

Photoetching

by

Randy Gordon-Gilmore

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Photoetching

- Producing flat parts from a sheet of metal by selectively dissolving unwanted material through a photographically-patterned mask (photoresist)
- I have etched .003-.032" brass, .006" and .010" nickel silver, and .010" steel shim
- Most practical are .005" and .010" brass
- Hardness or temper of metal doesn't matter

Dry-film Photoresist

- A partially-cured plastic film
- Laminated onto the workpiece with heat and pressure
- Fully cures when exposed to ultraviolet light
- Resistant to acid, susceptible to bases

The Photoetching Process

- Create the Artwork
- Clean the Workpiece
- Apply the Photoresist
- Expose the Resist
- Develop the Resist
- Etch the Workpiece
- Strip the Remaining Resist
- Keep a Logbook

Create the Artwork - 1

- Traditionally artwork was drawn by hand to a large scale and photographed to size
- Now artwork is drawn 1:1 on a PC
- "Good" artwork is photoplotted directly onto film—generally 2540 dpi
- "Trial" artwork can be laser printed on special paper—600 or 1200 dpi printers are best

Create the Artwork - 2

- Opaque areas on the artwork etch away
- Clear areas on the artwork remain
- Etching from one side will produce a recess (groove, bend line, recessed window frame, etc.)
- Etching from both sides at the same place will produce a through hole (part outline, window opening, etc.)
- Raised detail (rivets, fluting, etc.) is only possible by recessing the surface around it

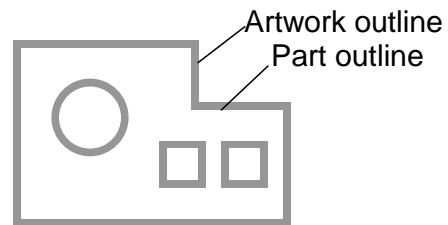
Create the Artwork - 3

- Minimum practical detail size is twice the metal thickness
- Uniform margins around parts and large openings
- "Tabs" to hold parts into fret – (can be half-thickness)



Create the Artwork - 4

- Etching process will undercut all edges of artwork
- Add 20% material thickness *to each edge* for double-etched brass



Clean the Workpiece

- The workpiece must be chemically clean
- Wear rubber gloves to avoid fingerprints
- Use distilled or deionized water to avoid mineral contamination
- Gray Scotchbrite™ pads work well
- The workpiece is clean when rinse water sheets off

Apply the Photoresist

- Use subdued lighting - no fluorescents, yellow "bug light" is best
- Office laminator does one side at a time
- Tack down leading edge of resist
- Keep some tension on resist
- Use large backing sheet so resist edges don't stick to rollers
- Let the workpiece cool down before laminating the second side

Expose the Resist

- Sunlight is ideal, UV-fluorescent bulbs are good
- Emulsion/printed side of artwork must be in intimate contact with resist
- Expose resist to a glossy, dark blue
- Overexposure makes the resist brittle
- Keep a log of exposure times and results

Develop the Resist

- Developer is sodium carbonate (washing soda)
- Uncured resist must be removed down to bare metal
- Don't overdevelop - cured resist can begin to lift
- Resist can be touched up with lacquer or Sharpie™ marker

Etch the Workpiece

- Ferric chloride will dissolve all metals except titanium (and tantalum)
- Use protective eyewear and clothing
- Etcher styles:
 - Vertical tank with bubble agitation
 - Spray etcher
- Etch until edges are clean
- Keep a log of material, thickness, etching time and results

Strip the Remaining Resist

- Stripper is sodium hydroxide
- Resist will swell, discolor, and lift off metal

Disposal

- Neutralize spent etchant to neutral pH with baking soda or lime
- Small quantities of etchant can be poured down drain (depending on locality)
- Large quantities of spent etchant??
- Stripped resist is inert plastic and can be discarded