by DITP Gold technology.

The DITP Gold plate is a third generation plate and is designed for high speed production in commercial printing applications. Besides being fast to image (energy requirement 100 mJ/cm²), it has greater imaging latitude and less ablation than its predecessor. When baked it can print run lengths of over one million (150,000 unbaked) with a high degree of resistance to hostile press environments. Thermal Gold is a similar product sold in North America, with a slightly different substrate. DITP Gold can also be used for applications such as packaging or for exposure in conventional UV frames, in Europe, Africa and the Middle East.

Thermal News is a thermal plate based on similar technology exclusively for newspaper production. It is fast and suitable for run lengths of over 200,000 without post-baking, with high sensitivity, wide processing latitude and a reputation for consistency. It requires 120 mJ/cm² to expose.

Of the digital thermal plates by far Kodak’s most popular product is the Electra Excel, known for its reliability, consistency, accuracy and versatility. Electra Excel requires no pre-heating or post-baking and has excellent resolution and reproductive range. It is
popular with printers because it is simple to process, has a wide operational latitude and spectral response, and is generally easy to use. These plates require 150 mJ/cm² of laser energy for exposure, and can be optionally post-baked for runs of one million or more, or for use with harsh press chemistries or UV inks. The Electra Excel range has recently been updated with a “high resolution” version (HR) for better performance with stochastic screening.

The Sword Excel plate is a third generation of 830 nm thermal plate with higher resolution and faster imaging speeds than its predecessor. It is tougher, so suitable for longer run lengths (over 500,000) and requires no pre-heat or post-bake. Sword Excel is a similar positive plate sold in North America that develops in a negative processing solution. It requires 120 mJ/cm² of laser energy for exposure.

In the United States Kodak sells its Scorpion Waterless plate, a negative working thermal plate suitable for up to 100,000 impressions. These plates provide high resolution with good durability and imaging consistency. They require 170 mJ/cm² laser energy for exposure.

Kodak is keeping two ex-Creo plate products: the PTP positive thermal plate, and the Clarus WL Processless polyester plate for direct imaging presses. PTP is a long-run positive plate which requires no pre or post baking and can image dots as small as 20 microns, so it is suitable for stochastic screens. The plate is compatible with a wide range of press chemistries and alcohol substitutes. Clarus WL is a roll media for direct-imaging presses such as the Heidelberg Quickmaster 46DI, Ryobi 3404DI and KBA Karat 46.

**Violet Offerings**

It is impossible to see what the future holds for Kodak’s violet imaging, given Creo’s blind obsession with thermal imaging. However the company has emphatically stated that “Kodak is committed to providing our customers with the ability to choose the technology that best suits their business either thermal or violet, that is why the commercialisation of Violet Print, our violet plate for the commercial market, was announced in October. Kodak’s violet photopolymer negative plates are manufactured at what used to be the KPG factory in Osterode, Germany and are available as the Violetnews plate for newspapers and the Violet Print plate for the commercial market. This plate is in production at 100 B2 commercial sites and is suitable for runs of around 200,000 unbaked. It can be baked for longer runs.
Processless Plates

Thermal Direct is a thermal plate imaged at 830 nm and requiring energy of 325 mJ/cm² to image. It is suitable for run lengths of around 100,000 and Kodak claim that it is special because it has a reduced coating thickness that helps it perform better on press. There are now over one hundred users of this plate worldwide, which was commercialised at Print ’05.

Mitsubishi

Mitsubishi Chemical has a number of photopolymer plates suitable for runs of 100,000. The LV-1 is exposed with violet light, the LA-5 with blue and the LY-5 with green light. Mitsubishi has three thermal plates, the LT-1 for runs of 200,000 and LT-N for 100,000 impressions are imaged at 830 nm. The LT-G is imaged at 1064 nm and is also suitable for runs of 200,000.

Mitsubishi Paper Mills has three plates including the thermal PCP imaged at 830 nm plus two visible light silver halide plates. The Silver Digiplate Alpha is a violet sensitive plate designed for imaging at 400 to 430 nm. The Alpha Red is imaged at 630 to 688 nm. These plates are rated for run lengths of up to 200,000. Mitsubishi also has a processless plate based on thermal principals under development.

Presstek

Apart from OEM plates, Presstek’s processless plates are all thermal ablation plates imaged at 800 to 1200 nm. Many of them, such as Anthem and Freedom, are specifically designed for Presstek’s own platesetters. PearlDry plates for direct imaging presses are used for waterless printing up to 20,000 impressions. Presstek Aurora thermal chemistry-free plate technology runs on third party platesetters and Presstek recently qualified Aurora for Kodak Trendsetters and Screen’s Platerite platesetters.

Applause was Presstek’s first truly processless plate and was designed for on press applications, but it also runs on Presstek’s Dimension series platesetters. It is rated for runs of 100,000. Presstek expects to qualify this plate for third party imaging systems as it has with Aurora. Applause is processless in that it does not need to be rinsed before use. Aurora, Anthem and Freedom need to rinsed with water and are therefore classed as chemistry-free.

Next steps

Investing into CTP starts with understanding the relationship between plates and platesetters. The two are intrinsically linked, and it is impossible to say whether it
is plate imaging technology that drives platesetter evolution or vice versa. For the commercial printer investing into CTP plate processing, performance, imaging, and of course cost all shape choice.