LONG RUN DIRECT IMAGED LASER PLATE

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Abstract: A unique system of laser platemaking using a thermally sensitive, non-silver imaging material is described. The laser transfers the coating from this material to an uncoated lithographic printing plate which is subsequently fused and processed to produce a high quality, long run plate. Recent research is described which indicates the ability to consistently achieve substantially long run using special processing chemistry and a second fusing process.

Introduction

In the realm of laser platemaking, the process and the product developed by Crosfield Data Systems Inc. (formerly LogEscan Systems Inc.) are truly unique. Crosfield Data Systems (CDSI) is a member of the De La Rue Group of Companies and is an affiliate of Crosfield Electronics Limited. The CDSI laser platemaking system is comprised of two principal units: the Reader scans input materials which consist of line and/or halftone paste-up pages and the Writer images Lasermask film with a lithographic printing plate or paper receptor sheet.

Paste-ups are "read" by a HeNe (Helium-Neon) laser operating at a wavelength of 633 nanometers (visible red) with an output power of 4 milliwatts. Lasermask is imaged by an Nd:YAG (Yttrium Aluminum Garnet) crystal laser operating at 1,060 nanometers (infrared) with an output power of 12 watts. This platemaking system alone uses a stable, compact, solid-state crystal laser for imaging.

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Moreover, this is the only platemaking system to offer a stable, non-silver, dry, non-light sensitive alternative to silver film--Lasermask film; along with a process which has been perfected to produce high quality, laser-imaged lithographic plates from an uncoated aluminum substrate. The process used to produce these unique direct imaged laser plates is the subject of this paper.

Lasermask Film

CDSI uses Lasermask film for its direct platemaking system. Lasermask film is a thermally sensitive imaging material. It consists of a transparent polystyrene substrate coated with:

1. Graphite particles which absorb laser energy; and

2. a binder.

The Lasermask film is imaged (from the uncoated side) with a scanning YAG laser which provides a 1 mil diameter spot at about a 1.06 micron wavelength. The laser imaging assembly is focused through the transparent film to the interface between the coating and the film. The energy provided by the laser beam is absorbed by the laser energy absorbing graphite particles which heat the binder to initiate ablation. This ablation, at this stage, carries with it the heat absorbing particles and the binder leaving a clear area on the Lasermask film.

Prior to the exposure, the emulsion or coated side of the Lasermask film is placed in intimate contact with a receptor sheet. This receptor sheet may be a paper or an uncoated lithographic printing plate.

The transferred coating leaves a clear area on the transparent substrate which corresponds to the image areas on the receptor sheet. The laser imaged transparent film thus constitutes an opposite transparency of the image produced on the receptor sheet. See Figure 1.

The receptor sheet is used for several reasons:

1. It provides an instant positive proof when the Lasermask is to be used as a negative transparency. The positive proof on the paper receptor is also well suited for microfilming.

2. It produces a direct imaged laser plate when a lithographic printing substrate is used in intimate contact with the Lasermask film as receptor and/or image carrier.

3. The receptor collects the ablated coating and thereby prevents contamination of the laser platemaking equipment.

4. By providing a surface for the blown-off coating to adhere to, it improves the clarity of the image area of the Lasermask film.

During scanning, vacuum is applied to hold the Lasermask film to the receptor sheet and to maintain intimate contact. The vacuum also provides better transfer of the coating to the receptor sheet.

When imaging a plate directly, an anodized uncoated lithographic printing plate is used as a receptor. The negative image remaining on the Lasermask film could then be stored or used to image additional wipe-on or presensitized printing plates.

The image produced on the Lasermask film does not require any processing to achieve image amplification and stabilization. The Lasermask film, whether imaged or not, is very stable and can be stored for years without any noticeable deterioration.

The optical density and sensitivity of the Lasermask film are functions of coating thickness. The coating of the Lasermask film should be thick enough to provide low light transmission during subsequent exposure to conventional photosensitive materials, but not so thick as to require excessive laser energy to transfer the coating.

The coating thickness of the Lasermask film also influences the run length of a directly imaged laser plate. A relatively thin coating on the Lasermask film will transfer only a small amount of material to the printing plate resulting in a short run length. On the other hand, a very thick coating on the Lasermask will require reduced writing speed or higher output power from the writing laser. Therefore, optimum coating thickness and proper density of the Lasermask film is very important.

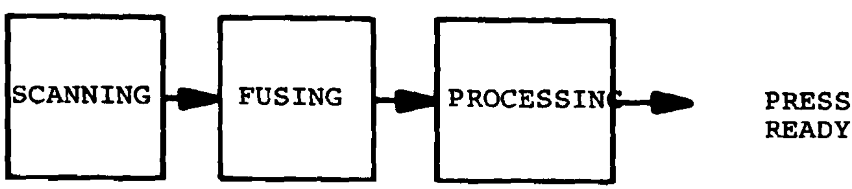
Unlike photosensitive material, thermal imaging material does not suffer from reciprocity law failure. Most photosensitive material, therefore, cannot be efficiently exposed by laser radiation due to this limiting factor.

Figure 2 shows a plot of the laser power as a function of scanning rate.

Figure 3 shows a plot of the Lasermask sensitivity as a function of laser power.

Direct Imaged Laser Plate

For direct platemaking, the coating of the Lasermask film, which is selectively transferred onto an anodized uncoated lithographic plate, is rendered durable by heating the binder. The fusing process is followed by chemical processing in the following sequence:



The imaged plate is fused in a convection oven at 475°F and at a speed of 2 feet per minute. At 475°F, the binder transferred from the Lasermask film melts and enters the grain and porous surface of the printing plate. It provides a strong mechanical bond between the image and the surface of the plates, and also collates the binder itself.

The special convection oven, designed by CDSI and used for heat treatment, maintains the temperature within $\pm 5^{\circ}$F tolerance of the processing specification.

The fused plate is then lacquered with selected conventional additive lacquer and desensitized and preserved with gum arabic or an equivalent plate finisher. The lacquer consists primarily of epoxy resin and solvent. During processing, the lacquer adheres to the fused image areas. This lacquer provides an overcoating on the image area, which makes the image substantially more durable and ink receptive. The plate is rinsed after lacquering to remove the excess lacquer from non-imaged areas and also to remove most of the solvent from the imaged areas. The solvent softens the epoxy resin in the lacquer which will become hard only when the solvent is removed from the imaged area. The durability of the image is greatly enhanced when the resin hardens.

The solvent in the lacquer must be compatible with the binder of the Lasermask film. Otherwise, the solvent will not only dissolve the image from the printing plate, but will also affect the bonding of the image to the grain of the plate. Therefore, a proper selection of lacquer is imperative. The plate is desensitized and preserved with gum arabic after rinsing and is then handled like any other conventional plate. The finished plate can be run side-by-side with conventional plates and under conventional press conditions.

The printing plate used for directly imaged fused plates requires a special grain. The grain of the plate should neither be too shallow nor too deep. A shallow or deep grain would not yield an image well bonded to the substrate, which in turn would affect the quality and run length of the plate.

The tonal accuracy is influenced by the grain of the plate and further accentuated by the printing process; proper press set-up, press quality, and operator skill. Fine highlight dots are significantly influenced by plate grain. Solid areas on the other hand, are not affected by plate grain. Therefore, the CDSI recommended substrate, a compromise between very shallow and deep grain, will guarantee a very satisfactory and reliable performance.

The most demanding application for any printing process is the reproduction of high quality halftone images. The maximum image or dot fidelity is key to the accurate tone reproduction.

The image quality of CDSI direct fused plates is far better than any other direct imaging laser plate. Frequent tests and production runs exhibit high image fidelity of a 133 lines per inch screen tint. Both highlight and shadow areas are maintained and reproduced quite satisfactorily. The image quality and resolution on the printed paper are restricted by the paper quality itself. Therefore, direct fused plates with 133 lines per inch or higher screen ruling will exhibit better image quality on coated paper than on standard newsprint.

Of many other factors, image quality and resolution depends significantly on the plate grain, the characteristics of the lacquer, the type of ink, press conditions, and operator skill.

The length of the run of direct fused laser plates has been improved significantly over the last 2 years. Figure 4 shows the reliability of the CDSI direct imaged laser plate life. Data was collected from customers' production. The mean is 120,000 impressions with a standard deviation of 11,000. Ninety-eight (98) percent of these plates will have a life of 120,000 $-2(\delta) = 98,000$ impressions and this has been confirmed in a large newspaper production environment. However, plate life is markedly influenced by the press conditions and operator skill.

Ongoing research and testing indicates a substantially longer life for this plate is possible.

Industry Trends

The future of direct laser-imaged plates depends on achieving industry requirements for:

1. Large format plate.
2. Long run length.
3. High image quality.

Engineering Developments

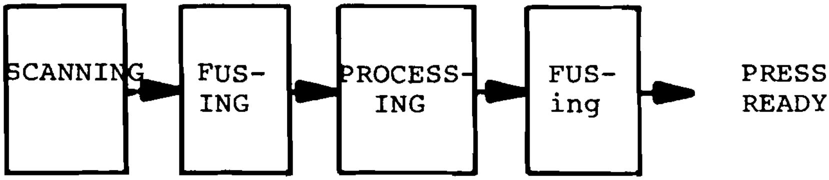
1. Large Format Plate

The latest CDSI platemaking equipment, "DATRAX" 760, (see Figure 5) will be introduced to the graphic arts market at ANPA/RI '83 in Las Vegas. This equipment will be able to image Lasermask film and lithographic printing plates up to 27" x 40". Several other image sizes of this new platemaking equipment are shown in Figure 6.

Other important capabilities of this equipment includes high image quality, multiple exposure, programmable formats, and a variable halftone control.

2. Long Run Plate

The run length of the single fused plate can be substantially increased with the application of special thermosetting lacquer followed by post-fusing. The process involves the following steps:



The added step in this process is post-fusing. The thermosetting lacquer used in this process applies an overlayer to the initial fused image which is then further hardened by post-fusing. This hardened image is highly resistant to solvents and abrasives.

A very long run plate which goes far beyond the standard newspaper requirement is achieved by this process.

3. <u>High Image Quality</u>

The resolution and the image quality of the direct imaged laser plate processed with special thermosetting lacquer were very satisfactory. In the production run, a 100 line per inch screen ruling demonstrated an accurate reproduction. Both highlight and shadow details were precisely maintained. Screen rulings up to 133 lines per inch were tested in the laboratory and the result promises a system capability suitable for many commercial applications.

Direct laser platemaking has progressed a long way from the development stage. The CDSI direct laser imaged platemaking system has already proven its capability at several large metropolitan newspapers and the technology used has been evolving along with the state-of-the-art.

Summary

The advantages of the CDSI direct platemaking system may be summed up by reviewing the assets of Lasermask film and the direct imaged laser plate.

A. Lasermask Film

1. Lasermask film can be stored for a long period of time.

2. Non-silver, daylight operation - Lasermask film is not light sensitive.

3. Lasermask film does not require any processing--non-polluting.

4. Lasermask is a by-product of direct imaged laser plates and as such, provides "security" in facsimile applications. It can be retained for back-up or archival storage. Does not need a computer data bank. At 1200 lines per inch scan rate, 1.5 giga bits of information can be stored on a 27" x 40" Lasermask.

5. When producing imaged Lasermask only, the paper receptor sheet can be used as a proof copy. The paper receptor sheet is also well suited for microfilming.

6. Multiple exposures by conventional means are possible using Lasermask film.

B. Direct Imaged Laser Plate

1. The direct imaged laser printing plate does not need any light sensitive coating.

2. The direct imaged laser plate uses basically the same chemistry as (other) wipe-on plates.

3. The direct imaged laser plate is characterized by reliability, fidelity, and long run.

4. Large format plates to 27" x 40" can be imaged.

References

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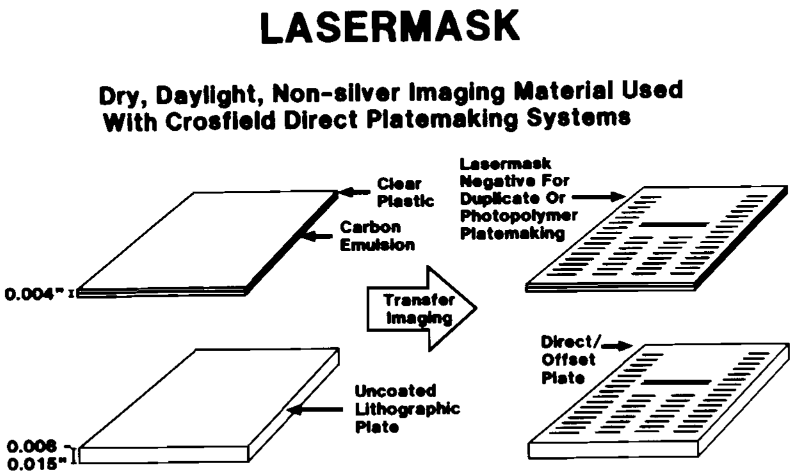

Figure 1

WRITING RATE VS. POWER FOR A DENSITY OF 1.

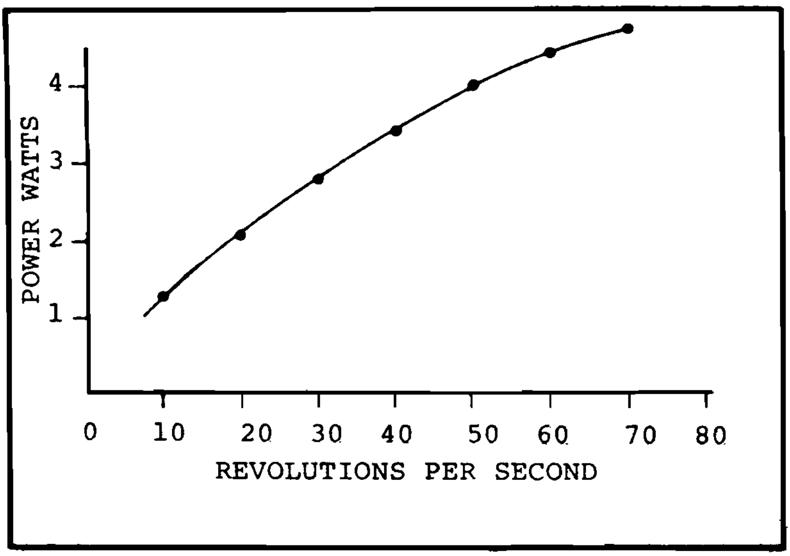

Figure 2

LASERMASK FILM SENSITIVITY
AS A FUNCTION OF AVAILABLE
POWER FOR A REFLECTION
DENSITY OF 1.

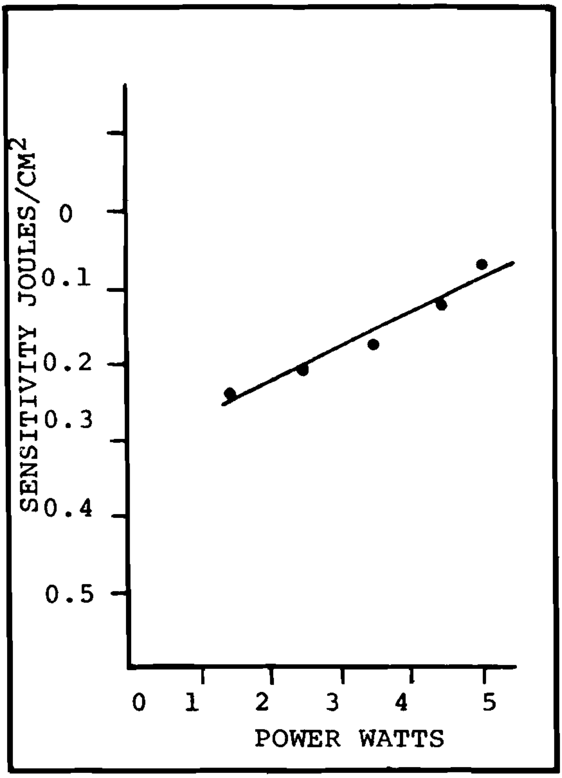

Figure 3

Figure 4 RELIABILITY vs. LENGTH OF RUN

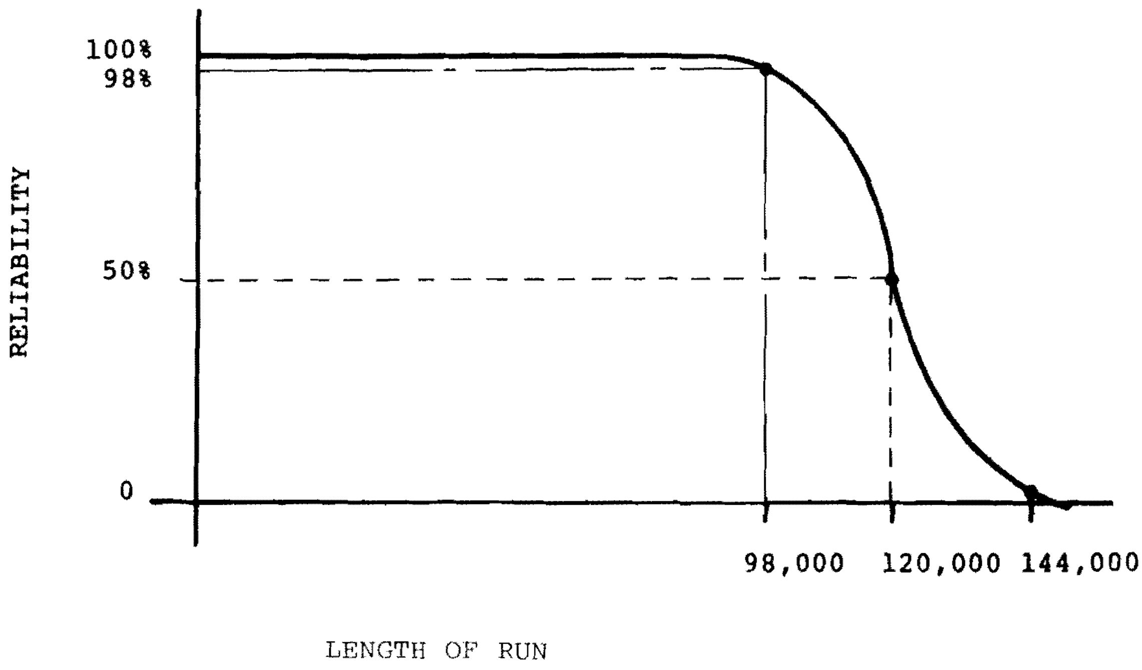

Figure 5 "DATRAX" 760

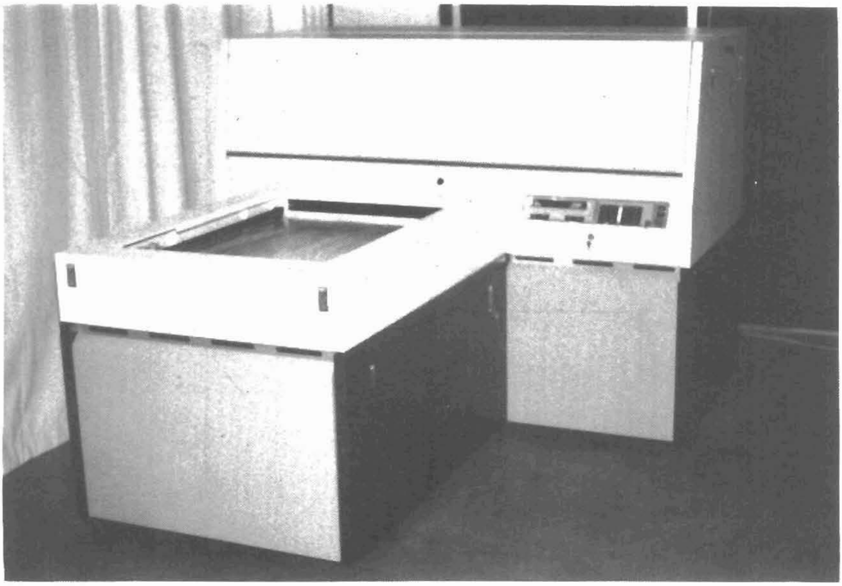

Figure 6 LAYOUT OPTIONS FOR DIFFERENT PLATE SIZES