Apply Photopolymer

Overview:
Photopolymer is affixed to the surface of a metal with water and allowed to dry thoroughly. By selectively exposing it to UV light and developing in sodium carbonate, a resist is formed. The metal may then be etched or printed from directly.

Links:
http://www.capefearpress.com/puretch.html
https://shop.takachpress.com/puretch-photopolymer-etching-resist/
https://www.polymetaal.nl/siteUK/Linkdocs/Puretch/modepuretch.htm

https://www.youtube.com/watch?v=xkGt9nFER1s

Procedure:
I work with 22g 3" x 3.5" sterling silver- surface must be clean and absent of texture

METAL:

Polish existing surface of metal with polishing pad and or polishing compound. I recommend Rio polishing pads. Using compound introduces waxes that may be troublesome to clean away.

Do not bevel edges as you might in printmaking. Maintain right angle of the edge and avoid rounding it for purposes of trimming the polymer film.

Degrease with any method until water sheets off the surface. I like dish soap and formula 88 from Lowes. Often one then the other; repeating if necessary. From this point on avoid touching the surface to be etched. Any oil from your finger tips could act as a resist itself or hinder adhesion of the polymer.

Dry the degreased plate with a clean absorbent cloth or paper towel and a hair dryer to avoid water stains or oxides. The cleaning procedures should be followed immediately by polymer application to reduce oxidation and the gathering of dust.

POLYMER:

The photo polymer is "Puretch" made by Cape Fear Press. It is a UV sensitive film on a roll. All work involving the polymer should be done in a dark room lit with a yellow "bug" light. The film is sandwiched on two sides by protective plastic. As it comes off the roll there will be an interior and exterior side. The side who's edges curl up is the interior. The plastic on this side is softer and less crinkly than the exterior.

Trim -(On a cutting mat) Measure plate and cut off a section of film that exceeds the dimensions of the plate by a 1/2 inch on all sides. I use a small snap-blade boxcutter. The film can be pinned down in the corners with push pins to hold it flat but for small plates it is easier to hold the film directly

APPLYING:

Remove interior protective film by scratching the corner with the tip of a small box cutter blade. Don't worry if you mar the corner of the film because this corner will be part of the excess 1/2" margin. Peel away the interior plastic making sure not to let the unprotected polymer make contact with itself. Place adjacent to the metal.

Mist, with a spray bottle, the polymer and the plate. Enough water to cover both surfaces but not so much that is excessively dripping. In a draping motion, lay the polymer onto the plate from top to bottom paying attention to air bubbles. Ideally the surface tension of the water pushes out the bubbles as the polymer is rolled gently downward onto the plate.

Adjustments to the position of the polymer can be made if there is enough water between the film and the plate but ideally it should be in its proper place to avoid potential wrinkles or premature adhesion.

Spray the protected top side of the polymer to reduce friction in the next step

Squeegee the water out from between the polymer and the plate using a credit card, id card, or rubber rib. Beginning lightly at first, push the water out from the center- out beyond the edge. Continue around all sides pushing the water out from the center, increasing pressure with each pass. Pay attention to the corners and try to avoid wrinkles.

The polymer is now mostly adhered.

Trim the excess margin of polymer with a blade. Begin cuts from the center of the edge of the metal. Cut in each direction to avoid pulling the polymer back up which may in turn pull in air/water/contaminants. Discard cut off polymer margin.

Dry plate and work surface with clean soft cloth. Use a hair drier to heat the plate and look for moisture that still needs to escape. With the plate warm and dry, you can try to push any additional moisture to the edges. At this point the film may be too affixed for moisture to get out by mechanical means. If that is the case let the plate dry overnight in the dark and any water trapped will eventually evaporate on its own.

For best, most consistent results leave plate to continue to dry for 12 to 48 hours (the bigger the plate- the longer you should let it dry).

EXPOSURE AND DEVELOPMENT:

The polymer is sensitive to UV light. So once it is fully dried it can be "exposed". This is the same "exposure" that happens when shooting film except that the polymer is only reactive to a particular wavelength of the light spectrum. This portion of the light spectrum must be considered when choosing the source of the light in the exposure process. Some bulbs produce more UV than others. Some bulbs are stronger than others. The professional way to expose polymer is with a very fancy, expensive unit designed to customize the time and intensity of the light. I dont have one of these so my alternatives have been a 1000 watt halogen shop light, a 1000 watt metal halide bulb- in a "grow light unit" and most often sun light.

As far as I can tell, the sun is the best light source because it contains the entire spectrum of wavelengths. Of course the downsides are nighttime, and ever changing weather. I recommend metal halide bulbs because of their high output of UV but they are more expensive and trickier to find. The halogen shop light is the most convenient but it takes the longest, produces unsafe amounts of heat, and has a limited spectral range. Here on out we will assume the use of sunlight. But there are many more options and I encourage anyone to experiment more with other bulbs and lamps. (Research on this might start with screen printers exposing emulsion)

Assembling the exposure scenario requires: A transparency of the image to be exposed, a board larger than the dimensions of the transparency, a sheet of glass equal to the size of the board, a towel or other means of padding, and several squeeze clamps.

(See other hand out for detail about the transparency)

Place some kind of padding over the board. (I use a terrycloth dish towel, but this could be anything that provides some even compression between the glass and the board.) Then position the metal so it is centered on the padded board. And position the transparency (ink side down) registered where you'd like it to be over the metal. Then the glass on top. Use squeeze clamps on four sides to compress this sandwich together. More clamps will be needed for larger images. The idea is to flatten the transparency against the polymer on the metal to keep light from exposing unintended areas.

(Remember this is all being done under a yellow bug light)

Cover the glass with something opaque while you transfer the sandwich outside. Have a timer ready to clock the exposure time.

Exposing the plate can be executed with varying degrees of precision. Testing for exposure times can be done with a Stouffer guide and instructions for that process can be found here **https://www.polymetaal.nl/contents/en-uk/d1077.html**

> My method relies more on tacit knowledge that I'll do my best to explain. Depending on the intensity of the sunlight, the quality of your transparency, the detail of your image, and the dryness of your polymer, exposure times will vary. I find the staring range on a sunny day is no more than a couple minutes and no less than 30 seconds. Trial and error is the best teacher.
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> You should see the color of the polymer darken as it reacts to the light. For reference I'll say it starts as a Pantone Ice Green (13-5414 TCX). During exposure I try to catch it between a Pantone Azure Blue (17-4139 TCX) and a Pantone Royal Blue (19-3955 TCX). Along with changing color, the polymer has also hardened. Any of the polymer that has not changed color remains soft, and will be washed away in the development stage.

Once in direct sunlight, remove the opaque cover from the sandwich at the same time you start your timer. When the desired amount of time has passed, re-cover the sandwich and stop the timer. Keep lots of notes so when it all goes to hell you can figure out why. Return inside and disassemble the sandwich in a dark room under a bug light.

Development of the exposed polymer is done with sodium carbonate, also called soda ash. This can be found as a cleaning product in most grocery stores. I use "Multi-Purpose Oxygen Cleaner" a Kroger brand product. It can also be sourced from chemistry supply companies, or craft supply places found along with dying products- as it is used to help dyes fix to fabrics. Sodium carbonate is different that sodium **bi**carbonate (baking soda). Baking soda may or may not work- I've never tried it. User instructions suggest an aqueous solution of 1% sodium carbonate. Again, I prefer trial and error and making notes, but mixing this solution can also be done by the books.

Mix a small amount of sodium carbonate in room temp water until it fully dissolves.

Remove the last protective layer from the polymer by either sticking scotch tape to a corner and pulling it away or just peeling it back quickly from one corner.

Submerge the plate in the sodium carbonate solution and begin timer. Brush lightly with a soft, small celled foam or sponge. I use a bit of yellow upholstery foam. You will see the unexposed polymer dissolve, revealing bare metal. This shouldn't take more that 1 minute or you risk overdevelopment. If you leave the plate in the solution too long you will develop away portions of the hardened polymer.

Rinse under cool water to wash away development solution.

Dry with hairdryer. I like to dab away excess water with newsprint or other paper to assist the drying without leaving behind fibers that may stick to the polymer.

Further harden the plate in direct sunlight or other UV light source for 1 hour or until the purple-y color begins to fade to a lighter tone. This step is extra important for electrolytic etching but could be skipped if the plate is being used for some other purpose or being etching in acids. I etch very detailed images so this step is crucial to my work but if the image is less detailed you could probably get away with skipping it.

PROBLEM SOLVING:
This link has most issues and solutions covered.
https://www.polymetaal.nl/contents/de/d1080_puretch-trouble-shooting.html

-Other issues may be caused by the quality of the transparency which is covered in another handout.
-Best practice is to go slow, take notes and examine closely. I use a 10x loop to inspect the polymer after development and after etching. (For information about electrolytic etching see the handout made by Ben Dory here

https://www.bendory.design/electrolytic-etching

The hardened polymer can be stripped off using denatured alcohol in the case that something doesn't look right. After removing the polymer the plate should be re-cleaned with soap and degreaser.