US Ink A Division of Sun Chemical Corporation

Lithographic Plate Basics

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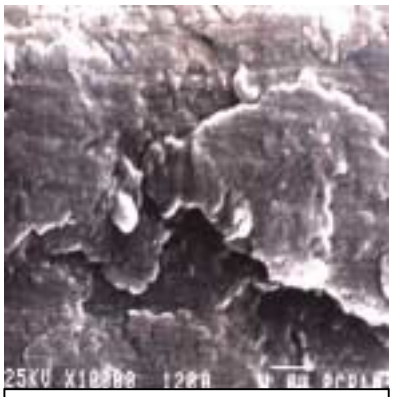
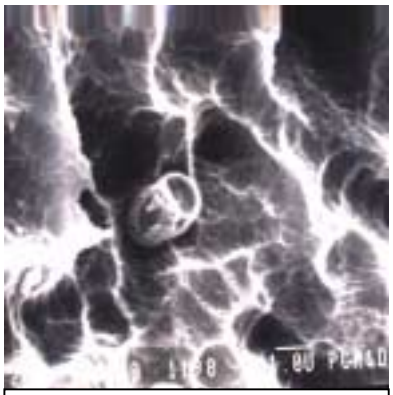
Offset printing uses the "Lithographic Method" which is based on the principle that ink and water does not mix. In reality, ink and water do mix and print a "balanced emulsion" of ink and water from the plate to the paper via the blanket cylinder.

A negative working offset lithographic plate is an aluminum plate with a coated surface of light sensitive material, which is hardened (or exposed) by light passing through the clear areas of a film negative. The areas that are hardened by the exposure become the image area. The polymer in non-image areas (dark areas of the negative film) is removed during the plate processing. When developed, the image area of the plate is oleophilic (ink receptive) and the non-image area of the plate is hydrophilic (water receptive).

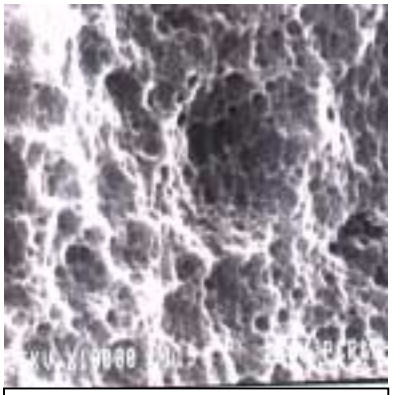
Plate manufacturing starts with base aluminum whose surface is grained to become water receptive. There are several methods for graining the surface of the aluminum. The following SEM photographs show the results of the different methods for graining the surface.



Wire Brush Grain



Pumice Grain



Electrochemical Grain

As one can see from the photomicrographs, different graining processes will cause differences in the plate's ability to hold fountain solution. High porosity grains such as the electrochemical will hold larger volumes of fountain solution when compared to the Wire Brush grain.

The grained plate is then anodized to harden the surface for better plate life. The thicker the anodic layer the longer the plate life. At this point there are two basic types of plate chemistry used in the industry.

Two Basic Types of Offset Plates:

- **Additive Wipe-on or Presensitized Plates** – Diazo sensitized lithographic aluminum printing plate developed by adding a lacquer emulsion.
- **Subtractive Presensitized Plates** – Lithographic aluminum printing plate coated with ink-receptive resins and a photosensitive medium. Exposed image does not need reinforcement during development.

Additive Plates

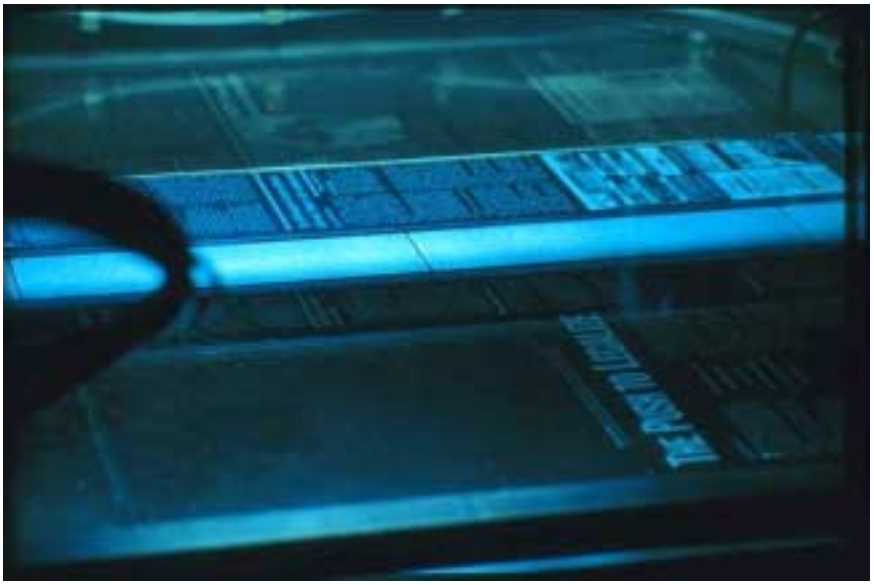
Additive lithographic plates are grained, anodized aluminum with a water-soluble diazo coating applied either by the manufacturer (presensitized) or by the pressman (wipe-on). Diazo is highly acidic (pH 1.5). So long as diazo stays dry, it is inactive. But diazo is also hygroscopic, i.e. it attracts moisture. Diazo literally pulls water out of the atmosphere which, in turn, activates the acid. The acid then begins to eat, or etch, into the surface of the plate. This is why most presensitized plates have a maximum shelf life of six months depending on many variables from manufacturing tolerances to weather conditions.

Subtractive Plates

The basic plate substrate for a subtractive is the same as the additive. In subtractive plates, the diazo coating is suspended in a photopolymer resin applied to the plate. The diazo, suspended in the photopolymer, is isolated and protected from the atmosphere so it cannot attract moisture nor can it etch the plate.

Exposure

When a lithographic plate is exposed, the portion of the diazo, which is struck by the light, is chemically altered (polymerized) and fixes the image to the plate. The exposed image area becomes oleophilic (oil loving). The unexposed diazo in the non-image area retains its original properties including sensitivity to light.



Exposure speed will vary from plates of different manufacturers. This is due to the effective range of the plate's emulsion sensitivity for each product with the particular light source that is being used. Light sources vary in their intensity and their concentration within the UV portion of the light energy spectrum. It is important to understand that the exposure speed (time/units) used to achieve the solid step recommended by each manufacturer is dependent upon these factors.

A properly exposed plate will provide consistent reproduction from your film negative. There are two (2) quality control tools available to check exposure…the Stouffer scale and UGRA scale. A typical recommendation for plate exposure is a **solid 5** on a Stouffer sensitivity guide (Note. Check with your manufacturer for their specific recommendations).

UGRA scales may also be used to check exposure in addition to evaluating resolution. It is suggested you take daily readings to assure quality standards are being met. One must remember that these tools are pieces of film and therefore have a shelf life of one (1) year from the date of manufacture. The more you expose UV light through these tools, the faster the emulsion will age. One should replace Stouffer and UGRA scales after six (6) months of use to assure accurate readings.

The recommended checklist for assuring consistent, high quality exposures in a frame are:

- ✓ Glass must be cleaned often with residue-free cleaner and lint-less cloth. Clean glass reduces light absorption and refraction.
- ✓ Insure that the vacuum pump is clean and the vacuum sub-system is free of leaks.
- ✓ Backing mats should be gray or black and stiff to resist deformity. The surface should be uniform, free of hills and valleys.
- ✓ Verify integrity of seal / bead around the mat.
- ✓ Lamp distance should be great enough to cover the printing frame with even illumination, but short enough for practical exposure. Experts suggest as a rule of thumb, a twenty-one step (Stouffer, RIT, GATF or UGRA) scale should not be more than one step different from the center of the image to the edge of the largest possible image you would use in that frame. Be aware of light fall off (lower exposure) towards the edges. Determine the evenness of exposure
- ✓ Lamp bulbs must be replaced from time to time, because their spectral output changes as they age. Over the life span of a bulb, its efficiency decreases by about 20%. Follow manufacturers replacement schedule.
- ✓ An original exposure control guide (such as a Stouffer, RIT, GATF or UGRA scale) should be contacted or duplicated in the same manner as the production materials are to be processed. A test target must be used on a daily basis. New lamps can vary by as much as 40% from one manufacturer to another and from bulb to bulb of the same manufacturer.
- ✓ Insure consistent light intensity. Light intensity is influenced by lamp to substrate distance, age and condition of bulb, type and condition of reflector, and accuracy of resetting lamp brightness control. Changes in the voltage supplied to a contact exposure lamp can cause significant changes in the actual exposure obtained. Integrators should be set to “Integrate” as opposed to “Time”.

✓ Draw-down time should be sufficient to insure intimate contact. A test should be done to verify draw-down time.

Development

Once the plate has been exposed, it is then developed. The exposed plate is passed through a developer bath. The developer bath contains chemicals from the plate manufacturer to remove the unexposed areas of the plate coating.

The developer bath needs to be maintained with fresh chemicals. Each manufacturer recommends the usage life of these chemicals. Be sure to follow these recommendations.

Additive Development

The developer must scrub and rub the surface of the plate. The developing solution adds resin to the image area and removes the unexposed diazo in the non-image area. A sponge or brush applies pressure to develop the surface.

Subtractive Development

The developer will flood the surface to dissolve the non-image area. The developer can be recirculated, filtered and reused.

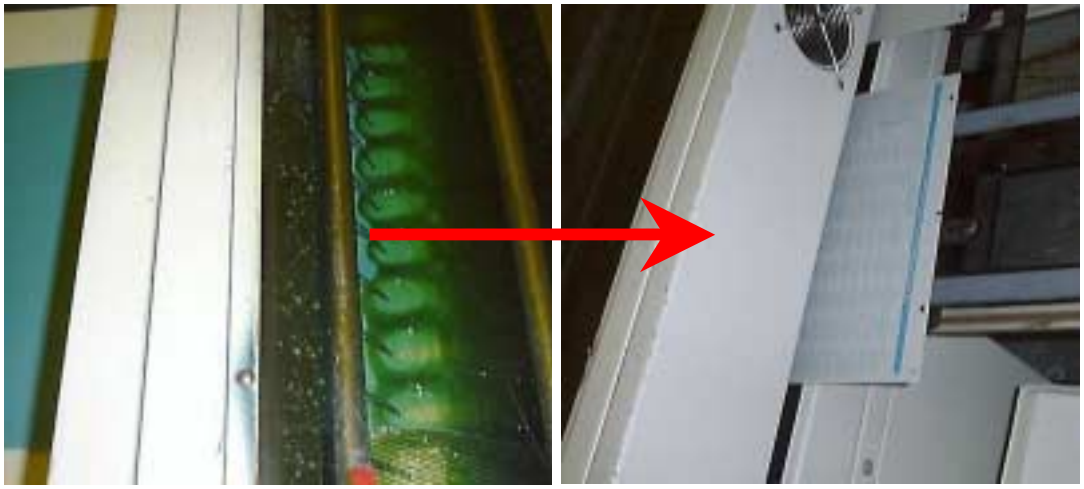
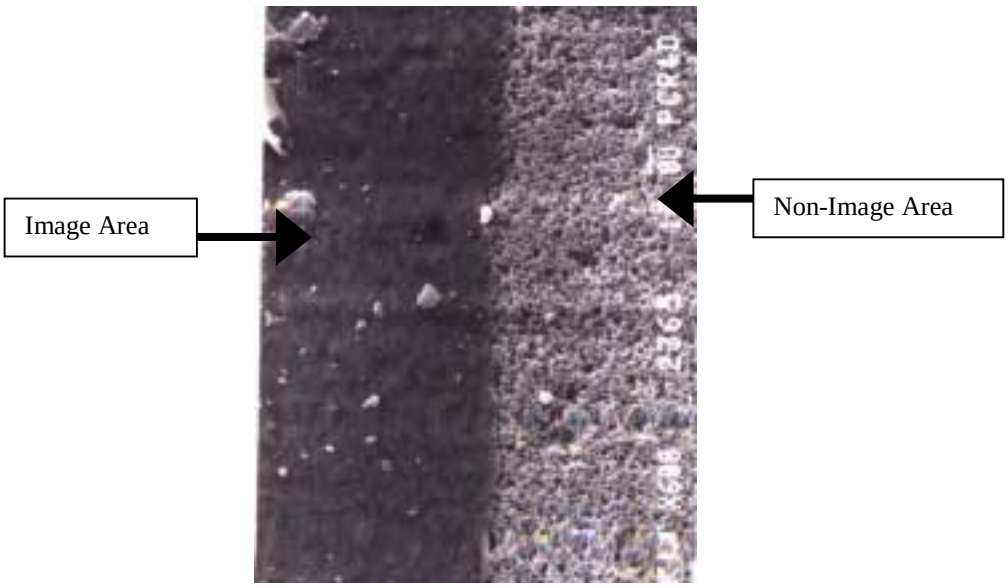


Plate into developer

Plate exiting developer



Photomicrograph of Lithographic Plate

Finishing

Finisher is used to protect the integrity of the non-image area of the plate from the ambient conditions in the production environment. It ensures that the water loving property of the plate is protected. The plate is coated with a solution of Gum Arabic or synthetic gum to accomplish this. Gum Arabic is a gum obtained from either two species of Acacia trees. Gum Arabic solution is used to desensitize or remove any affinity for ink in the non-printing areas of a lithographic plate. The plate is then bent so that it can be properly mounted on press.