PLASTIC SHEETS IN LITHO PRODUCTION

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Plastic sheets, a development in modern plastics, distributed under such trade names as "Vinylite", "Dyrite", "Loftrite", "Copyrite", etc., each with that most desirable characteristic, an expansion that is negligible, have proven of great value in the processes of lithography in the reproduction plant of the Coast and Geodetic Survey, especially during the war period when all possible means were sought to short-cut production limitations.

The normal work of the Coast Survey is the production of nautical and aeronautical charts and topographic maps, millions of which were produced from the modern offset presses in the plant of the "Survey" to aid in the prosecution of the war. Color process reproduction is frequently on the program.

Plastic sheets have been used to a great extent in this plant in developing methods and means for expediting the processes connected with chart and map production, but it is believed that a description of these methods, which have proven so beneficial and economical, may prompt thoughts of usage in the general field of lithography.

Plastic sheets are available in many forms and thicknesses, transparent, translucent (partially transparent) and opaque (white), the transparent type can be secured in clear, or grained, one or both sides, the translucent and opaque are usually grained one side. Thicknesses are .005, .0075, .010, and thicker if desired, and in size as large as 51 × 150 inches. Thinner sheets are in production.

In the reproduction of aeronautical charts in this office, colors are used to emphasize water and land areas, blue for water and green and brown to emphasize the earth's elevations. Two tones of green represent the lower elevations and as many as six tones of brown the higher. The tones of green and brown are secured by the use of solids and rulings and the water area is produced by halftone screen on the drainage (dark blue) plate. (See portion of aeronautical chart).

Each tone and screen area requires a negative, from which the tone or screen is produced by interposing a film of ruling or halftone tint between negative and plate during the process of plate making in the vacuum printing frame, a method long practised in this plant.

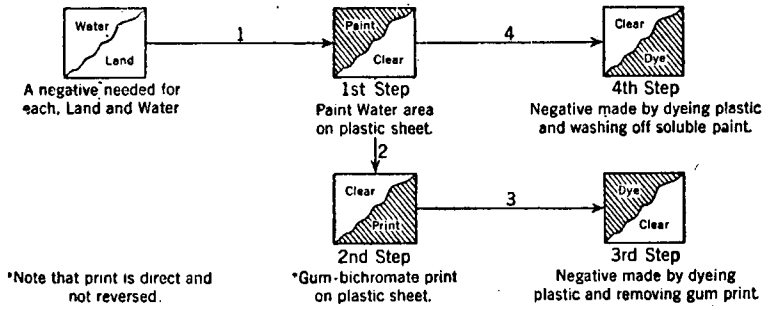
Here definitely the plastic sheet serves to expedite the work and provide an economy in time and labor.

By using plastic sheets for such work, certain selected areas representing tones of color are made manually, painting the area with a water soluble opaque. A blueline print on the plastic furnishes a guide for the painting. The remaining tones are secured chemically by using the painted sheets to secure process prints on gum-bichromate coated plastic sheets. These process printed plastic sheets are developed by the deep etch method and stained with a non-actinic dye, after which the gum-bichromate prints are removed to produce the artificial plastic negatives for such tones.

Following the production of the chemically made artificial negatives, the drawings, which were made with water soluble opaque, are likewise stained with the non-actinic dye. The soluble paint, which is not penetrated by the dye, is then dissolved, converting the drawings also into artificial negatives.

Thus by this method a great amount of drawing and the normal photographic camera work are avoided.

A sample diagram will illustrate the evolution of the artificial negative, and the saving effected in drawing. (Below).



Normally drawings would be made for both Land and Water areas, but here the Water area only is drawn from which artificial negatives are created for both.

A further use of the plastic sheet in this plant has been the production of duplicate negatives, which can be accomplished without the usual intermediate step of first making a positive.

The charts of the Coast and Geodetic Survey are usually large and require two or more large glass negatives for reproduction purposes, but in producing duplicate negatives on plastic sheets these are combined into one negative for the entire chart. The method of producing duplicate negatives permits multiple exposures, in the same manner as in process plate making from negatives, either to compose the chart from several negatives or to expose several negatives on the same area.

Duplicate negatives serve well for purposes of alterations where it is not desirable to change the originals, and are ideal for shipping to avoid breakage in handling.

In making duplicate negatives on plastic sheets the method followed is similar to that of the lithographic deep-etch process in regard to reversal of image, and as explained in the diagram.

For negative making the plastic sheet is cleaned with a weak solution of hydrochloric acid and coated with a gum-bichromate emulsion in the whirler. In a vacum printing frame, golden-rod paper is placed on the rubber blanket, the coated side of the plastic to the paper, and the negative, emulsion side to the plastic ; it is exposed by using one double arc lamp at not less than 48".

The exposed plastic is taped at all edges to the glass of a light table to prevent any damage to the back of the plastic in the dyeing operation. Development is accomplished with the same materials used in the deep-etch process, after which a non-actinic dye is applied with cheesecloth over the entire sheet for about one to one and a half minutes, surplus dye is removed and sheet is dried. The gum-bichromate image which resists the dye is removed with warm water to which a weak solution of hydrochloric acid may be added. When completed it is washed thoroughly with water and dried with squeegee and cloth.

Duplicate negatives made in this manner are clear and sharp and need no painting or retouching, with the dye forming a durable negative not easily marred or scratched. The dye used, while non-actinic, can be so applied as to be quite transparent.

Duplicate positives may be made in the same manner as described for duplicate negatives, providing the positive is sufficiently transparent. Only one exposure can be made in making a duplicate positive.

There has always been a desire to produce a print, from a glass negative, on a material that would give definition the equal of the negative, and that would retain size. This we have accomplished on both the opaque white and the translucent plastic sheets. For this the plastic sheet is cleaned and coated on the grained side with a modified black-line print emulsion. After exposure in the vacuum frame the print is developed with deep-etch materials and produces on the plastic sheet a dense black print to which additional drawing or lettering may be added, and thus create an excellent copy for the production of negatives in the camera. Broken negatives are readily replaced in this manner.

A very modern use of the plastic sheet is the production of color proofs of charts or maps directly from the negatives or positives in the vacuum frame. For verification or proof reading of work and registration, one or more proofs are required, on which the verifier or proof reader indicates such changes as may be necessary to be made before printing.

Proving such charts on plastic is economical, as it eliminates the necessity of making process metal plates for hand or press proving in lithographic colors, and, because of the proof changes, which usually required the remaking of the metal plates, a considerable economy in time and material is effected. Proving in color on plastics can be accomplished in practically the same amount of time as that required to process the metal plates.

To produce color proofs on plastic sheets from negatives, the plastic is coated, exposed, and developed, for each color required ; the color is secured by adding dye to bichromated emulsion at each coating. The production of proofs in six colors is routine in this plant at this time. Colors are quite true to tone and registration is perfect, furnishing the verifier or proof reader with a facsimile copy of the chart with true relation of features such as drainage in one color, to other features such as contours, culture, etc., in other colors. When positives, which are needed for deep-etch, are used for plastic color proving, the plastic is coated, exposed, and developed, for each color, but when using positives the development is by the deep-etch method. After the development of each print the plastic is coated with a dye of the color required and the bichromated emulsion print removed ; this is repeated for each color.

We have tried such plastic color proving for four and five color process art work from deep-etch positives, and have had pretty fair results, and believe that with a standardization of dyes to simulate process inks, true process proofs may be made economically in this way.

We have used clear plastic sheets to control, or key, deep-etch halftone positives in place, to conform to design of original, where numerous drawings required assembly into one subject for reproduction. On one clear plastic sheet the halftone positives for the black were assembled in proper position, then over this a second piece of clear plastic was placed and the second color positives were assembled, the visibility and stability of the plastic assuring perfect registration. This was repeated for the third and fourth colors and resulted in very successful production of the deep-etch plates for registration.

Some progress has been made commercially in coating transparent plastic sheets with silver emulsion for photographic use, and while we experienced some difficulties in the use of the earlier coated sheets, the present coatings are enabling us to proceed with reproduction methods for certain types of work, chiefly the production of positives or negatives by contact printing.

We have through the use of a suitable substratum developed a method for coating plastic sheets with the normal wet plate collodion emulsion, though we have not as yet used this to much extent.

The grained plastic sheet, transparent or opaque, constant in size, provides an excellent meduim for drawing. The transparent sheet permits the making of the finished drawing by copying or tracing the original. Separation drawings for colors may readily be made by tracing the finished drawing with the assurance that each drawing will maintain size for correct registration, or if the color separation is complex, blueline prints may be made from the negative of the finished drawing, on plastic sheets, to furnish the artist or draftsman a key for producing the colors. In preparing such keys we use plastic drawing ink from which negatives may be made in the camera, or by painting with water soluble paint and dyeing the plastic to secure a negative without the aid of the camera, as previously explained. Note however that in producing drawings for dyeing, the blueline is made on the back of the plastic and the drawing painted on the face or grained side to produce the reversed image needed in a negative for offset reproduction.

In the production of aeronautical and related charts in this office, plastic sheets serve an important role. In the initial steps the compilation or original drawing is made on a transparent plastic sheet and is accomplished by tracing information assembled from various sources and changed to the scale of the proposed chart. A crude but accurately compiled chart is thus produced as an original. On this original, colors are used to distinguish the various characteristics of a chart, colors that will photograph in the camera, black for culture (names, roads, railroads, latitude and longitude lines, etc.),

dark blue for drainage (shoreline, rivers, etc.), and brown for contours (lines of elevations).

For reproduction of the chart by photo-lithography a "finished" drawing for each color must be made, termed finished in that each drawing must conform to established conventional form, changing the crude character of the compilation to proper style.

To produce these drawings with an assurance that registration will be correct the plastic compilation is photographed and the resulting negative (glass) used to produce blueline prints on plastic sheets or paper mounted on metal, as may be required one for each color for delineation by the draftsman.

These finished drawings are termed base colors to distinguish them from the tints used for land and water areas previously mentioned.

Prints from type are used for all names and figures to avoid hand lettering. Such type prints, suitable for reproduction, are produced in thin cellophane with the impression made on both sides of the material when printed in the press. Some prints are used as printed on the clear cellophane, other cellophane prints are coated with a white ink to provide an opaque back. All prints are coated on the back with an adhesive wax for mounting on the drawing.

In addition to the base colors of black, contours (brown) and drainage (dark blue), there is an aeronautical information plate (red) that really converts a topographic map into an aeronautical chart. The drawing for this color is prepared on either white plastic or on mounted paper on which a combination blueline print of the black, contour and drainage is made to provide a key or copy for drawing and on which the names and symbols, both from cellophane prints, can be placed in relation to previously prepared drawings. Certain information such as radio ranges, etc., is produced on the red plate by the use of 133 line halftone screen film, which is interposed between the negative of the ranges and the plate as the red plate is made.

This red aeronautical information is subject to frequent changes and requires revision at each printing. To accompilsh this cycle the existing negative is painted for deletions and a blackline print made on translucent plastic on which new information is added by drawing and type lettering, and a new glass negative made for reproduction. This method provides a sharp, dense black copy from retouched negatives for each revision and avoids any necessity for correcting deteriorating originals. Each fresh print when revised becomes an original.

The use of screens, patterns and rulings for map work to emphasize certain features has been practised for many years. Such screens normally have been added to the printing plates by hand transferring from standard or stock plates. It has only been in recent years that such screens and rulings have been added to printing plates in the process of platemaking in the vacuum frame by interposing photographic film of the desired screen or ruling between the plastic negative and the coated plate.

This modern method of interposing screens and rulings produces plates decidedly more economically than is possible by any other means. The plastic negative, a simple open negative, is easily prepared and as easily corrected. With no ruling or screen on the negative, they are interposed between negative and plate, and the resulting plate is strong, sharp, uniform, with no junctions to improve and an ideal plate for the offset press.

By perseverance at the task we have been able to produce in our plant master films of halftone dots of various tonal values, using a 133 line halftone screen, and in size 30 × 40 inches.

Tint films for use in producing the tones on the plates are made by contact from the master films by using the vacuum back of the camera as a printing frame, and the light source an electric bulb at some distance.

Rulings are produced on glass negatives in the camera by using the 133 line halftone screen and accomplished by moving the negative in the camera back during exposure so that the dots form lines.

These become master negatives and are placed in the transparency holder of the camera in producing film rulings of varying tones, at same scale, or by enlarging to provide desired number of lines per inch. These are also 30 × 40 inches in size.

The foregoing describes to a great extent the use of plastic sheets in our plant. Whenever we need a medium that will maintain size in accomplishing some phase of reproduction we use the plastic sheet.