

Green Texture Plates for Metal Clay

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Learn everything you've ever wanted to know about creating textures for metal clay including new technology that uses easy, non-hazardous solutions for electro-etching. Etched copper sheet can be used to make personalized texture plates for metal clay. You can also etch on all types of metal clay (silver, bronze, and copper) with electrical etching. This presentation will also feature many types of resist used for etching including new types that make etching foolproof. All methods displayed will assure safety and they will keep your studio green.

There are a variety of ways to apply texture and patterns to metal clay. Many clay artists are familiar with rubberstamps, manufactured texture plates and tools, found materials and objects from nature. In a quest to find even more options for creating original textures for metal clay, there are exciting techniques available for making custom stamps, rubber molds and etched plates that one can use to expand their collection.

Recently methods for creating photo polymer plates and chemically or electrically etched plates (copper or brass) have become very popular. These processes are a means by which original art is transferred to the respective material to make a relief patterns that can be used as a custom texture or stamp. By creating your own designs for textures you have the freedom to incorporate personal imagery. You do not have to rely on existing generic designs or worry about copyright infringement associated with certain rubberstamp designs.

There are kits you can purchase for making photopolymer plates. These plates are created by passing UV light through a printed image on transparency film. The technique for making this type of plate is very similar to the UV Film Resist Method described in this handout under "Resists for Etching". By reading this reference you will have a general idea of how images are transferred using UV light which then provides a relief pattern to a plastic sheet. For the sake of brevity, this document will not go into depth about polymer plates and instead address methods for etching on metal. For more details about the photopolymer process several metal clay suppliers sell kits for this process.

Etching on Metal

Copper plates can be etched to make inexpensive texture plates. Most are familiar with the traditional chemical etching method which involves using Ferric Chloride (FC). In recent years FC has become increasingly hard to obtain (it used to be a common product sold in shops like Radio Shack). It is considered an environmental hazard to ship and dispose of which makes it a challenge for use in the studio or for traveling teachers and students alike. FC is however a tried and true etching chemical and has its own advantages which will be explained below when compared with chemicals and methods used for electrical etching.

When it comes to etching silver, chemical etching is even more challenging as the chemicals used can be very dangerous. Nitric Acid is most commonly taught as the standard silver etchant, however Nitric Acid is extremely hazardous if proper safety precautions are not strictly adhered to. Ferric Nitrate is another etchant used for silver and has environmentally hazardous properties very similar to Ferric Chloride. However, silver can be etched electrically with an electrolyte that does not pose the same risks. This can be a welcome relief to many who wish to etch on silver in the home studio.

New Technology for Electrical Etching

For the past few years, Dan Haab MSEE, has been researching the metal etching process and subsequently developed new patented technology for easy electrical etching. He designed a microprocessor based controller (E3 Etch) for easy electrical etching that requires little user intervention. The E3 controller samples the current and voltage and constantly adjusts the average current to maintain a constant power to the piece to be etched. Although one can use an ordinary rectifier or battery for electrical etching, it can be a new science experiment every single time because of the adjustments that need to be made for each piece to be etched. The E3 Etch takes the guess work out of the equation to provide consistent results. This document is an overview of various methods, chemicals and resists that are used for etching to educate one on the art of etching on metal. The E3 is referenced in conjunction with electrical etching because it is exciting new technology and is the easiest way we know of to accomplish etching with electricity. Electrical etching also allows one to work greener in the studio as this process does not create by-products that require hazardous disposal after etching has occurred.

Copper, Brass and Bronze Etching

Chemical vs. Electrical Etching

With chemical etching, corrosive acids are used to dissolve metal. Different acids are required for the metal to be etched. After a resist is applied to the metal the metal is placed in a bath of the acid solution and then the etching process begins.

Agitation is required to keep the precipitate off of the plate as it etches, otherwise the buildup of copper chloride and iron oxide on the plate will cause uneven etching or interfere with the acid as it tries to reach the metal underneath. A gentle movement of the container is usually sufficient to knock the particles loose thus keeping the plate clean as it etches.

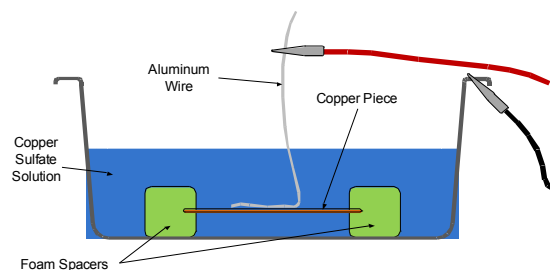
Often the plates are floated on top of the solution with the aid of taped Styrofoam or some other method to keep them suspended on top of the solution face down in the bath. After etching the plates are removed and rinsed. Wear rubber gloves to protect skin from the acid.

Electro-etching is accomplished by running an electric current through the metal piece to be etched that is suspended in an electrolyte solution. Etching occurs in a transfer

process as atoms are moved from one metal plate to another. The electrical charge causes the exposed copper (or other metal) to be plated to a cathode (bottom of a stainless steel pan). The resist blocks the transfer of the metals thus resulting in a relief pattern after etching.

The metal is prepared by taping an electrode to the back of the piece. This can be a piece of aluminum wire or strip of copper. Aluminum does not etch so it doesn't need to be masked off. In both cases the metal of the electrode needs to be in contact with the metal that is to be etched. The piece is suspended face down close but not touching the bottom of the pan. Small foam spacers can be used to suspend the piece or it can be suspended from above with something like un-split wooden chopsticks to hold the attached electrode wire from above. Lead wires are connected to the pan and to the electrode wire to make a complete circuit. No intervention is required unless using an ordinary rectifier which requires a voltage/current meter to check the bath as the piece etches. With the E3 Etch one only needs to see that the power and current lights are on. After etching the piece is rinsed and dried off.

Here is an illustration of the electrical etching set up:



NOTE: The copper piece is fully immersed in the Copper Sulfate solution and is held to inch above the bottom of the stainless steel pan by the foam spacers

Comparing Chemical vs. Electrical Etching

Chemical (Ferric Chloride)

Pros:

- Etches quickly (while the solution is fresh)
- Resists hold up fairly well (Rubberstamp inks and sharpie pen can be used)
- Multiple pieces can be etched at one time
- Life of the solution can be prolonged with citric acid
- Does not require a lot of equipment

Cons:

- Must be properly disposed (hazard)
- Agitation is needed during the etching process
- Creates undercuts in the texture as it etches deeper into the metal and past the resist
- Accidental spills will permanently stain carpet, clothing, sinks, etc.
- Toxic fumes will result from heating above 150°F
- Becomes exhausted over time as copper ions saturate the solution
- Difficult to etch metal clay due to the clays porosity

Electrical Etching (Copper Sulfate) for Copper, Bronze and Brass

Pros:

- Can be found in hardware stores (Root Kill)
- Does not produce harmful fumes
- Can be used indefinitely as copper atoms transfer to the cathode rather than adding copper ions to the solution. Simply strain and re-use
- Minimizes undercutting as electricity etches in a straight line. Great for texture plates since the clay will not “catch” on sharp undercuts. Very smooth etch
- No need for hazardous disposal, it can simply be flushed down the drain. Copper Sulfate is commonly used for home maintenance as method to rid pipes of tap roots.
- No need for user intervention during etching, no agitation required
- Can etch on copper and bronze metal clay.

Cons:

- Can only etch one piece at a time if using a controller designed for a single piece.
- The resist needs to be tough, rubberstamp ink and sharpie will not hold up. Use toner, paint pens, Resist paint or UV film instead. Most resists will benefit from heat setting before etching.
- May take a bit longer than chemical etching
- Care must be taken for proper set up to make sure electric current is not obstructed.

Silver Etching

The pros and cons for silver etching are similar. With electrical etching, Silver Nitrate is used in place of copper sulfate for fine silver. Silver etches 3-4 times faster than copper does. Silver nitrate is mixed in distilled water as a 2% solution which is similar in concentration to burn creams or the antibiotic solution previously used in baby's eyes at birth. Air born silver nitrate dust is harmful to breath and grains can stain skin. A dust mask and rubber gloves should be worn while measuring dry powder.

Silver nitrate can be used over and over for fine silver. With sterling silver the solution eventually turns into copper nitrate over time as the copper is extracted from the sterling. It can be used a limited amount of time but if you want to keep using the same batch, stick to fine silver. It does an excellent job of etching on silver metal clay. Strain the solution through a coffee filter and reclaim the silver that is etched for other uses.

In regard to sterling silver, we have found that the alloy of the metal makes a big difference. If the sterling simply contains copper, then silver nitrate works great and by simply straining the solution after each etch (you will see quite a bit of material that looks like “silver cotton” floating around) the solution works over and over. But if the silver contains other metals then you may have a limited number of uses before it is contaminated. Recently we have been experimenting with **Copper Nitrate** as a promising substitute for the silver nitrate in regard to etching sterling. It works very well and is cheaper than silver nitrate. It will also etch copper. With a very strong

solution (1 oz copper nitrate mixed with 10 oz distilled water) you will be able to etch sterling in a speedy manner. The solution must still be filtered (through a coffee filter) and then can be re-used. It still may be contaminated over time but expense wise might be worth it for etching sterling. Follow safety precautions for copper nitrate as it can be very hazardous if inhaled or ingested.

Chemical etching is rarely done for silver in the home studio or in the classroom as this requires proper ventilation and safety equipment. For this purpose it will not be detailed in this handout but mentioned if one desires to pursue further research on methods and chemicals (search for nitric acid and ferric nitrate for silver etching).

Resists for Etching

Resists are methods used to mask off the surface of metal to prevent etching wherever it is applied, which allows one to create an image or pattern. For example, if you use a paint pen to write your name on metal, the painted lines will not etch and only the background where metal is exposed will be etched. Your name will remain as a raised pattern on the metal after etching the plate.

Traditional resists for chemical etching are not as reliable for electro-etching. Electricity causes slight warming and erodes the resist off more than chemicals do. Therefore one must make adjustments in the type of resist used for optimal success. Each resist has unique properties with advantages that may make one preferable over another.

- PnP Blue-Traditional laser toner transfer process that many are familiar with. Image is printed on a plastic sheet with a laser printer and then the toner is transferred to the metal from the plastic by burnishing the back of the plastic as heat is applied. Acetone will remove the toner after etching.
- Direct Toner Transfer- Toner is transferred from paper with heat and pressure (household iron). After heating the paper is removed in water leaving only the toner on the metal. Acetone will remove the toner after etching.
- Paint Marker-Paint markers such as a Sharpie Oil Based Paint Marker hold up better than regular Sharpies. Heat set the design with a rubber stamp heat tool or hot hair dryer prior to etching.
- Resist Paint (Jacquard)-Paint freeform designs on metal and then set the design with a rubber stamp heat tool or hot hair dryer prior to etching. Can also be silk screened onto the metal.
- UV Resist Film-More steps but worth the effort for flawless resist. It is the Cadillac of resists. UV light is passed through a design printed on a transparency onto a special UV film that has been applied to the metal plate. After exposure the plate is developed in a soda ash solution and then is ready to etch. The film will not come off until soaked in the soda ash after etching. It produces pristine line quality and will not flake off during etching.
- Nail Polish-Nail polish can be painted on the plate or to protect the edges of the metal as a resist. After etching acetone is used to remove the polish.
- Stickers or Tape-stickers and tape will provide a resist and provide a way to make geometric designs on the metal.

- Beeswax-Wax is applied to the metal and then the design is removed with a scribe similar to methods used by printmakers to make intaglio plates.
- Embossing powders heated over rubberstamp ink designs offer a possible solution for those who want to use rubberstamp images.

Common questions, myths and FAQs about etching

Q: I heard that baking soda or cat litter neutralizes ferric chloride solution, making it safe to dispose of.

A: The use of baking soda or cat litter is often misunderstood to mean that the solution is completely safe and no longer considered a hazard. The baking soda does nothing to the copper ions that create a hazardous disposal problem. It does however raise the pH of the solution so that it is no longer acidic. Cat litter is slightly basic and will also help raise the pH. The advantage of cat litter is that it absorbs the solution making it easy to transport. In small quantities ferric chloride can be disposed of as long as it is diluted as directed by local authorities.

Q: If I want to dispose of copper sulfate or silver nitrate solutions, how do I do it?

A: Remember that your solutions will last indefinitely, but if you do want to dispose of them, it is safe to pour them down the drain and flush with lots of water. Both solutions are so diluted that they pose little or no hazard. Copper Sulfate is used for routine maintenance to keep tap roots out of pipes, and it is used in grape orchards and for other crops as a fungicide. Low concentrations of Silver Nitrate can also be safely flushed. Silver nitrate solution not should be flushed into septic tanks.

Q: How can you claim a process is green if the chemicals in their dry form are dangerous?

A: Electrical etching with copper sulfate or silver nitrate is the most environmentally friendly way to etch metal. There are no hazardous by-products and there is no waste or need for disposal. Green does not mean that you can drink, inhale or splash chemicals in your eyes or on your skin. You still must respect the fact that chemicals are dangerous if not used properly. Always use proper safety precautions.

Q: I've heard that you can use salt water with electro-etching. Isn't this a better choice than copper sulfate?

A: No, because after etching, the resulting sludge is hazardous waste because of the copper ion content left behind.

Q: Is the electricity from the E3 dangerous?

A: No, the E3 etch is only 12 volts which will not harm you if you should touch the clips. In regard to the solution, wear gloves to protect skin.

Q: My toner resist did not transfer, what went wrong?

A: Metal must be sanded and cleaned for the resist to adhere. Make sure your design is nice and black and is has thick line quality. It's asking a lot of the toner to transfer when there is very little of it to work with. Practice is key here, with variables including proper heat and pressure applied for success.

Q: My piece stopped etching after awhile during the electrical etching process, what did I do wrong?

A: There can be several reasons. Check the following:

1. Is your electrode wire firmly attached to the piece? It may have come loose or the wire is bent and has lost contact with the etched piece. Re-tape and continue.
2. The piece may be touching the metal pan. Make sure it is not touching the sides or bottom.
3. Minerals in water can interfere with etching, always use distilled water.
4. Bits of loose copper from previous batches along with solution that has become over concentrated due to evaporation can cause problems. Clean the pan and re-fresh with new solution.
5. Is the metal pure and not plated (copper, brass or bronze for copper sulfate) or (silver for silver nitrate)? Base metals will not etch.

Q: How do I re-use solutions for electrical etching?

A: Simply strain with a coffee filter lined funnel and keep in capped plastic bottle for future use. Add distilled water as needed to maintain proper ratio of chemical to water.

For more information and how-to, visit:

<http://www.sherrihaab.com/etch/>