



DELPHI
Be Creative!

DelphiGlass.com • info@delphiglass.com

To Order **800-248-2048** • Project Help Line **800-821-9450**

© Copyright 2010 Delphi Creativity Group.

Welcome to

BRONZclay™

&

COPPRclay™

BRONZclay™ bracelet
created by Celie Fago



An introduction to the
tools & techniques
for working with
BRONZclay™ and
COPPRclay™



The Next Step in the Evolution of Metal Clay

Welcome to the next step in the evolution of metal clay: BRONZclay™ and COPPRclay™! Both provide an incredible artistic range. And, because they're so affordable, they can be used to sculpt large pieces and create specialized tools—they can even be thrown on a potter's wheel to shape bronze and copper hollowware. Available in generous 100- and 200-gram blocks, BRONZclay™ and COPPRclay™ allow the artist to experiment with how far (and big!) designs can go.



BRONZclay™ bracelet created by Celie Fago

These clays can be pinched, rolled, sculpted and manipulated. In their dried state, they're still highly flexible and easy to carve—ideal canvases for applying details and finishing touches prior to firing.

When fired in a kiln (as outlined in this booklet), the binder vaporizes, leaving a solid, pure bronze or copper object that can be sawn, shaped, drilled, sanded, patinaed or soldered using traditional jewelry tools and techniques. And because COPPRclay is pure copper, it's great for jewelers and sculptors who enjoy applying enamels (follow the special firing schedule on page 9). These exciting products offer a new world of possibilities for jewelry-makers, artists and sculptors.

The Art of Metallurgy

Used as far back as 3500 BC and 6000 BC, bronze and copper respectively delivered more strength and durability than iron and commanded a higher price. Every day, bronze and copper artifacts are unearthed, still in excellent condition, still rich in color, full of history and representing an incredible combination of skill and art.

Growing up, Bill Struve, the inventor of BRONZclay™ and COPPRclay™, thought about being a physicist or maybe a psychiatrist, but he wasn't interested in math or medical school. Instead, he earned a doctorate in classical chemistry and a master's in electrical engineering, working 20 years in each field before embarking on a third career: art, in the form of metallurgy.

His desire to produce a new medium for his wife to use in creating strong, durable and wearable jewelry led Bill to experiment for countless hours to achieve success with BRONZclay™ and COPPRclay™. As Bill developed these clays, one of his goals was to keep their ingredients safe to use. Another was to keep the tools needed for working with the clays simple: nothing fancy, just the basics, a kiln and the artist's imagination. BRONZclay™ and COPPRclay™ would be gifts to the artist, new additions to the tool box.

Although Bill has earned many letters to follow his name, he considers those he ascribed to himself to be the most accurate: "P.M.H." (Philosopher, Maker, Helper). Striving for perfection, he achieved excellence in the form of a piece of clay—open to artistic opportunity, bursting with creative potential. Welcome to BRONZclay™ and COPPRclay™—it's time to play!

The Right Formula

BRONZclay™ consists of 11% tin, 89% copper, water and non-toxic binding materials; COPPRclay™ consists of pure copper, water and non-toxic binding materials. The binding materials vaporize completely during the kiln-firing process, leaving a solid bronze piece with a density 90% that of cast bronze, or a solid copper piece with a density over 95% that of cast copper. And, all copper used to make BRONZclay™ and COPPRclay™ is recycled!

Commercial Bronze and Copper vs. BRONZclay™ and COPPRclay™

BRONZclay™ is true bronze (although a bit less dense) and is composed of tin and copper, not the brass form that you see in most commercial bronze. COPPRclay™ contains pure copper metal.



COPPRclay™ earrings created by Patrik Kusek

Tips for Working with BRONZclay™ and COPPRclay™

BRONZclay™ and COPPRclay™, like any clay, are highly workable; but, because they are metal clay, they have their own characteristics as well. Here are some tips for working with BRONZclay™ and COPPRclay™:

- When you're not using the clay, keep it in a water-tight plastic container along with a wet sponge or wet paper towel (a take-out soup container works great!). Make sure the clay is not touching the sponge or paper towel.
- Rub a dab of olive oil on your hands and tools before you begin working with the clay.
- BRONZclay™ and COPPRclay™ tend to dry quickly. You'll notice the clay stiffening and cracking when it begins to dry. While working the clay, refresh it periodically with a small amount of water using a spray bottle or brush. You can also knead a small amount of olive oil into the clay to minimize stickiness and to improve pliability.
- Keep pieces wrapped in plastic and placed to the side when they are not actively being worked.
- Avoid using tools that absorb water.



COPPRclay™ and enamel pendant created by Pam East

Forming BRONZclay™ and COPPRclay™



Metal clay tool kit

Using simple tools and your own talented fingers, roll, press, form and sculpt BRONZclay™ or COPPRclay™ into any desired shape. Clay elements can be added, removed and refined as you go, making this a spontaneous and highly creative process. Keep the tips on page 3 in mind as you form your piece.

Suggested Hand Tools

One of the best things about BRONZclay™ and COPPRclay™ is that you can find tools to work these clays just about anywhere—around the house, in the studio, the kitchen, the office, the toy box and the great outdoors. In fact, you'll find yourself always on the look-out for everyday objects that can become the next great tool for enhancing your designs.

Basic Tools

Sheets of plastic or glass make terrific and portable work surfaces. Use Mylar® sheets, page dividers or plastic signs. Most artists start with the tools below:

- water dish with sponge
- paintbrush
- plastic rolling tube
- drinking straws
- rubber-tipped shaping tool
- playing cards (spacers)
- needle
- ruler
- nail brush
- knife
- toothpicks

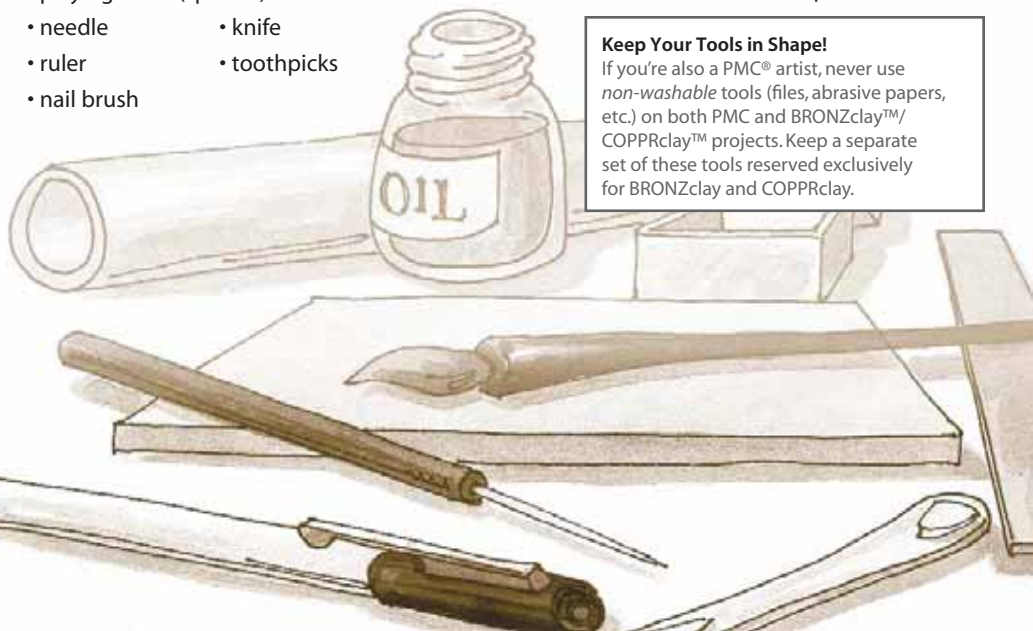
Specialty Tools

As your interest grows, you'll start adding tools to your collection. In addition to your own discoveries, you might find these useful:

- magnifiers
- stiff flat brush
- rubber stamps
- texture plates
- plastic design templates
- patina solution
- small chisels
- files
- tweezers
- tissue blade
- emery boards
- potter's wheel

Keep Your Tools in Shape!

If you're also a PMC® artist, never use *non-washable* tools (files, abrasive papers, etc.) on both PMC and BRONZclay™/COPPRclay™ projects. Keep a separate set of these tools reserved exclusively for BRONZclay and COPPRclay.



Basic Forming Techniques

- Rub a few drops of olive oil on your palms and tools before starting to keep them from sticking to the clay and to keep the clay moist.
- To make sheets, use a roller and stir sticks or two equal stacks of playing cards on each side of the lump to make a uniform thickness (thicknesses of 3–6 cards are typical for jewelry items).
- A knife, X-Acto® blade or playing card edge can be used to lift the pieces off the sheet.
- To join parts, set them close together and apply a drop of water and slip with a pointed brush. Let the water penetrate for a few seconds, then firmly press the parts together and hold them in place for several seconds.
- To achieve textures, press the clay against a rough surface or roll the surface over a sheet of clay. Even simple objects such as bottle caps create interesting trails, and leaves, bark and wood offer many possibilities.
- One way to make a pendant bail is to roll out a slender rod and form it into a loop. Cut off the ends to make a solid attachment, moisten with water and press it into position.
- To make rings, wrap enough wide tape around a dowel to create a form of the correct size (remember to allow roughly 20% for shrinkage). Cover the form with plastic wrap and create your ring. When it is finished (and preferably before the clay dries), slide the ring off.

Note: If the clay becomes dry as you work, spray or brush on a little water (not too much!) and cover it with plastic wrap for a few minutes to allow it to rehydrate. If you add too much water, just set the clay aside, loosely wrapped, and allow it to dry out. You can also knead a small amount of olive oil into the clay to prevent stickiness and to keep it pliable.



Use stirring sticks as a thickness gauge.



Use a sharp edge to cut the clay.



Use just about anything to add texture.

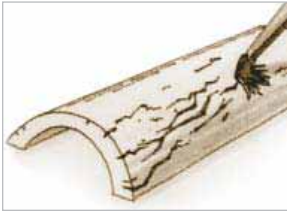


Roll out a slim rod to form a bail.



BRONZclay™ necklace created by Jeanette Landenwirth

Making and Using Slip



Use slip to fill small cracks that can appear as the piece dries.



Use slip to fill between elements.

Making Slip

Slip will quickly become one of your favorite tools for working with BRONZclay™ and COPPRclay™, and it's easy to make. Simply mix tiny pieces of clay (filings, small fresh or dried pieces, etc.) with water (we recommend distilled water) until you reach a toothpaste consistency. Keep your slip stored in a sealed container; stir before using.

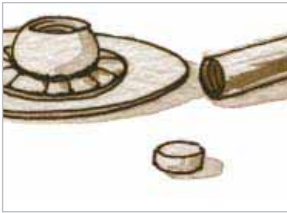
Making Repairs

Because of their strength, BRONZclay™ and COPPRclay™ slips are suitable for attaching parts, repairing breaks and reinforcing delicate areas such as the point where a loop attaches to a pendant.

Transitioning

Use slip to fill between elements when creating an organic effect.

Adding Stones



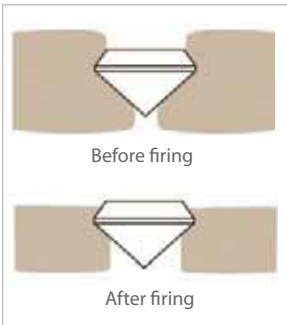
Create a seat to hold a faceted stone.

Add CZs or certain lab-created stones to BRONZclay™ and COPPRclay™ to add design versatility. Because these particular gems are composed of laboratory-grown corundum, spinel or CZ, and are created at very high temperatures, they will not be damaged during firing. We do not recommend firing precious natural stones, most glass objects or any organic material such as pearl, opal, bone, shell and wood.

Important: Never fire a doublet.

To Set a Small Faceted Stone

1. Prepare a seat or rim that will provide enough metal to surround the stone. This can be added to a completed form or built into the original design.
2. Make a conical hole with a pencil point or similar tool.
3. Use a straw or similar tool to remove clay from beneath the stone.
4. Set the stone in place and press it down until the table is below the surface of the work. Remember that the clay around and under the stone will contract, squeezing the stone upward.
5. Fire as usual; cool in the oven to prevent thermal shock.
Important: Pieces embedded in activated carbon will remain hot for several hours; do not remove them until you can comfortably hold your hand just above the firing pan.



Set the stone deeply into the clay to compensate for shrinkage.

Making Molds and More

BRONZclay™ and COPPRclay™ lend themselves easily to working with molds you make yourself or with commercially made molds. Molds allow for repeated elements and the production of multiples. Hollow forms allow your work to be light. Here are some ideas for molds:

Soap

A simple way to get started is to carve a pattern into a bar of soap. Press the clay into the depression, peel it away, and you have a molded form. If you don't like the result, re-work the carving and try again. Need a dozen? It's a simple matter of repetition.

Rubber Molds

Hobby shops sell a variety of molds intended for candy, candles and plaster. Specialty kitchen shops may be a good source for interesting cookie, butter or gelatin molds. All will work for BRONZclay™ and COPPRclay™.

To make your own molds, buy a two-part silicone mold compound (such as Cold-Mold™, shown below). Most molds do not need lubrication, but if the clay sticks, spray the mold lightly with an aerosol cooking oil.



Combine equal parts of Cold-Mold™ silicone compound into a flexible putty that you can use to create your mold.

Cold-Mold™ compound, 1 lb.

Drying BRONZclay™ and COPPRclay™



BRONZclay™ earrings created by Yvonne M. Padilla

You will need to dry your BRONZclay™ and COPPRclay™ pieces thoroughly before firing to prevent moisture in the clay from expanding and creating defects during firing.

To dry the piece, gently place it on a warming surface such as a coffee mug warmer or a vegetable dehydrator.

When dry, the clay will be leather-hard, making it flexible and amenable to finishing touches such as filing, drilling, sanding and carving. After firing, this work is more time-consuming, so take advantage of this pre-fired stage to do as much of your detailed finishing work as possible.

Firing BRONZclay™ and COPPRclay™



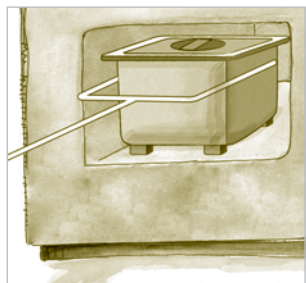
120-volt kiln



Firing pans
7" x 6 1/2" x 4"
7" x 6 1/2" x 2 1/2"

Coal-based, acid-washed carbon

Coconut shell-based carbon



The stainless steel lifting fork is ideal for removing a hot firing pan from your kiln. Gently slide the fork tines around the bottom half of the firing pan and lift the fork until the tines engage the lip at the top of the pan. Carefully lift the pan from the kiln and set it on a heat-resistant surface to cool. **Note:** The fork will only fit around the narrow side of the firing pan.

Firing BRONZclay™ and COPPRclay™ is a process that uses low heat to prepare the kiln's atmosphere and vaporize the binder and high heat to sinter the alloy. BRONZclay and COPPRclay™ must be fired in a kiln. During firing, the non-toxic binder vaporizes, leaving a solid, pure bronze or copper object. **Note:** Make sure your piece is completely dry before firing; it's not a problem for the piece to dry for weeks before firing, but firing a piece while it's still damp can cause the moisture to expand, creating blisters.

To reduce oxidation, the clay piece(s) must be surrounded by activated carbon during firing. On BRONZclay™, the coconut shell-based carbon (#703-205) tends to produce a natural terra cotta color; the coal-based, acid-washed carbon (#703-204) can produce a colorful, more intense range of patinas, but may not sinter as well and lead to a weaker piece. **Important:** COPPRclay™ can be fired *only* in the coconut shell-based carbon; do not fire it in the coal-based carbon as the piece will not sinter properly and may break easily.

To Fire BRONZclay™ or COPPRclay™:

- 1) Spread 1" of activated carbon granules on the bottom of a stainless steel firing pan (#703-202, #703-206). *Remember, COPPRclay™ can be fired only in the coconut shell-based carbon.*
- 2) Place the piece on top of the layer; if firing two or more pieces, leave at least 1/2" between pieces; leave more if the pieces are larger. **Note:** Most front-loading kilns are cooler in the front near the door, so the front of your firing pan will be cooler than the back and sides. To compensate for this, place pieces closer to the sides and back of the firing container. If you're using a top-loading kiln, there's no need to adjust. Avoid the front of the pan when using a front-loading kiln.
- 3) Pour more activated carbon granules on top of the piece until the container is full, making sure there is at least a 1" layer of granules on top of the piece. If you are firing several pieces in layers, make sure there is at least 1" of space between the vertical layers as well.



Stainless steel fork; 36"L

Firing BRONZclay™ and COPPRclay™ (continued)

- 4) Cover the firing pan with its lid and place it in the kiln on 1" stilts to allow good heat circulation. Fire clay according to the firing schedules shown below:

BRONZclay™ Firing Schedule:

For pieces 1.7–1.75mm (6 cards) thick or less: Ramp at 500°F/hour (278°C/hour) to 1550°F (843°C) and hold for 2 hours (total firing time, including ramp-time, will be between 4 and 5 hours).

For pieces thicker than 1.7–1.75mm (6 cards) and less than 10mm: Ramp at 250°F/hour (139°C/hour) to 1550°F (843°C) and hold for 3 hours (total firing time, including ramp-time, will be about 9 hours).

Note: The firing schedule for thicker pieces will work fine for thin pieces should you have both thicknesses in your firing pan.

COPPRclay™ Firing Schedule (for pieces that will *not* be enamelled):

Regardless of thickness (embedded in coconut shell-based activated carbon): Ramp at full speed to 1700°F (927°C) and hold for 3 hours (total firing time, including ramp-time, will be about 4 hours).

COPPRclay™ Firing Schedule (for pieces that *will* be enamelled):

If you plan on enamelling your fired COPPRclay™ piece, follow the two-phase firing schedule below using **only the coconut shell-based activated carbon**:

Phase 1 (open-shelf fire)

For pieces 3mm thick or less: Place the piece directly on the firing shelf. Ramp at 500°F/hour (278°C/hour) then hold at 560°F (293°C) for 15 minutes.

For pieces thicker than 3mm: Place the piece directly on the firing shelf. Ramp at 200°F/hour (93°C/hour) then hold at 560°F (293°C) for 15 minutes.

Phase 2 (sintering)

Regardless of thickness: Embed the piece in coconut shell-based activated carbon inside a firing pan. Ramp at full speed to 1750°F (954°C) and hold for 3 1/2 hours. Allow the piece to cool naturally inside the kiln.

Warning! The firing pan will be extremely hot; do not touch! Allow the pan to cool completely before removing the lid. We recommend wearing heat-resistant gloves such as 12" welding gloves while removing the firing pan.

- 5) The firing pan should be allowed to cool completely before removing it from the kiln; however, if you need to use your kiln again right away, you can move the pan to a heat-resistant surface (e.g.: a soldering pad or ceramic tile) and allow it to cool there.
- 6) Once the firing pan and carbon have cooled (you can hold your hand just above the firing pan comfortably), remove the pieces from the carbon bed and place them on a heat-resistant surface to finish cooling. You can re-use the activated carbon until you notice it starting to break down (broken grains and a sooty appearance). **Note:** If there are no stones embedded in the piece, it can be quenched in water at this time.

Finishing BRONZclay™ and COPPRclay™



BRONZclay™ bowls created by Jeanette Landenwich



Set of three burnishers



Spectrum™ polishing papers



Steel bristle brush



Rotary tumbler; 1 qt.

Once fired, the BRONZclay™ or COPPRclay™ pieces are solid metal and, like any other metal, they can be sawn, drilled, sanded, patinaed or soldered using traditional jewelry tools and materials. Fired COPPRclay™ can also be enamelled; make sure to follow the required firing schedule on page 9.

Hand-Burnishing

Perhaps the most basic (and rewarding) way to polish BRONZclay™ and COPPRclay™ is to rub it with any hard, smooth object. Commercial burnishers offer a time-tested tool shape held in a comfortable handle, but you can use knitting needles, teaspoons or polished wood nails. Rub the piece in all directions to bring out a shine. Follow this with a polishing cloth to smooth away burnishing marks.

Spectrum™ Finishing Papers

The screen mesh structure of Spectrum™ finishing papers resists loading to increase their effectiveness and help extend service life. Each sheet is reversible, doubling its useable surface area. The synthetic fiber backing of carefully graded white aluminum oxide abrasive can be used wet or dry and is especially effective on BRONZclay™ and COPPRclay™. Sheets measure 8 1/4" x 11".

Scratch-Brushing

Brushes made from very thin stainless steel wires can be used to burnish BRONZclay™ and COPPRclay™. Lubricate the brush with any sort of soap and work under a slow drizzle of water. Scrub in all directions. Scratch-brushing can be used in conjunction with any other technique.

Mass Finishing

A rotary tumbler is a mechanical device in which hundreds of steel balls and rods cascade against jewelry objects as they rotate in a drum like a miniature clothes dryer. Using this method, many pieces can be finished at once with minimal individual handling. A magnetic finisher with steel pins is also a very effective choice.

Health & Safety

Safely Working With BRONZclay™ and COPPRclay™

Issues of safety do not arise from BRONZclay™ and COPPRclay™ themselves, but rather in the firing/sintering process due to the use of high-temperature kilns. Kilns should be positioned on a sturdy, stable surface, away from combustible materials, with a foot of open space on all sides. Take special precautions if the kiln is in an area where animals or young children may come in contact with it.

The binder in BRONZclay™ and COPPRclay™ is non-toxic, and no toxic fumes will be present during firing. Though rare, it is possible for some individuals to experience some sensitivity to BRONZclay™ and COPPRclay™. We recommend wearing a dust mask while working with the activated carbon. Use a nail brush to clean hands and nails after working with the clay.

As always, when working around high heat, wear appropriate clothing and avoid loose or dangling clothes and clothes made with synthetic fabrics. There is little reason to look into a hot kiln for any length of time, but if you do, wear appropriate eye protection; we recommend our kiln safety glasses. Please access and read the online MSDS for BRONZclay™ at bronzclay.com and for COPPRclay™ at copprclay.com.

Storage & Shelf Life

BRONZclay™ and COPPRclay™ are sealed in air-tight foil packages to preserve their freshness. Keep the clay inside the package, and keep the package in a water-tight plastic container (a take-out soup container works great!). Add a wet sponge or wet paper towel to the container, making sure the clay doesn't touch the sponge or the paper towel. Use the original package or a good-quality plastic wrap to keep your clay moist. It is good practice to take out only what you will use within a few minutes and to add a few drops of water to the lump at the end of each work session. BRONZclay™ and COPPRclay™ can be rehydrated if they dry out, though it can be difficult to achieve the homogenous consistency of fresh BRONZclay™ and COPPRclay™. To restore dry material, pierce the lump with several holes or dice it into small pieces. Add water and knead, then seal the clay and water in a water-tight container in a hydrated atmosphere such as a humidifier. Set the container aside to allow the water to penetrate; allow at least one full day, more if the clay was very dry. With the clay still wrapped in plastic, knead repeatedly to force the water into the dense metal structure. If you find you have added too much water, spread the clay on a piece of plastic, glass or waxed paper and allow it to dry to a useable consistency.



BRONZclay™ pendants and components created by Yvonne M. Padilla

Many illustrations are copyrighted by Jeff McCreight and reprinted here courtesy of Brynmorgen Press.