Breaking the Ice: Kiln Firing Fine Silver, 950 & 960 Metal Clay

After all the excitement of creating your Silver Metal Clay project, it's time to sinter the metal into a beautiful piece of fine jewelry. To transform your creation from fragile greenware to a usable object, it is fired in the flame of a torch or in a kiln. Torch firing has some limitations, but a kiln can open up a whole new world of creativity, allowing for larger, more complicated items, enamels, and other heat-treated techniques. Some Metal Clay bodies can only be kiln fired due to the length of time or carbon needed, such as Sterling Silver 925 and base metal clays. This is the magic of Metal Clay.

What You Can Expect from a Kiln Firing

First

The binder burns away. The binder is organic, and it is reported to be non-toxic. Its smoke dissipates into the air during the firing. The fine particles of metal sinter together to form a solid piece of metal, albeit a porous metal. Depending on the version of Metal Clay used, this can take from 15 minutes to several hours.

Note: I get a headache, and I prefer not to allow anyone in the room when firing, myself included.

Second

After it is fired, you will notice a change in the appearance. Fine silver looks "kiln white" with almost a powdery white appearance. This is the look of unpolished metal through and through. Base metals may turn dark or have a rainbow appear as the heat can patina the metal.

Third

The piece will shrink between 10% — 30% depending on what version you use and how long you fire the work. The shrinkage is due to the removal of the water and binder used to make the metal flexible. Then, the metal will sinter together.

Fourth

The piece will go from a clay-like form to solid metal. If properly constructed, it is not fragile and will not break when dropped. Strength is the most significant advantage of using a kiln.

Safety First

- Heat resistant gloves.
- Long handled metal spatula.
- Your kiln should be 12" away from anything.
- Good cross ventilation.

Pieces that Qualify for Kiln Firing

- The Piece must be completely dry.
- Size - must fit on your kiln shelf or inside the kiln bowl.
- Stones fired in place must be able to tolerate the heat setting you plan to use for the kiln.
- You can use a support item in your project — a combustible such as cork clay, paper clay or wood clay, however it also must be fully dried.
- Pieces should not be fired with delicate inclusions that you want to be part of your project without ruining them, such as shells, pearls, non-fire-in-place gems, etc.

Clockwise: Spatula, Tweezers, Fiber Bowl with Vermiculite, Stilts, Fiber Board Shelf, Kiln Shelf, Kiln Gloves.

Kiln Set Up

- Place on a heat proof surface - large tile or metal surface.
- Metal Clay Kiln.
- Kiln shelf.
- Kiln stilts.
- Long handled metal spatula.
- Vermiculite in a heat proof bowl for dimensional items.
- A tile or heat proof surface to put your piece on when you take it out of the kiln.

Kiln Process for an Open Shelf or Open Air Firing

A firing for Fine Silver, 950 & 960 Metal Clay will need Oxygen for the metal to sinter, unlike Sterling 925 which requires a carbon firing.

The carbon reduces the oxygen atmosphere, avoiding oxidation and allowing for a full sintering.

- Put stilts on the bottom of the kiln.
- Set a ceramic kiln shelf or fire board on the stilts. This allows heat to circulate around the piece.
- Turn on the Kiln.
- Wait for “Idle” to appear.
- A temperature reading on the panel should be the reading of the ambient temperature of the room.

Selecting and Setting the Program to Run Your Kiln

Use these three buttons to navigate the programing process:

- **Start/Stop button** advances you through your programing choices such as, which Program, Ramp, Temperature, Hold time, 2nd Ramp, and Starting the KIln up. The same button sets the choice you want at the end of each selection.
- **Higher button** is used to change the setting to a higher number.
- **Lower button** is used to change the setting to a lower number. The same button is used after you set all your choices and want to review and double check you set them correctly.

Program (PRO #1 – 9)

Choose a program, either a preset program or a user defined program where you get to customize the settings. To set which program you want to use click the [START/STOP], then use [HIGHER] to cycle around to the program you want. We are going to create a User Defined Program (Usually one of the higher programs **are not** preset). Then set the program with [START/STOP].

Kiln Control Panel

Ramp (RA 1)

A ramp is used to slow down your kiln, so it doesn’t hit the target temperature to quickly as in when using a combustible or glass in your project. A ramp is defined by how long your kiln will take to rise to a given temperature over an hour.

For example, when using a combustible like wood, paper or cork clay as a place holder for a hollow form, you want to ramp it to 800ºF. This means the kiln will slowly rise to the 800ºF over an hour, then will proceed to go as fast a possible to your target temperature. The temperature you want to use to sinter the Metal Clay. To set the ramp, click the [START/STOP], then use [HIGHER] or [LOWER] to cycle around to the temperature you want.

Click [START/STOP] to set your choice. If you do not wish to set a ramp and you want the kiln to head to your target temperature rapidly, click the [HIGHER] until the panel reads [FULL].

Temperature (ºF ?)
Set your reading to the target temperature you want to use to sinter the Metal Clay.
Click the [START/STOP], then use [HIGHER] or [LOWER] to cycle around to the temperature you want. Click [START/STOP] to set your choice.

Hold time (HLD)
How long do you want to hold the kiln at that target temperature?
Click the [START/STOP], then use [HIGHER] or [LOWER] to cycle around to the amount of time you want. Click [START/STOP] to set your choice.

Ramp (RA 2)
A second ramp is used to slow down your kiln, a second time after the program has been held at the target temperature. Some base metal clays need a slower cooling period, or some inclusions may need the same.
When you don't need to slow down the kiln and you just want it to cool down naturally, Set the RA to 000
Click the [START/STOP], then use [HIGHER] or [LOWER] to cycle around to the amount of time you want. Click [START/STOP] to set your choice.

Starting the Kiln
Once you are ready you can Click the [START/STOP]. You know it is on when the temperature on the panel starts going up. On my kiln it clicks.

Review
[LOWER] doubles as the program review and only works this way after you hit the start button. It's great to check the program to make sure you set things right.

Stop
To stop the Program while in progress, cycle through until is reads [STOP].

Complete
Turn off the kiln with the ON/OFF switch when the program reads [COMPLETE] and it beeps. Yeah!!!!!
.
!!! Warnings !!!
When taking the piece out of the kiln and placing on a heat proof surface, ***Never*** *set it down in front of the controller as the heat will cause problems to the electronics.*
Never *shut the kiln off with the On/Off switch while it is running a program. Both of these actions will kill your controller!*

Firing Flat items
Flat items can be fired right on the shelf. If it is large, some people like to put kiln paper, usually used for glass fusing, or a sprinkle of vermiculite on the shelf to avoid drag —slight distortion where the item shrinks during the sintering process.

Firing Dimensional Items
For dimensional forms you are looking to support the item to avoid distortion. Position the item where the gravity is of least resistance, as the weight can cause slumping when the metal is extremely hot.
The following are used:

- **Vermiculite** - look for small grain variety and place in a kiln bowl.
- **Alumina Hydrate*** is a fine grain white substance and needs to be place in a kiln bowl.
- **Fiber Blanket*** is a thick pillowy substance used right on a kiln shelf.

***Warning**: I personally don't recommend either alumina*

Open Shelf firing on Vermiculite

hydrate or the fiber blanket because of safety concerns. Use with care, respirator and gloves when handling, it is very toxic if inhaled.

Kiln Firing, Sintering and Silver Metal Clay

It seems the bigger the equipment in the jewelry studio the more intimidated newcomers are of that equipment. But you need not be afraid if you test your kiln and the Metal Clay you will be using first to get to know your kiln and how it behaves. Once you perform these tests you are good to go.

And when I say test, I don't mean putting the masterpiece you spent hours on in the kiln to see how things turn out, I mean test small simple earring components not giving you the same angst of failure. I figure if I mess up, no big deal and if I don't mess them up, well I have a nice pair of earrings.

Fiber Blanket

Alumina Hydrate

But Why Test if the Metal Clay Manufacturer's Instructions Have a Given Temperature and a Percentage of Shrinkage Right on the Package?

Because each kiln is ever so slightly different. Temperatures on a kiln can vary, and even new Metal Clay kilns at high mountain levels, for example, may need to be adjusted for the elevation difference. Also overtime a kiln may need to be adjusted. For instance, my 10-year-old kiln needs 10ºF more added to the temperature to register as accurate. The only true way to know the shrinkage of a given brand of Metal Clay is to measure yours before greenware and after fired piece.

Understanding Metal Clay Sintering Basics:

It's all about the Sintering. As you know Metal Clay is made up of particles of metal, an organic binder, and water. It is the ability for the binder and water to be removed with the intense heat of the kiln, and the remaining metal particles to sinter together and form a solid piece of metal.

- **Fire as hot as you can and as long as you can allowable "for your project" for the strongest most durable end product.**
  For fine silver that is1650°F for 2 hours (PMC3, Art Clay Silver, Cool Tools FS999, FYI Silver, and Metal Clay Powder*. (Other clays may have not been tested or have different schedules, and other unknown properties - Prometheus is a good example as it's highest temperature is 1292º F. It bubbles at 1650ºF, which scientifically speaking baffles me as it is stated to be pure fine silver)

- **The sintering of the metal is the key element in the process.**
  At the lower temperatures of the firing schedule, the silver particles sinter together, but it is NOT a full sinter, leaving microscopic spaces.

  At higher temperatures, the metal DOES fully sinter and becomes a more dense material, thus there is more shrinkage at a full sinter as well. Ok, what does this mean? This means at all levels of firing on the firing schedule you will get a hard piece of metal, however, at the lower temperatures, the metal will not hold up to the same amount of abuse, wear and tear, and stress as a piece fired at the higher temperatures. Pieces fired at the highest temperature not only fully sinter, but the metal can actually gently bend without breaking.

- **There are reasonable uses for some of the lower firing temperatures such as glass, gems, and fire-in-place inclusions, but the usage of the final item, construction, and design should be considered.**

For instance, earrings and pins get less wear and tear than rings, so firing at low temperatures for a ring would not be prudent. Also, delicate parts or construction like filigree or prongs need high firing also. In fact, I never fire an entire piece at the 1,110°F firing schedule since my "personal" feeling is the strength is compromised. I hear too many reports of breakage and have experienced some myself in the early days. There are exceptions to the rule such as adding an element in a second firing that can not handle hire temperatures, however that item would require no wear and tear. Examples include adding low fire gems, glass or a flat metal addition.

We were Told Firing at 1,650°F for 15 Minutes is Almost as Good as Firing for 2 Hours, is this True?

There had been tests conducted by the PMC Guild when they were in existence suggesting when firing at 1,650°F for 15 minutes compared to a 2-hour firing, there was a small advantage to firing for 2 hours, but the difference was very small - a 2% difference I think it was. For this reason, teachers may choose to use the shorter firing time during a class setting without compromising the strength of the given project due to time constraints.

So Why A Full Firing Schedule?

There are factors that need to be considered before selecting your firing schedule. One firing schedule does not fit all projects:

- **The Sturdiness of the design.**
  Is your project delicate with filigree and very thin parts and appendages? Is it sturdy enough to hold up to wear and tear or should you fire at higher temperatures to avoid breakage?
- **Manipulation and use of the end item.**
  Will the piece need to be worked further requiring shaping, bending, or hammering? Will it get a lot of abuse such as a ring or a bracelet would?
- **Are there inclusions?**
  Are you firing in place glass, gems, or inclusions that require a lower firing schedule? If so, you may need to alter the clay thickness, design of the piece, and consider the stress on its end-use. A new sturdier construction plan may also need to be considered.

Let me again emphasize that all projects should be fired as high as they can with consideration of the inclusions for the strongest most durable results.

Firing PMC 925 Sterling Silver Metal Clay

Because Sterling Silver has 7.5% copper and 92.5% silver, it has enough copper to require a Carbon Firing to avoid oxidation during the sintering process.

What you need for this two-step firing process:

- Kiln.
- Steel firing pan and lid — a good quality pan sheds less dust and can be purchased at a restaurant supply store or Metal Clay manufacturer.
- Activated carbon.

STEP 1

- First you need to remove the binder by firing your work on an open shelf.
- Heat to 1000°F for 30 minutes, a bit more for thicker pieces.
- After firing, allow the work to cool completely and handle pieces carefully as they are more fragile.

STEP 2

- Carefully, transfer the piece to a stainless steel firing container that has a half inch layer of activated carbon.
- Keep the pieces at least 1/4" apart.
- Place another layer of carbon covering the pieces about a 1/2". You can fire several pieces in multiple layers. Make sure to leave a 1/2" of carbon in between each layer.
- Cover with a lid and heat to fire at 1500°F
- Hold for at least 1 hour.
- Allow the work to cool while buried in the carbon, so the Sterling comes out cleanly.
- Test strips are recommended for carbon firings.

Stainless Steel Pan and Activated Carbon

Troubleshooting

My piece came out of the kiln with tiny bubble, what happened?
If your piece had any moisture, it could come out with some small bubbles. Make sure your piece is bone dry before putting it in the kiln.

I think I melted my piece, How can I tell?
Your piece will have bubbles on it, usually a bit larger than described above for a wet piece. Another, more obvious sign is a big blob of metal left behind. First, check your firing temperature matches the Metal Clay you are using. Next, check your kiln is running at the proper temperature. See “How Do I Know If My Metal Clay Kiln Is Running Hot And How To Fix It?” in the reference section.

My piece warped in the kiln, Why?
It happens sometimes due to the intense heat and gravity, but there are things you can do. First, make sure it is well supported in the kiln in vermiculite. Next, position your piece where gravity is of least resistance — heavy part facing down. In the case of a lentil, () submerge the point down verses on its belly. You can also use a combustible for hollow forms. Warping can also be worked out with nylon pliers or tapping it with a rubber mallet on a bench block or form. Make sure your piece is sandwiched in leather to avoid marring surfaces.

My piece broke, Ahhhhhhh Help!
This is the symptom of a piece being too thin, a fissure, or crack in the piece or not being sintered properly. Check these items and your kiln temperature. To fix it, you can add Metal Clay and refire.
See “Successful Post–Fired Metal Clay Connections” in the reference section.

More References on HollyGage.com

Live Online Interactive Small Group Classes
Simply great connectivity with other artists during this pandemic, and tons of learning.
https://www.hollygage.com/classes

Technical blog about working with Metal Clay
https://www.hollygage.com/blog

Successful Post–Fired Metal Clay Connections
https://www.hollygage.com/post/successful-post-fired-metal-clay-connections

How Do I Know If My Metal Clay Kiln Is Running Hot And How To Fix It?
https://www.hollygage.com/post/how-do-i-know-if-my-metal-clay-kiln-is-running-hot-and-how-to-fix-it

Metal Clay Tips, Techniques
https://www.hollygage.com/tips-and-techniques

Free Tutorials
https://www.hollygage.com/tutorials

Video Channel
https://www.youtube.com/channel/UCXPHe8CeN2txwFfKVmx286w

This Metal Clay Comparison Chart
Lists the firing temperatures of ALL available clays. This is a public document kept up to date by manufacturers and other contributors
https://tinyurl.com/y62tl5m4

Holly Gage of Gage Designs is a 2015 Saul Bell Design winner recognized for distinction in jewelry design. She creates contemporary jewelry and teaches her unique techniques with a gentle blend of design instruction and technical proficiency. Holly brings her innovation, creativity, and gift of helping others find their artistic voice through classes, mentoring programs, and master workshops. Classes are available live Online, throughout the US, and abroad. She is a full-time jewelry artist, Certified Metal Clay Instructor, author, and conference speaker. In addition, Holly holds a BS in Fine Art and Education. Her jewelry and articles on techniques and design can be found in over 75 regional and national publications including the Best of America Jewelry Artists; Named 3rd in Handmade Business: Top 12 Makers, Movers, and Shakers; Metal Clay Today; Art Jewelry and Lapidary Journal Jewelry Artist; Making Jewellery: among others. You can find more information about Holly’s jewelry, classes, and awards, along with numerous Metal Clay tips, tutorials, and blog on her web site at http://www.HollyGage.com

Peruvian Style Appliqué
Newbie Friendly

Bezel Setting Like a Pro
All levels

You can make so much with Metal Clay and your Kiln.

What are you going to make?

Whimsical Critters
Intermediate

Romancing the Stone
All levels

Holly's classes
https://www.hollygage.com/classes