

Introduction to Copper Enameling



Enameling is one of those techniques that takes a minute to learn, but a lifetime to master.



Introduction to Copper Enameling

The basic procedure for enameling is to apply the enamel to clean metal, and heat the piece either in a kiln or with a torch to a temperature of 1500 degrees or so, until the glass enamel melts and fuses to the metal. Enamels come in powdered and liquid forms, but powder is more commonly used because it is easier to apply and comes in a wider range of colors. Enamel can be fused to gold, fine silver, copper, and steel.



What is Enameling?

- Enamel is glass bonded by fusion to a metal surface.
- The techniques of today draw heavily on the traditional methods passed down through the centuries.
- Modern enamellers incorporate many experimental processes using new ideas and materials.



What is Enameling?

- The word "Enamel" refers to the glass material, as well as to the finished product.
- Artists that work with enamel are called "Enamelists"
- Enamels are precious objects which can be washed carefully in warm, soapy water.
- **They are durable, non-fading and, if handled carefully, will last down the centuries.**





How is it done?



1. Enamel (glass) is crushed to a powder somewhat finer than granulated sugar and somewhat coarser than flour.
2. This powder is applied by, by one of several methods, to the metal surface.
3. Next, the article is heated to 1000-1600°F, either in a preheated furnace, or with a hand-held torch. After 1-1/2 to 10 minutes, the article is removed and allowed to cool to room temperature.
4. Subsequent coats, normally different colors, are applied.
5. Sometimes 10-20 firings are required to bring about the desired results.

What is it's History?

We do not know when or where enameling originated. The earliest known enameled articles are six enameled gold rings discovered in a **Mycenaean tomb at Kouklia, Cyprus** some 8000 years ago.



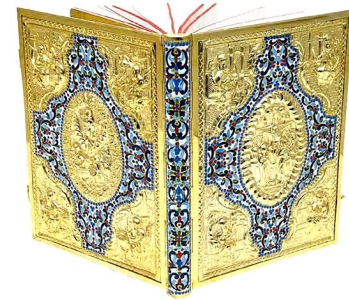
What is it's History?

- Cyprus is an island in the eastern Mediterranean.
- Cyprus was one of the earliest producers of copper in the world
- They had a flourishing metal industry and during the 'Golden Age' the island enjoyed a high level of prosperity.
- This brought a great number of settlers and craftsmen from neighboring countries.



What is it's History?

- The Greeks were enameling gold jewelry as early as the 5th century B.C.
- Caesar found the Celtic inhabitants of Britain enameling in the 1st century B.C. During the Byzantine era, 4th through 12th centuries, numerous enamel religious works were made.
- Fifteenth century artisans in France, perfected the use of enamels in a painting technique. The 17th, 18th and 19th centuries and the early decades of the 20th century saw the production of a great volume of luxury and decorative enamels, made in many different centers.



What is it's History?

- Starting early in the 19th century, it was realized enamel could be used for utilitarian purposes.
- First in pots and pans for cooking, then stoves, refrigerators, kitchen sinks, bathtubs, home laundry appliances, & architectural panels.



Who Does it?

- Utilitarian enamels are made in large factories
- Artistic enamels are made by thousands of individual artists throughout the world.
- We see enamels exhibited at schools, arts and crafts shows, art galleries, museums, and rare examples have sold at auction for more than 3-1/2 million dollars.



Modern Day Enameled Art



Modern Day Enameled Art



Modern Day Enameled Art



Modern Day Enameled Art



What is a quality enamel?



- A quality work of enamel art should have a sense of design, a feeling for proportion and appropriate color and texture.
- Transparent enamels should be jewel-like.
- Firing of all enamels should be sufficient to insure a permanent bond of glass to metal.
- The work should show that the artist has full control of the technique and materials

What are the Techniques?

There are many techniques to apply the enamel to the metal. We will learn the

following:

Sifting

Stenciling

Sgraffito

Wet Packing

Swirling

TYPES OF ENAMELING

Images courtesy of Mary Chuduk and Deborah Lozier.

One of the world's oldest art forms, enameling is simply the art of fusing glass to metal. Different techniques for accomplishing this have been developed and mastered all over the world. Below are a few common styles.



Sifting: Enamel powders are evenly applied to metals through a mesh screen and fired in individual layers.



Stenciling: A design is cut into stiff paper or mylar; enamel is sifted onto the piece through the open spaces.



Cloisonné: Wire is used to create design cells (cloisons) that are then "wet-packed" with enamel.



Silkscreening: Enamel is applied to workpieces through silkscreening material.



Basse Taille: Base metal is textured by stamping, etching or engraving and enameled using transparent colors.



Champlevé: Recessed areas are etched or carved out of the piece and filled with enamel up to the metal surface.



Sgraffito: Lines and designs are scratched into an unfired layer of enamel, and the workpiece is then fired.



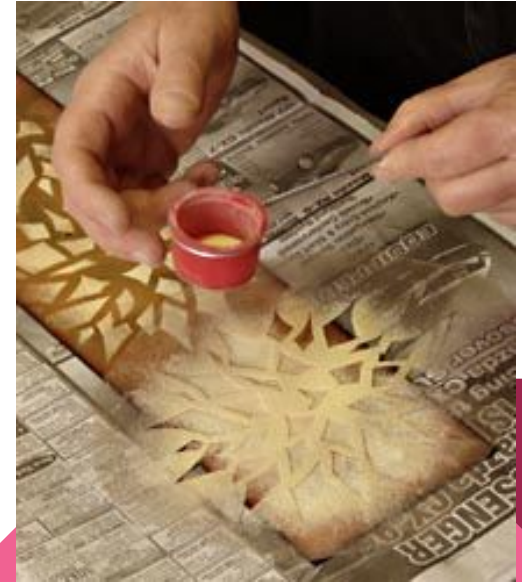
Limoges: Fine enamel particles are suspended in oil or water and "painted" onto the surface of the workpiece.

What are the Techniques?

Sifting: enamel powders applied evenly to metal through a mesh screen.



Stenciling: a design is cut into still paper or mylar (you can buy stencils at any craft store) then sifted into the open spaces.



What are the Techniques?

Sgraffito: Lines and designs are scratched into a unfired layer of enamel and then fired again.



Wet Packing: wet enamels are painted on the surface of the metal. (Don't apply a layer of enamel that is too thick. Your net result will be better if applied in thinner layers rather than thick layers--thick layers will possibly cause bubbles to form during the firing process)



What are the Techniques?

Swirling: fire brite noodles are placed on a blue pre-colored surface. While the enamel heats the kiln top is removed and the wands are used to swirl the colors.



Cover trinket evenly with enameling powder. Fire in kiln until glossy.

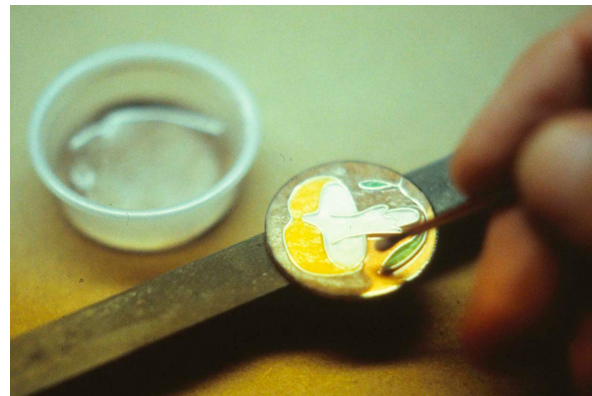
Arrange glass particles using tweezers on surface, When particles are soft quickly swirl the colors a little bit with the swirling wands.

Turn & Talk to Your Neighbor

What technique do you see?



What Techniques Do You Think It is?



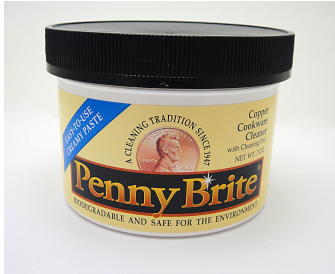
How to apply the glass using glue video clip



Enameling Tools & Supplies



Enameling Tools & Supplies

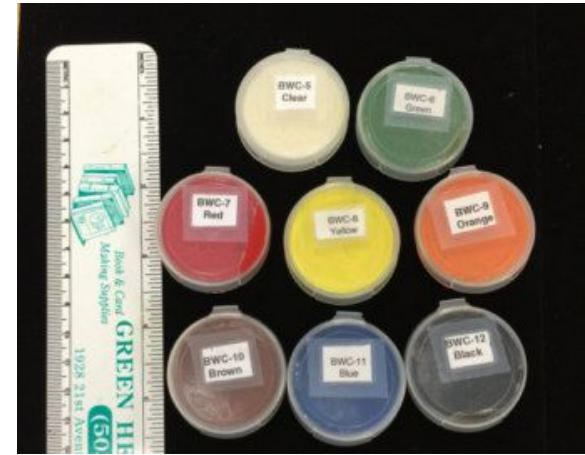


Penny Brite: used to cleaned the metal and remove oils from your skin.



Copper Trinkets: Pieces of pre-cut metal that we use as our canvas to enamel on.

Enamel Powder: Finely ground glass. Powder correctly applied can look like a jewel. Powders should never be mixed.



Enameling Tools & Supplies



Klyr-Fire: Adhesive we spray on to the metal before applying the powdered enamel. It allows the powder to stay in place and not shift. Glue must be completely dried under a heat lamp before firing.



Little Kiln: This hot pot style kiln is portable and plugs into any home outlet. It can fire one piece at a time. It is also called a beehive or hotplate kiln. It's basically a heating element inside a round chamber with a domed lid.



Cooling Pad: A heat resistant pad to set trinkets on after they come out of the kiln

Enameling Tools & Supplies



Firing Supports: The firing support should hold the enamel while firing it is a mesh screen.

Enameling Spatula: Stainless steel spatula with handle for moving hot trivets.



Swirl Wands: Use to swirl molten glass on the metal surface.




Safety

- **Wear a plastic apron** as some enamel particles will get stuck to your clothes
- Work in as clean an area as possible/ wash area before working.
- **Clean throughout the enameling process so you do not add or mix color particles of something to something else--e.g. Introducing a different fire scale to your enamel jars, or blue enamel into your white enamel, etc.**
- Clean up your work table when you are finished enameling and before moving into a new design project



Safety

- The area where you will be working with enamels should have **good ventilation** **be sure vent is on!**
 - **Don't eat or drink anything** where you will be doing the enameling (particulates could wind up in these items and then inadvertently be ingested)
 - **When sifting the enamels wear a dust mask and glasses**
 - When working with a kiln or torch, **wear closed-toe shoes, heat protective gloves, and kiln-approved safety glasses.**
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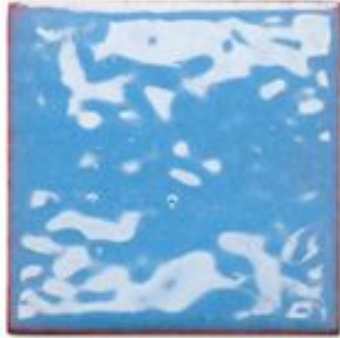
Firing

There are **4 stages** that enamel will progress through when heated: **sugar**, **orange peel**, **full fuse** and **over fired**. These words describe what the enamel looks like at each stage:



1. Sugar

Sugar looks like fine sugar



2. Orange Peel

Orange peel looks just like an orange peel--glossy with bumps



3. Full Fuse

Full fuse is when the surface is smooth and shiny



4. Over Fired

Over fired is when you start to see pits in the surface, black spots and sometimes the edges start creeping and/or changing color.

Firing- Estimated Times



3.25 minutes Sugar Stage



7 minutes Full Fuse



Firing- Fire Scale

- When firing on copper, firescale will form on the surface wherever there isn't enamel.
- Firescale is an oxide that is created when the metal is subjected to high heat.
- As the metal cools, most of the firescale will flake off; any remaining firescale should be brushed off and the metal cleaned again.



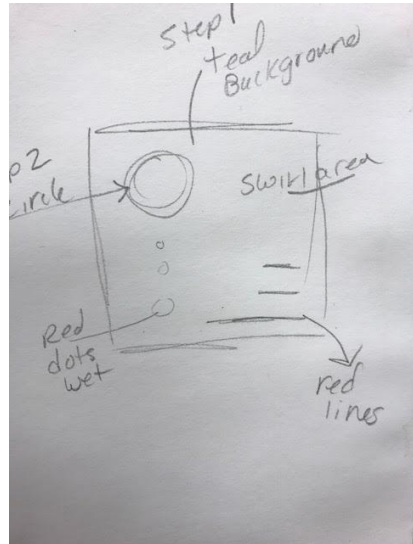
Firescale brushed from copper blank



Firescale removed gently with steel wool

Step One: Enameling Preparing the Metal / Planning the Design

- Create three sketches of your trinket shape and select what techniques you will use. Here is an example of a design idea from start to finish



Step Two: Enameling Preparing the Metal

- Get dressed apron, gloves, mask & glasses
- Clean copper with “Penny Brite” a clean surface removes any oils on the metal that would cause the enamel not to adhere properly.
- Don't touch surface with finger



Step Three: Enameling Area Set Up

- Clean your work surface so it's free of debris from any past projects
- Place newspaper over workspace
- Have sifters and enamels nearby
- Have a good dust mask ready
- Put on glasses
- Know what color you will lay down first.
You can only use one color at a time.
- Avoid dark colors as your base color- only because other dark colors won't show up and light colors will not be as brilliant



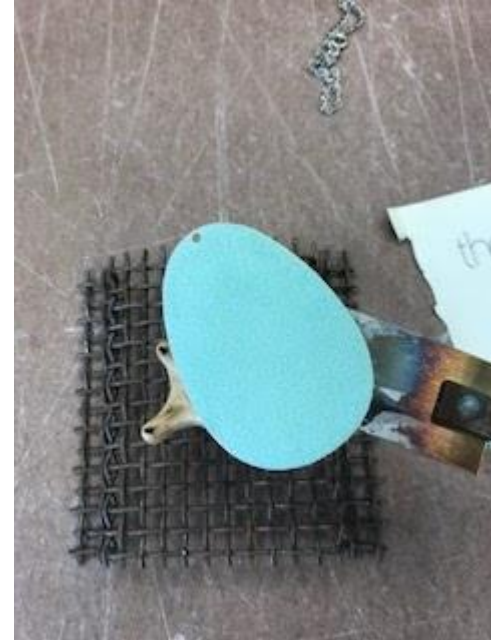
Step Four: Applying Powder the Glass

- Apply Glue
- Your first/base color will be a solid coat on one color.
- Sift over old glossy magazine pages. (allows powder to slide off)
- Fold the pages that caught the enamels, to form a funnel-like spout then pour the enamels back into its original container
- NEVER MIX COLOR POWDERS
- Let glue dry completely under a heat lamp before firing.



Step Five: Preparing to Heat

- **Preheat kiln. Be sure area is set up. You will need a spatula, cooling pad, heat gloves.**
- Set up a **heat-proof area outside** the kiln so you can place the mesh rack and trivet onto a safe surface when removing from the kiln (everything will be very hot)
- Place a bowl of **cold water** and a fire extinguisher near the kiln for safety in the event of an accident



Step Six: Enameling Ready to Heat

- Place the trinket on a folded mesh screen.
- Place spatula under the mesh then lift the screen and trivet.
- Place the firing rack into the kiln on the kiln shelf and close the kiln door, doing your best to not slam the door so you don't disturb the enamels



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Step Seven: Enameling Removing From Heat

- Once the piece is fired as you would like, place the firing fork under the trivet or use a spatula to remove the kiln shelf.
- Place the trivet or kiln shelf onto a heatproof cooling surface next to the kiln.
- Allow all to cool to room temperature before adding new powder designs.



Step Eight: Re-applying Powder the Glass

- Your first/base of sifted color will be a solid coat on one color will be done.
- Add glue and apply whatever other technique you have chosen.
- You only get one chance to take your time and carefully plan out what you will do.
- Once cool remove last fire scale and polish back with penny bright

