Welcome to BRONZclay™ & COPPRclay™

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

BRONZclay™ bracelet created by Celie Fago
Welcome to the next step in the evolution of metal clay: BRONZclay™, FASTfire BRONZclay™, COPPRclay™ and WHITE COPPRclay™! All 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 create hollowware. Available in generous 100- and 200-gram blocks, BRONZclay™ (original and FASTfire) and COPPRclay™ (original and white) allow the artist to experiment with how far (and big!) designs can go.

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 original 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

Bronze and copper, used as far back as 3500 BC and 6000 BC 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™, FASTfire BRONZclay™, COPPRclay™ and WHITE COPPRclay™—it’s time to play!
The Right Formula
Each of these metal clays contains water and non-toxic binding materials. In addition, original BRONZclay™ consists of 11% tin and 89% copper; FASTfire BRONZclay™ consists of 10% tin and 90% copper; original COPPRclay™ consists of pure copper; WHITE COPPRclay™ consists of a proprietary blend of nickel and copper. The binding materials vaporize completely during the kiln-firing process, leaving a solid bronze piece with a density 90% that of cast bronze, a solid copper piece with a density over 95% that of cast copper, or a solid nickel/copper alloy piece. All of the copper used to make BRONZclay™ and COPPRclay™ is recycled material.

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. Original COPPRclay™ contains pure copper metal.

Tips for Working with BRONZclay™ and COPPRclay™
BRONZclay™, FASTfire BRONZclay™, COPPRclay™ and WHITE COPPRclay™ each have their own special characteristics. 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.
Welcome to BRONZclay™ & COPPRclay™

Using simple tools and your own talented fingers, roll, press, form and sculpt BRONZclay™, FASTfire BRONZclay™, COPPRclay™ or WHITE 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™, FASTfire 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.

Just the Beginning . . .
The list below is just a small sample of the tools you can use on BRONZclay™ and COPPRclay™. See your Rio Grande catalog or visit riogrande.com for a wide selection of hand tools to add to your tool box!

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; many are available from Rio Grande:

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

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; many are available from Rio Grande:

• 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.

800.545.6566 www.riogrande.com
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 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.
Making and Using Slip

Making Slip
Slip will quickly become one of your favorite tools for working with BRONZclay™, FASTfire BRONZclay™, COPPRclay™ and WHITE 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™, FASTfire BRONZclay™, COPPRclay™ and WHITE 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
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 or other assembled stone.

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.
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Making Molds and More

BRONZclay™, FASTfire BRONZclay™, COPPRclay™ and WHITE 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

To make your own molds, buy a two-part silicone mold compound (such as Rio Cold-Mold™, shown below). Most molds do not need lubrication, but if the clay sticks, spray the mold lightly with Cool Slip or other metal clay release.

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™.

Drying BRONZclay™ and COPPRclay™

You will need to dry your BRONZclay™, FASTfire BRONZclay™, COPPRclay™ and WHITE 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™

Firing BRONZclay™, FASTfire BRONZclay™, COPPRclay™ and WHITE COPPRclay™ is a process that uses low heat to prepare the kiln’s atmosphere and vaporize the binder, followed by high heat to sinter the alloy. BRONZclay and COPPRclay must be fired in a kiln. To reduce oxidation, the clay piece(s) must be surrounded by activated carbon during firing. The coconut shell–based carbon and the coal-based, acid-washed carbon tend to produce a subtly different range of patinas.

**IMPORTANT:** Original COPPRclay™ and FASTfire BRONZclay™ can be fired only in the coconut shell–based carbon; the piece will not sinter properly in the coal-based carbon and may break easily.

During firing, the non-toxic binder vaporizes, leaving a solid, pure bronze, copper, or nickel/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 Fire BRONZclay™ or COPPRclay™:**

1. Spread ½”–1” of activated carbon granules on the bottom of a stainless steel firing pan (see **IMPORTANT** note above).
2. Place the piece on top of the layer; if firing two or more pieces, leave at least ½” between pieces, more if the pieces are larger. **Note:** Most front-loading kilns are cooler in the front near the door. To compensate for this, place pieces closer to the sides and back of the firing container, avoiding the front of the pan. If you’re using a top-loading kiln, there’s no need to adjust.
3. Pour more activated carbon granules on top of the piece, 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.
4. Cover the firing pan with its lid and place it in the kiln on stilts to allow good heat circulation. Fire clay according to the firing schedules shown on the facing page.

**Warning!** The firing pan will be extremely hot; do not touch! Wear heat-resistant gloves, such as Rio 12” heat-resistant gloves, while removing any hot firing pan from the kiln. Allow the pan to cool completely before removing the lid.
5. If you need to use your kiln again before the pan has cooled completely, wear protective gloves and move the pan to a heat-resistant surface (e.g.: a soldering pad or ceramic tile) and allow it to cool there.
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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.

FASTfire BRONZclay™ Firing Schedule:
Regardless of thickness (embedded in coconut shell–based activated carbon): Ramp at full speed to 1525°F (829°C) and hold for 1 hour (total firing time, including ramp-time, will be about 2 hours). If you discover that your pieces are not sintering properly, try raising the firing temperature by 50–100°F. IMPORTANT: Test fire a piece of FASTfire BRONZclay™ to ensure you have the optimal firing temperature before firing your designs. Please Note: Use a slotted lid on the firing pan.

COPPRclay™ Firing Schedule (for pieces that will not be enameled):
Regardless of thickness (embedded in coconut shell–based activated carbon): Ramp at full speed to 1700°F–1800°F (927°C–982°C) and hold for 3 hours (total firing time, including ramp-time, will be about 4 hours). Most firings perform well at 1700°F. However, if you discover that your pieces are not sintering properly, try firing them at 1800°F. Please Note: Blistering may occur at 1800°F; if this occurs, slightly decrease the firing temperature.

COPPRclay™ Firing Schedule (for pieces that will be enameled):
If you plan on enameling 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 (embedded in coconut shell–based activated carbon): Ramp at full speed to 1750°F (954°C) and hold for 3½ hours. Allow the pan to cool in the kiln.

WHITE COPPRclay™ Firing Schedule (see table on back cover):
For best results, do not fire more than 100 grams of clay at once; overloading may cause poor sintering.

Phase 1 (open-shelf fire)—Place dried piece(s) on a stainless steel mesh rack inside the kiln. Fire with a ramp of 500°F/hour (270°C/hour) to 600°F (320°C), and hold for 10 minutes.

Phase 2 (sintering)—Regardless of thickness (embedded in activated carbon): Ramp at full speed to 1850°F (1010°C) and hold for 2 hours. Allow the pan to cool in the kiln.

6. Once the firing pan and carbon have cooled (you can comfortably hold your hand just above the firing pan), remove the pieces from the carbon and place them on a heat-resistant surface to finish cooling.
You can re-use the activated carbon until the grains begin to break and its appearance becomes sooty.
Note: If there are no stones embedded in the piece, it can be quenched in water at this time.
Finishing BRONZclay™ and COPPRclay™

Once fired, BRONZclay™, FASTfire BRONZclay™, COPPRclay™ and WHITE 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 enameled (follow the firing schedule on page 8).

Hand-Burnishing

Perhaps the most basic (and rewarding) way to polish BRONZclay™ or COPPRclay™ pieces is to rub them with any hard, smooth object. Commercial burnishers offer a time-tested tool shape held in a comfortable handle, but you can also 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.

Tri-M-Ite™ Polishing Papers

With 3M micron-graded abrasives, you remove a controlled amount of material, leaving a more consistent finish after each grade of abrasive. This soft, cloth-like Wet or Dry™ Tri-M-Ite™ material is ideal for interior shapes and for polishing just about any contoured surface—it is especially effective on BRONZclay™ and COPPRclay™. Sheets measure 8½” 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.

Mechanical Finishing

Flex shafts and micro-motors are hand-held mechanical devices that accept a wide variety of shaping, smoothing and polishing tools, ideal for finishing pieces individually with precision and close control.
Health & Safety Considerations

Issues of safety do not arise from BRONZclay™ and COPPRclay™ themselves, but rather in the firing process due to the use of high-temperature kilns.

- **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.

- **Binder**—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.

- **Nickel Content**—WHITE COPPRclay™ is an alloy made with nickel and copper. Please be aware that nickel can produce allergic reactions in some people; your customers should be made aware that pieces made with WHITE COPPRclay contain nickel. For makers in the European Union: Please be aware that this item contains nickel and may not be in compliance with EU regulation EN1811-2011.

- **Attire & Safety Equipment**—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 kiln safety glasses (see your Rio Grande Tools & Equipment catalog or visit riogrande.com).

- **MSDS**—Please access and read the online MSDS for BRONZclay™ and for COPPRclay™ at riogrande.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 humidor. 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.

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See your Rio Grande Gems & Findings and Tools & Equipment catalogs for BRONZclay™ and COPPRclay™ products, tools and supplies. Call toll-free 800.545.6566 or visit riogrande.com to order.
### WHITE COPPRclay* from Metal Adventures

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All dried clay was fired in air on a metal screen; ramp speed 500°F/hr. to 600°F, hold for 10 min. (278°C/hr 316°C, hold for 10min.); then fired in carbon as shown above.