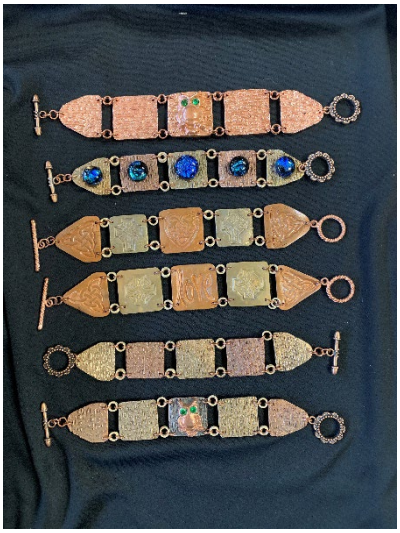
Copper & Bronze
The Other Metal Clays

By: Thomas J. Tessier



Equipment Used:

1. 100 gms of "Art Clay" Copper
2. 100 gms of "Metal Adventures Present" Bronze Clay
3. At least 20 18ga X 4mm copper jump rings
4. At least 20 18ga X 4mm bronze or gold-plated jump rings
5. One 18mm copper toggle clasp (or make your own)
6. #2 flat artist brush
7. A couple of 6-inch square Ceramic Tiles to work on or other work surfaces
8. Large roller frames, plastic slates, or playing cards
9. Clay roller of your choice
10. Clay pick for cutting clay
11. Clay cutter
12. Spatula
13. Course/Medium/Fine Fingernail sanding sticks
14. Heat source to dry clay – food dehydrator, electric grill, or air dryer
15. Heat source to sinter the clay – programable kiln preferable
16. Means to burnish project – large rotary tumbler or magnetic burnisher
17. Two pair of Flat Nose Pliers or Chain Link Pliers
18. Stone setting tweezers
19. Small drill press (or you can drill manually)
20. Metric drill (1.7mm)
21. Texture plates and/or leather stamps
22. Sanding Sponges (Fine, Superfine, Ultrafine & Microfine)
23. Metal metric ruler. At least 150mm in length
24. One or two stainless steel firing pans
25. Coconut Carbon for the firing pan(s)

26. 6-inch square firing screen
27. Water spray bottle with tap water (or distilled)
28. File folder
29. Utility knife

Optional:

30. Photopolymer plate equipment to make stamps
31. Texture plates
32. Certified calibrated pyrometer
33. "FoodSaver" Machine
34. Notebook & pencil

Introduction:

The purpose of this article is to present step-by-step instructions on how to make a copper & bronze panel bracelet with Copper & Bronze Clays. I will also address some of the technical issues and challenges involved with working with these clays. The same concepts can then be used to make other jewelry items with the clays. So why would you want to use these other clays? At the time of writing this article Gold Clay was selling for around $96.33/gram, Fine Silver around $2.40/gram, Sterling Silver around $1.92/gram, Copper Clay around $0.32/gram and Bonze $0.24/gram. If for no other reason, the cost of the clay is a big motivator.

Planning Your Layout

Like any other clay project, the first step is to decide what you are going to make and what it will hopefully look like when finished. Some artists like to make drawings, even if in the rough to get a visual image of what the ending result will look like. Sometimes I make a sketch and do any mathematical calculations in a notebook if the project is more involved. I also use a notebook to record things like the actual shrinkage of the clay versus what the clay manufacturers' state in their instruction sheets. I also record the actual firing schedules used, which sometimes vary greatly from what the manufactures recommends.

Since I'm going to make a panel-bracelet I will need a little more information. First, how big are the panels going to be? The smaller the panels, the more of them I'll need to go around the wearer's wrist. Speaking of the wearer, what's the circumference of the wearer's wrist? That is, how long does the bracelet need to be? That will determine how many panels we'll need. Simply use a soft measuring tape to measure the person's wrist (figure 1). If you don't have a soft measuring tape, simply use a piece of string to go around the wrist. Then measure the length of string needed to go around the wrist with a ruler. My wearer's wrist is 172 mm.

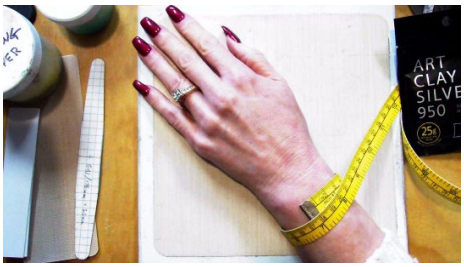


Figure 1

Another thing to take into consideration will be how the panels will be textured, if they are. You can use a texture sheet and roll the clay on to it. The texture sheet can be pretty much whatever you like. In the alternative, the panels can be stamped. Stamps you can make or purchase. I'll discuss this further on in this article.

The clays, findings, firing pans, coconut carbon, etc. I purchased at Art Clay World in Chicago (artclayworld.com). The stamps I purchased online from Tandy Leather (tandyleather.com).

A Little about the Clays

There are a number of manufactures of metal clay today. The instructions on how to use each is enclosed with the clay. Copper is one of the elements on the "periodic table." It is used in all kinds of manufacturing. The wires that run in the walls in your home and your appliances are copper wire. It's a great conductor of electricity and heat. Artists use it because of it's color, and low price. It also accepts enamel well. The melting point of pure copper is 1,984°F.

Bronze on the other hand is an alloy. That means it's made up of at least two metals. Usually Copper (82%) and Tin (12%). Other metals may also be added to change the characteristics of the alloy. Bronze and copper have been used by man for thousands of years. Bronze is used in making tools, in manufacturing gears and bearings, and a lot in marine applications. Again, artists tend to use this clay for it's color and low price. The melting point of bronze is around 1,742°F. This can vary if other metals are in the alloy.

Working with the Clays

Working with copper & bronze is very similar to silver clay. There are a few differences though. The first thing that you'll probably notice is that both clays are harder and stiffer than silver clay. You'll need to knead the clays with your thumbs and forefingers before using them. You may also need to spray them with a little water to soften them up. If you see any cracks in the soft clay, stop and add water. If any cracks are present they will only get worse when you dry the clay and will get much bigger when you fire the piece. Another thing unique to these clays is they actually become softer when cooled down in the refrigerator or freezer.

Both clays are stored in your refrigerator or freezer when not being used. Both clays can also react to the oxygen in the air over time. When storing them they need to be wrapped up tightly in plastic wrap and kept in an air-tight container with a little moisture present. You could use something like an empty baby food bottle and add a small sponge moistened with water. Then

there is a much better way. I use my FoodSaver machine and simply vacuum seal the clay (figure 2-3). No air and it's airtight so no moisture can escape!

Figure 2

Figure 3

When you need some clay, simply cut off one side of the bag. The unused clay can be returned to the same bag and resealed. Like silver clay you need to store the clay you are not working with in a humified clay keeper of some sort. A simple plastic bottle with a lid that contains a moistened sponge will work fine. I've gotten tired of screwing & unscrewing the lids, so I've improvised. I'm now using a butter dish (figure 4). I learned this from Pam East. You can buy the butter dish from Crate & Barrel for less than $4.00 online.

Figure 4

I also like using Japanese plastic wrap (figure 4), which is available from Amazon. It's heavier than the plastic wrap you buy in your grocery store. It's also the right width (15 cm) and comes in a 50 meters long roll. Probably enough to last you your lifetime.

Stamps & Textures

You can buy ready made stamps from a variety of sources. The stamps I used in this project were purchased from Tandy Leather online (figure 5). They can be purchased in sets or individually. You can also make your own stamps from photopolymer plates (figure 6). There's a great YouTube video that Pam East did that will walk you though the process of making your own stamps.

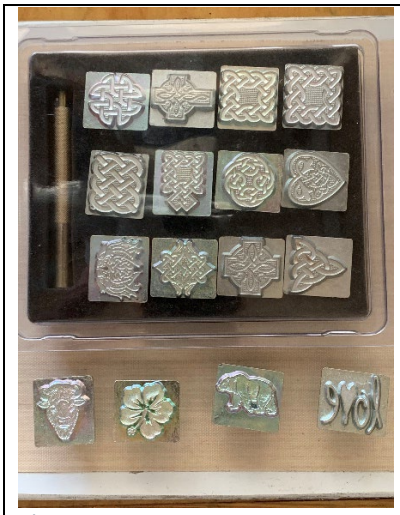


Figure 5

Figure 6

If you don't want to use stamps, you can simply roll your clay on to a textured surface. There are a few examples on the cover photo for this article.

Ready, Set, Go

Before you pull your clay out, set up your work area and have all your tools ready to go (figure7).

Figure 7

On my work area I have a 6 X 6 inch ceramic tile that I'm going to work on. You can buy these tiles at Home Depot for about 50 cents each. I like working on the tile because my needle tool and other cutting tools can't scratch the surface. Also it's rigid and I can pick it up and put the tile directly into the food dehydrator. On top of the tile I have a 1.5mm (6 card) clay rolling frame. I like using these rolling frames because you can roll the clay in any direction without having to readjust the spacing or move the clay before rolling. These and larger frames are available from CoolTools (cooltools.us). Also notice that I have the stamp ready to go and a cutting template (red frame at the top of the tile) that I made out of a piece of file folder. The frame is 32mm square on the inside. I choose 32mm because the panel needs to be big enough to contain the stamp with enough space to allow holes to be drilled on the outer edges (allow at least 2mm from the edge of the panel to the hole). I simply held up a metric ruler next to a stamp and eyeballed it.

I also placed reference marks on the frame so I could cut the tapered panels that go on the very end of the bracelet (Figure 8), Look at Figure 8 and note that I place a mark (arrow tip) 10mm down on each side of the frame. Then I placed marks 10mm in from the bottoms. When your frame is sitting on top of the clay and you cut from the points of the two left arrows, you'll have half of the taper (Figure 9). Then cut across the two arrow points on the right and you'll have the correct taper (Figure 10).

Figure 8

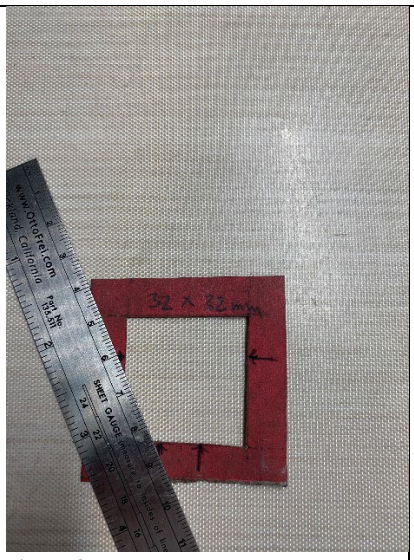


Figure 9

Figure 10

If you look closely you'll also notice that the tile has been coated with a little resist. In this setup I'm using Badger Balm and a toothbrush to apply it. Whatever resist you like should be fine. It doesn't have to be Badger Balm. Be sure to apply the resist to anything that will come into contact with the clay. Such as the tile, the stamp, the texturing plate if you're doing a texture, the needle tool, and a little bit on your fingers.

Next, take out some clay and knead it between your thumbs and forefingers. When it softens up and is kneading without showing any signs of cracking, make a little pancake and place it on your tile. Roll it out and again make sure you're not seeing any cracking (figure 11). If you see ANY cracking, STOP, pull up the clay and start over. Add water as needed to keep the clay soft and pliable.

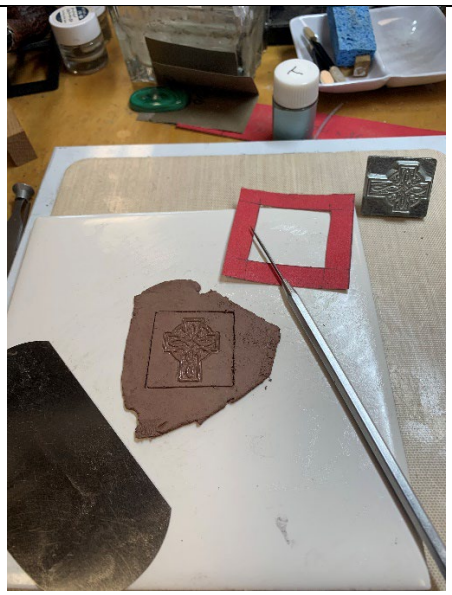


Figure 11

Once the clay is rolled out and crack free, use a stamp to make an impression. It will take a little practice to get a good clear impression. I usually push the stamp straight down, then carefully rock It in all four directions. Rock only slightly or the imprint will show shadowing. Once you're happy with the imprint, place the cutting frame over it and cut the panel out. Put the extra clay in your clay keeper. Now place the tile with your panel into the dehydrator to dry it (mine is set to 158°F). After 5-7 minutes see if it will easily slide on the tile. If so, slide it off on to the dehydrator's rack. Allowing it to dry from all sides is important to limit the warping. If you forget your panel on the tile it will turn into a potato chip. Set a timer if you need too.

While your panel is drying go make another panel and repeat the process. After all your tiles are dry it's time to clean them up. The first thing I do is square them up using a large rubber block and fingernail sanding sticks (figure 12). I personally like the "Tropical Shine" brand of fingernail files. They can be washed and cleaned with a nylon brush in your sink. They look like new when you're done. The edges of the block are at right angles, so use them to square up your panel. Once square I then use the files to round the four corners of the panel. You can leave them square, but I personally like rounded edges.

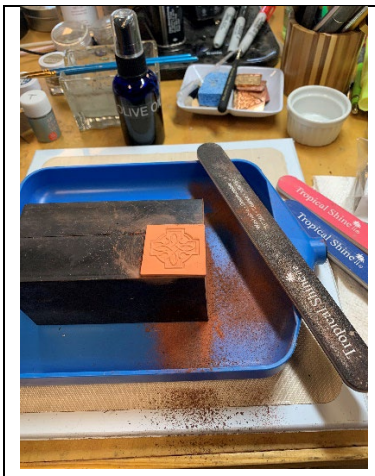


Figure 12

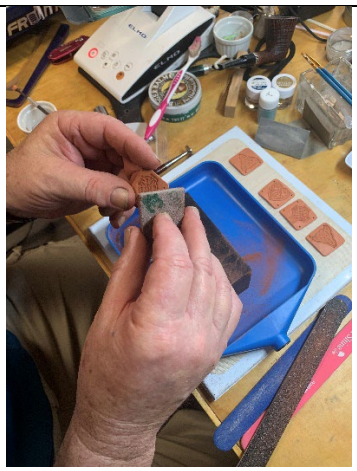


Figure 13

At this point you're ready to sand the back, front, and edges. Personally, I like to use 3M sanding sponges (Figure 13). You only need to use the Fine Grit (320-400) and Superfine Grit (500-600), but you can also use the Ultrafine (800-1000) and Microfine (1200-1500) if desired. The sponges can be washed and reused again like the fingernail files. Always use a separate set of fingernail files, metal files, and sanding sponges for your copper & bronze projects. That way you won't contaminate your silver clay projects.

Now that your panels are nice and smooth you're ready to drill the holes. Use at least a 1.7mm drill and a small drill press. You can drill the holes manually, but there are a lot of holes to drill. Small drill presses can be purchased for cheap at tool importers, like Harbor Freight. I have one, but I usually use my Foredom drill press accessory instead (figure 14).

Figure 14

Once you have all your holes drilled, you are ready to fire your pieces. The first time I fired my panels I learned a great lesson. They were all destroyed, even though I followed the firing schedules to the letter. I falsely assumed that when you buy a new kiln that it's already calibrated. That is, when the digital display is showing, say 1500, that it's 1500 degrees inside the kiln. WRONG. I was using one kiln for the copper panels and another for the bronze. The copper panels were seriously cracked and the bronze panels were warped and had bubbles on them. This come to find out, is a sign that the kilns are too hot. I have a calibrated pyrometer in my shop, so I decided to test these two kilns. I have a K2 Instruments pyrometer (figures 15-17). You can get one at Amazon for around $90.00.

Figure 15

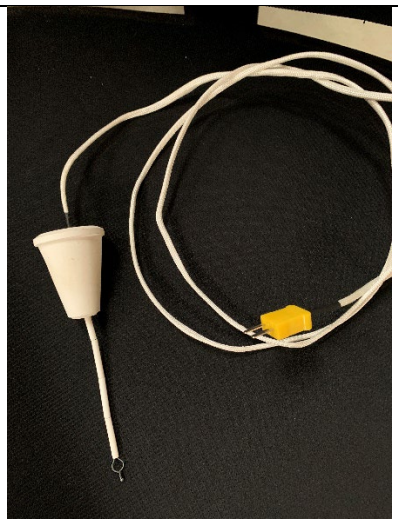


Figure 16

Figure17

The way you use the pyrometer is to set it up for a kiln. You can see in figure 15 that I removed the peep hole plug from the top of the kiln. Then Inserted another peep plug that I put a hole into with a diamond drill and ran the thermocouple from the pyrometer through it. I packed this peep plug with pieces of kiln blanket to hold the wire in place. I shoved it through far enough that the thermocouple would hang down inside the kiln midway (figure 16). That's were the kiln's thermocouple is located. Then you heat the kiln to a predetermined temperature. This kiln I ramped up full speed and set hold for one hour at 1500 degrees. After it reached temperature and settled in, I turned on the pyrometer. You can see in figure 17 that the kiln's display is indicating 1506, where in fact the temperature is 1531. If you are firing silver you'd never know the difference, but copper & bronze clays are very sensitive to temperature. Fortunately the display on the kiln can be adjusted. In the kiln's software there is a function called thermocouple offset. Through your kiln's keypad you can access the software and add or subtract to bring the display to the actual temperature. In this example the kiln is reading 25 less that what the actual temperature is. To fix this, go into the software and add 25 degrees to the display reading. Before the kiln cools off repeat the ramp up to 1500. Let it stabilize again and compare the readout to the pyrometer. If the difference between the kiln display and the pyrometer is within a couple of degrees your good to go. If not, go back and readjust the thermocouple offset. Over time, the kiln's thermocouple will vary in it's performance and you'll have to recalibrate it. This is normal (who would have guessed). How much you use your kiln will determine how often it has to be recalibrated. I'm going to check once a month and track the results in a notebook to determine just how stable the thermocouples in the kilns are.

Now we're ready to fire our panels. The copper & bronze have two totally different firing schedules, but both will be fired in coconut carbon for simplicity. Here are the schedules:

Art Clay Copper:

Place your copper panels on a stainless steel wire screen. Place them into your kiln and ramp full to 860°F and hold for 7 minutes. The panels will turn from their copper color (figure 18) to a dark grey (figures 19). This is called a "burnout." Your burning out the binder. Remove the screen from the kiln and allow the pieces to cool down. They don't have to be cold, just a little cooler so you don't burn yourself while transferring them to a firing pan (figure 20).

Figure 18

Figure 19

Figure 20

Figure 21

I've been removing the pieces from the wire screen with a pair of laboratory tongs while they are still fairly hot. In your firing pan add about 1 inch of the coconut carbon (figure 20). Add your panels and fill the pan up the rest of the way with the coconut carbon. Place the lid on and set the pan into the kiln on kiln posts. This keeps it off the bottom and allows better circulation of the heat around the pan (figure 21). Also be sure that the firing pan isn't touching the thermocouple in the back of your kiln. The closest thing to the thermocouple should be at least one inch away. Otherwise the thermocouple will be giving a false reading.

Program your kiln to ramp full to 1400°F, then hold for 4 hours. Allow the kiln and contents to come back to room temperature. I usually do these firings in the afternoon, so I can be around while the kilns are running and be sure they are off before heading to bed. The next morning everything is nice and cool and there's no chance of getting burned. Remove the pan and either dig out your pieces, or better yet pour the contents through a ¼ inch wire mesh screen (figures 22). I made this screen out of some scrap wood laying around and picked up some ¼ screen at Home Depot. I cut the screen to fit and stapled it in place with my shop stapler (figures 23-24).

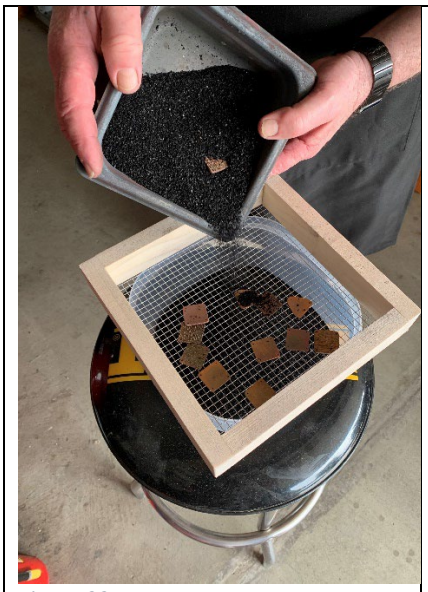


Figure 22

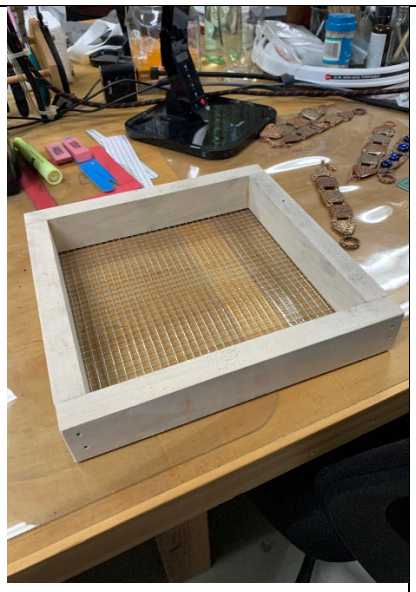


Figure 23

Figure 24

I made the frame 8 X 8 inches on the inside. This was the perfect size to sit on top of the Rubbermaid container I store the coconut carbon in.

Metal Adventure Presents Bronze Clay:

Place your bronze greenware directly into a firing pan on top of about an inch of coconut carbon like you did with the copper panels. Fill the pan up with the coconut carbon and place the lid on the pan. This time program your kiln to ramp up at 500°F per hour to 1550°F. Hold at that temperature for 2 hours. Let kiln cool back to room temperature. Remove your fired panels.

Now that you have all your panels fired, your ready to tumble them. I like using a barrel tumbler with stainless steel jeweler's mix. Any tumbler you may have should work. If you prefer, you can hand brush the pieces. I usually tumble for at least 2 hours in a barrel tumbler. Longer is better if you're not in a hurry.

Now that you have all your panels finished, it's time to assemble them. I'm using 18ga 4mm copper & gold plated jump rings. You can make your own, or for around $5-6 you can buy 100 that are ready to go. Simple choice. I've decided to run the copper jump rings through the panels, then run the bronze or gold plated jump rings, in pairs, through the copper jump rings (figure 25). Remember my wearer's wrist was 172mm in circumference. Add about 20mm to that and round the number. 172 + 20 =192, call it 190 more or less (figure 26). Just add copper jump rings to the ends to adjust the overall length. Let the wearer try it on, and re-adjust length if necessary (Figure 27).

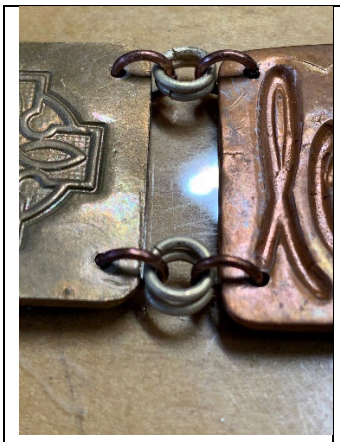


Figure 25

Figure 26

Figure 27

Other Little Secrets

There are a few more items of interest that I discovered while working with the various brands of copper & bronze clay. First of all, they all shrink differently from brand to brand. They also shrink differently depending upon the texture that you apply and the thickness of the panels. Sometimes they will shrink equally in height & width, and sometimes they will shrink more in width, depending upon the applied texture and the direction of the texture. Trial & error is the key. Keep detailed notes in your notebook of each project. Also keep in mind that bronze shrinks considerably more than copper. If you want your panels to all be the same size you'll need to take this into consideration. In this project I determined that the Art Clay Copper shrinks 12.5% (manufacture says 10.0%) and Metal Adventures Bronze shrinks 25% (manufacturer says 20%). If you cut all your panels the same size, then the bronze panels will come out smaller than the copper panels. If you take a close look at the third bracelet down on the cover photo, you'll notice that the bronze panels are a little smaller than the copper panels. All were cut at 32mm square. I think the varying sizes is interesting, but if you want all the panels to be the same when completed (like the fourth bracelet down), then you start with larger bronze panels. In this case 37mm square. The finished size of a copper panel, when starting with a 32mm square is 28mm. For the bronze to end up at this size you'd need to start with a 37mm square **(28mm / (1.00 - 0.25)).**

Another item of interest is attaching greenware to fired finished pieces. With fine silver & sterling silver it's not a problem. Simply add a little silver overlay paste, paste or syringe and stick them together. Dry and fire, no problem. Copper & bronze is another story. Greenware of either will not attach well to a finished piece. There's too much shrinkage, so the greenware as it sinters pulls away from the fired metal. I've tried attaching copper greenware to solid copper and bronze greenware to solid bronze. I've also tried attaching copper greenware to solid bronze and bronze greenware to solid copper. They just don't play well together. However, greenware to greenware works well, assuming it's copper greenware to copper greenware and bronze

greenware to bronze greenware. Look at the bottom bracelet in the cover photo. The center panel has an owl attached. I made the owl from a mold in copper clay, dried it, and attached it with copper paste to the copper greenware panel (Figure 28).

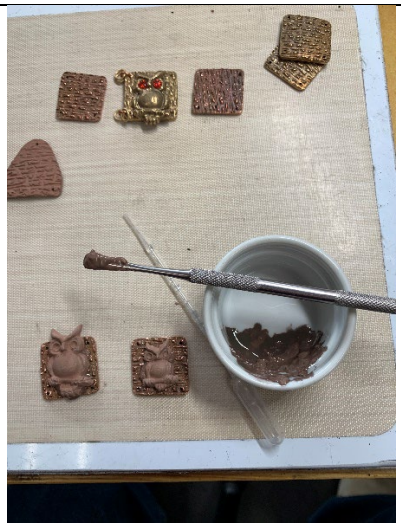


Figure 28

Note that copper and bronze clay don't come in paste or syringe form. You have to make your own paste. No problem, just take a piece of the clay in a small container and add water with an eye dropper and squish it up with a spatula until you get the consistency you want. Apply with the spatula and clean up with a small paint brush (like fingernail files & sanding sponges, only use the brush for copper & bronze).

Conclusion

You now have the "basics" for working with copper and bronze clays and how to avoid some of the problems. Have fun and a great Christmas!

Author:

Tom studied jewelry art at the Revere Academy of Jewelry Art in San Francisco, California in 2017 and graduated as a "Graduate Jeweler." Subsequent classes were taken at Silvera Jewelry School in Berkeley, California. One of those classes was an introduction to Art Clay, taught by Master Instructor Arlene Mornick. Additional Art Clay classes were taken with Arlene as well. In 2018, Tom received his Level One Certification and Senior Level Certifications. Tom teaches primarily in the Sonoma County area of California, one of the great grape growing areas in northern California. Tom's website and contact information is at: www.tessierjewelry.com

Artist Philosophy:

Discovering metal clay has been one of the greatest joys in my life. I'm just amazed at how easy it is to work with and what beautiful pieces can be created in a relatively short amount of time compared to traditional jewelry. It's like magic. I'm so looking forward to taking more art classes that can be combined with metal clay and teaching what I've learned to others.