

Pam East – Enameling on Metal Clay

INTRODUCTION

Hi, I'm Pam East. Welcome to Enameling on Metal Clay. I've got a lot of information to throw at you, so if you can hold your questions to the end that would be great. I've allowed for some time at the end of this presentation for Q&A.

In a nut shell, enameling is the art of applying glass to metal. Metal clay is uniquely suited for enameling. Most of the silver used in jewelry is Sterling silver, which is 92.5% silver, 7.5% copper. Metal Clay, on the other hand, is 99.9% pure silver. This makes a big difference when it comes to the application of enamels. Because of the copper content Sterling can not be enameled directly. It has to go through a complicated process called "Depletion gilding" to remove the copper from the surface before it can be successfully enameled. Metal clay, being pure silver already, is ready for enamel right out of the gate.

Enamel is densely colored glass that has been chemically formulated to create a permanent bond with metals. Obviously this group is mostly concerned with enamels for silver, but gold and copper actually use the same enamels. They are the variety known as Medium Temperature, Medium Expansion enamels, and are available in both leaded and unleaded formulas.

Lead, as you know, is a nasty substance that can cause all sorts of health problems; however, it does act as a color stabilizer in enamels. Leaded enamels come in a wider range of colors than unleaded. On the other hand, there are health risks have to be considered as well when choosing leaded enamels; not only your own health, but the health of the people who manufacture it and are really at the highest risk. All the enamel produced in the United States is lead free. There are a few instances when I choose to use leaded enamels, when there is a color I just can't get any other way; but I work with lead free enamel about 95% of the time. Don't mix them though. Leaded and unleaded aren't generally compatible with each other.

SAFETY

This isn't to say that lead free enamels are completely non-toxic and safe. There are other elements used as colorants that aren't particularly good for you, and just the fact that its ground glass brings up issues you'll need to deal with if you want to enamel. Fortunately, the necessary safety precautions aren't all that difficult. Most of it comes down to common sense.

I know I'm sounding like a broken record here, but enamel is powdered glass... you don't want it in your lungs. Enamel in the air is your biggest concern. Your most important piece of safety equipment is a safety mask. You should wear a dust mask with a rating of at least N95 or N100 whenever you are sifting or screening enamels. Never eat in the area where you use enamels. When you clean your work space use a damp cloth and damp mop, rather than dry dusting which will just put enamel back into the air. I know this sounds obvious, but please don't lick your tools. I can't tell you how many times I've seen a student put a paintbrush in their mouth to bring it to a point. Trust me, you don't want to be eating this stuff.

You need to be especially careful when you are firing leaded enamels. Firing can release lead fumes into the air. For this reason I do not recommend torch or stovetop firing for leaded enamels. Pull the vent plug on your kiln with leaded enamels, and use an active ventilation system. I know most of you do not have a vent hood, but putting a box fan in a window blowing out works great.

I don't want you to think you are going to drop dead if you use leaded enamels. You're not. I have friends who have been firing leaded enamels almost daily for the past 30 years and they are perfectly healthy. I just want to make you aware of the issues so you can use some common sense while you're working.

ENAMELING TOOLS & SUPPLIES

Enameling tools fall into four categories; preparation tools, application tools, firing tools and finishing tools. I'm not going to mention every single thing you need, but it's worth going over some of the items you may not be familiar with.

Preparation tools are needed both for the metal and for the enamels. A glass brush is used to clean the silver before you apply the enamels. They're made of fiber glass so wear rubber or latex gloves when you use one. Just scrub the piece really well with the glass brush and ammonia to remove any dust, dirt, oils or soaps from the piece before you enamel it.

Enamels also have to be prepared for use. Enamels are made up of a variety of particle sizes. The very finest particles can cause cloudiness in transparent enamels. You can improve the clarity of your transparent colors by removing the fines before you start. Use a 200 mesh screen to remove the fines. You don't need to do this for opaque enamels, only transparents.

Application tools are things like a scribe and spatula, very fine paint brushes, and small sifters. You'll also need klyr-fire enamel adhesive. You don't need it for every process, but you'll use it often enough to want it on hand. It's important not to introduce chemicals, minerals, or other contaminants into your enamels, so always work with distilled water. At around a dollar for a gallon, it's cheap insurance.

To fire your enamels you'll need a trivet or sheet mica, a firing rack and a firing fork to take the piece in and out of the kiln. Trivets come in a variety of sizes and configurations. I find these little three point trivets to be pretty easy to work with for jewelry size pieces.

For finishing you may need an alundum stone which allows you to grind your enamels, wet/dry sandpaper, and tri-m-ite polishing paper. All enamel finishing is done wet, so plan to work at a sink at this stage.

There are two basic ways to apply enamels; it can be sifted on or wet-packed. Sifting is handy for quick application over a large area, but for small jewelry items, wet-packing gives you the most control, and it's the method I choose the majority of the time.

To wet-pack your enamels, start by putting a small amount of clean enamel into a plastic spoon, and wetting it with distilled water. The water should actually pool on the surface. When you run a brush through it, it should pass through the enamel quite easily. If your brush just runs across the top of the enamel without penetrating it, you probably don't have enough water in there.

Pick up a small amount of enamel with the brush, and then use a scribe to push it off on to the piece. You can use the scribe to push the grains around. If you have trouble getting it to lay into the piece it is probably too dry. Add more water. Apply the enamel in a thin layer. It's tempting to try and stuff a lot of enamel into the space to fill it up, but if the layer is too thick you can end up with bubbles or pits. If you want thicker enamel to fill an area or to achieve more complex shading effects, fire it on in thin layers, building it up a little at time.

You can put on multiple colors at one time and fire them all together. You can leave the colors discreet, or you can use the scribe to mix them together where they meet to create simple shading effects. More detailed shading is achieved through multiple layers of enamel.

Once you've applied all the enamel, you need to settle it. Pick the piece up and tap the edge with a heavy tool. I usually use the scribe. Paintbrushes tend to be too light. This tapping will cause the enamel to settle and the water to come to the surface. You can wick away the water with a bit of paper towel.

At this point you just need to let it dry and it will be ready to fire. Place the piece in a trivet or on a piece of sheet mica on top of a firing rack and put it on top of your kiln. It only takes a few minutes to dry.

Enamel sifting is fairly straight forward. Begin by spraying the clean piece with Klyr-fire that has been diluted with an equal amount of distilled water. Don't spray directly on the piece. Instead spray above it and allow the mist to settle down on to it.

The sifters have a twisted handle. Running your fingernail along the handle vibrates the tool and the enamel sifts out. Just work back and forth to cover the piece.

You can use multiple colors to achieve subtle shading effects. The piece will need to be set in a trivet or on a piece of sheet mica, the same as the wet-packed piece. I haven't found that these sifted pieces need much in the way of drying time though.

Unlike metal clay, you can't put enamel in a cold kiln and bring it up to temperature. You have to pre-heat the kiln. Enamels fuse between 1400 and 1500 degrees. I usually set my kiln for 1475 for firing enamels. Use a firing fork to transfer the firing rack, with the piece on it, into the kiln.

Enamels go through stages as they fuse. First it's granular, then it reaches what's call the "orange peel" stage, and then finally it's fully fused when the enamel is smooth and glossy. This process only takes a few minutes. Check it at 2 minutes. If it's not done, you can always put it back. It's better to pull it out too soon and have to fire it some more, than to over fire it. Over-firing can cause the enamels to darken and can increase color reactions with the silver.

That's the basic process. To add more enamel you would just repeat those same steps. Obviously my book goes into a lot more detail than I can cover here.

Once you get going it's actually pretty easy. It can be as simple or as complex as you like, from a single layer of a single color to a dozen colors shaded and blended.

I went through the application process pretty fast because there are some other concerns I wanted to make sure I had time for. There are three topics that come up a lot when we talk about enameling on metal clay. They are color reaction on silver, counter enameling and cracked enamel. I'll just tackle these in order.

When people first start enameling they have the idea that they can just choose their enamel colors much like you would choose paints; just buy the colors you want to use and go for it. I wish it were that simple! Unfortunately, many colors react badly with silver. Silver is, itself, a colorant; and will turn certain enamels a muddy brown or yellow color. This mostly affects warm colors like reds, pinks, oranges and yellows; but I've also had trouble with other colors off and on. Part of the problem stems from the porosity of metal clay. Because it's so porous it releases more silver salts into the enamel than fabricated silver, and as a result, color reactions are much stronger. All silver will react to some degree, but it's much more pronounced on metal clay. This is why it's so important to burnish your piece really well before you start. You want to close down those pores as much as possible. I'll often toss things into the tumbler before I go to bed and let them tumble over night.

There are a number of ways to deal with the problem. First and foremost is test, test, test! Before committing your piece, fire the enamels you want on a small test piece. If you don't want to use metal clay, you can get a thin sheet of fine silver and cut it into small pieces to use as testers. It will give you a good indication, although it's not perfect. The color reactions will not be as strong on fabricated silver, but it's a good place to start and it's less expensive than using up mountains of metal clay for tests.

Make sure you don't over fire your enamels. If you continue to fire the enamel after it's fused or fire it at too hot a temperature, that is going to increase the likelihood of the colors reacting. Enamel firing is a function of both temperature and time. It's better for reactive colors to fire them at a slightly lower temperature for a slightly longer period of time. Keep a close eye on them, and pull them out as soon as they reach the glossy stage. It's better to pull it out too soon, and have to put it back, than to leave it in too long.

For opaque colors if the reaction was just a little browning around the edges, you can sometimes reduce or eliminate the problem by firing over a layer of flux, which is just a fancy way of saying clear enamel. While this technique helps, it's somewhat limited with metal clay. Again, that old adversary porosity comes into play. If the silver salts get into the flux layer, and they will with metal clay, they are going to continue to affect whatever colors you put on top of it.

There are two other ways of addressing the use of warm colors on metal clay that work much better. One is to fire on gold foil, and the other is to use leaded enamels formulated for silver.

As soon as I say "gold foil" I'm sure half the people in here thought "Ah HA! Keum-boo!" Unfortunately, no. The problem with the keum-boo technique of applying gold foil to silver, is that the whole reason it works is the silver and gold molecules actually intermix... which means you still end up with silver coming up through the gold. You can reduce the silver reaction significantly if you use a couple layers of heavy gold, but you will probably not eliminate it completely. Especially if you are planning multiple firings. Each time you fire the piece, the gold will be absorbed further into the silver and more silver will leach into the enamel.

The way to use gold to eliminate the silver reaction is to place a barrier of clear enamel between the silver and the gold foil. Fire the clear onto the enamel first, but just to the orange peel stage. They lay in the gold foil and fire it again so the gold bonds to the enamel. The enamel will prevent the gold from being absorbed into the silver, and the gold will prevent the silver from coming up into the enamels you fire from that point on. The only thing you have to watch out for is around the edges. If the enamel comes in contact with silver around the edges you will still end up with a reaction, although to a much lesser degree.

You can see in this example I still ended up with some reaction in the red enamel. This was actually because I didn't get the gold foil fully bonded to the clear flux and it pulled away when I fired the red. I tried to fix it in subsequent firings, but ended up with some reaction around the edges anyway.

The other way to get around these problems is to use leaded enamels that are formulated to fire directly onto silver. Don't make the mistake of thinking all warm color leaded enamels are safe on silver. They're not. Only a very few have been made specifically for silver. The only red for silver that's being manufactured now that I know of is Nihon Shippo G704, which is a deep raspberry red. They have a number of very nice pinks as well.

The next topic I wanted to touch on is counter enameling. Counter enameling is just a fancy way of saying a piece will have enamel on both the front and the back. Enamel exerts pressure on the metal, pulling and warping it. This can cause the enamel to crack. By putting enamel on both sides you equalize the pressure and reduce the occurrence of cracks. The question that always follows this is "how do I know if I need counter enamel or not?" I wish there were some definitive answer to this, but the fact is it's more art than science. Several factors come into play. How thick is your piece? Is it domed? Are you applying a single layer of enamel, or several layers? Are you applying enamel to the whole thing, or just parts of it?

Thicker pieces are less likely to need counter enamel than thinner pieces. Domed pieces are less likely to need counter enamel than flat pieces. The more enamel you apply, the more pressure on the metal, so thick enamel will almost always need to be countered. This is just one of those things you have to experiment with.

Counter enamel will never hurt your piece, so my advice is to go ahead and apply it if you can.

The second most common problem with enameling, after color reactions, is cracks in the enamel. If you are only using one layer of enamel, or if you are only applying enamel to a small portion of a piece, this is unlikely to be a problem. The more enamel you add, the more you have to watch out for this.

Counter enameling is your first line of defense, and will solve the majority of cracking problems. If you didn't apply counter enamel to begin with and you got cracks, go ahead and apply it after the fact. The cracks in the front of your piece will heal as the enamel on the back fuses. Just be sure to clean the enamel on the front before re-firing. Oils or dirt in the cracks will prevent it from healing properly.

Counter enameling aside, there are other factors that can cause cracks that you need to take into account when you are designing your piece. So the first thing you have to ask your self is what type of piece is it? Stamped, syringe design, and stacked are just a few, of course, but the issues they represent cover most bases.

When filling impressions with enamel the sides need to be straight. Stamped images are great for enameling, but rubber stamps generally produce a sloped edge impression. This change in depth along the edge can cause a crack to appear along the line following the bottom edge of the slope. You can fix this in the greenware stage by running a very fine file around that edge to straighten it up.

Syringe designs are another way to create areas to be enameled. In this case you need to watch out for two things. One is the enamel lifting the syringe work off the base, and the other is cracks appearing where the enamel undercuts the silver design. You can use silver paste and a very fine brush to fill in the area around the base of the syringe work, and that will solve both problems.

One of my favorite methods for creating enamel areas is to stack pieces. I make a solid base and stack a piece with cutouts on top. This has the advantage of having very straight sides, so I don't have the sloped edge issue you see with stamped images. Where you have to be careful is getting the two layers completely sealed together. You need to use a generous amount of paste to join the two layers together. If there is an opening around the base of the area where the enamel can undercut the silver, you will end up with cracks. Just like with the syringe, go around it with paste to fill in any of these openings.

Ok, that's my presentation for this conference. Obviously, my new book "Enameling on Metal Clay" goes into a lot more detail. I'll now take questions.