

Joining, Attaching, Repairing, and Mounting Claywork

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Much of the challenge of working with clay is in the joinery, connecting or attaching parts. We also frequently need to repair or mount ceramic components. The following is by no means all-inclusive, but I have tried to include practical guidelines for most situations you might encounter.

With utilitarian clay forms, the assumption is that all attaching and assembling is done before the firing, but with non-utilitarian sculptural forms, almost anything goes. With large, complex pieces, it often makes sense to finish-fire them in separate component parts and then assemble with adhesives after the firing.

The issue of repair should be approached carefully. Elaborate sculptural forms are usually worth repairing at any stage of creating and firing. With utilitarian vessels it is usually not worth the time to repair a damaged fired piece except in the case of very special or antique pieces. Utilitarian forms that have been glued or otherwise repaired after the firing can never be sold as “firsts.” It would be unethical to ever sell a glue-repaired piece without telling the buyer of the repair. Generally, in the time it takes to repair a damaged utilitarian piece, you can make another one and learn more from the process.

Joining Wet, Damp, and Bone-Dry Clay

If you put clay in the hands of young kids and tell them to make something, without giving further instruction, they will experiment and discover that clay sticks simply by pressing the pieces together. But in reality, pressing pieces of clay together adheres them only temporarily, and creates a perfect fracture plane that will most likely fall apart later on. In order to attach clay components effectively, the clay platelets must be intermingled along the joint, and there are a number of ways to achieve that. In most traditional coil-building methods, the coils are smeared together without scoring or slurry. When done properly, that produces a very strong connection. For most other camp-clay connections, we generally use slurry. The standard medium for wet-joining clay is a slurry made from the claybody, and it works best with a bit of vinegar added (about a tablespoon per cup of slurry).

Making Joining Slurry

With a good hand-blender or a drill-impeller mixer, you can make slurry by dropping small wads of clay into a bucket with a little water in the bottom, mixing constantly. That is messy because the slurry often splatters, and it is difficult to eliminate all the lumps. It's just easier to start with dry scraps of clay, even if that means cutting thin slices off a new block of clay, and letting them dry completely. Once bone-dry (don't try this until they really are bone-dry), place the scraps in a bucket and immerse in water, making sure that all the scraps are completely covered with water. When clay dries, it shrinks. When you generously re-wet dry clay and the water absorbs, the opposite happens. The water forces the particles apart, and the clay disintegrates. Leave the clay

immersed in water overnight. The next day, pour off the clear water from the top, and then blend with the hand-blender or drill-impeller mixer until smooth and lump free. Add vinegar, and then add water if necessary to get slurry to ideal working consistency, blending thoroughly (the stainless-steel “Jiffy-Mixer” brand of drill-impeller mixer works best and is well worth the money – the model HS-2 is appropriate for small mixing jobs such as mixing up to two gallons of slurry or slip. For mixing glazes in five-gallon buckets, the model ES is best, but it’s too large for small jobs).

Joining Wet and Leather-Hard Clay

As a general rule, when joining wet clay to leather hard, such as when adding a handle to a mug, score the leather hard surface but not the wet clay. Always score thoroughly – there should be no unscored clay visible in the scored area – the surface should appear almost “fuzzy.” Apply slurry to the scored area and work the wet clay piece against the joint to ensure that the platelets have mingled thoroughly.

Choice of scoring tools makes a big difference. The ideal tool is a serrated rib such as the stand Kemper S-10 kidney-shaped serrated rib. That rib can be cut into smaller pieces with a pair of sheet-metal sheers in order to make mini-ribs for accessing tight places. The Mudtools model SSL-18 is the best serrated rib I have found, and it’s shape allows reaching into tight places.

I tend to stay away from scoring tools with sharp wire or needle points. Unless you use them with an extremely light touch, they cut deeply into the clay. The slurry will not penetrate those deep cuts, trapping bubbles along the joint.

When joining two leather-hard components, score both surfaces thoroughly, generously apply slurry to one surface, and press the two parts together. Be sure to avoid doing anything that might flex the joint after attaching, because that will likely weaken or break the connection. Don’t skimp with the slurry. Apply plenty and then clean off the excess after pressing the parts together. Part of the objective is to expel all air bubbles from the joint, and that will happen if you use plenty of slurry. If you skimp with slurry, air bubbles can be trapped along the joint. In firing those bubbles can easily cause the piece to pop apart at the joints.

For wet-joining troublesome claybodies, especially porcelain, a thin slip prepared with the dry claybody and vinegar often works better than slurry. In some cases, pure vinegar by itself works well. Experimentation with your claybody to see what works best.

In place of slurry in joining plastic clay, Lana Wilson advocates the use of *magic water*, made by combining 1 gallon of water, 3 tablespoons of liquid *sodium silicate*, and 1½ teaspoons *soda ash*. This has become popular among many porcelain-workers and works especially well when the clay is quite wet. Apply magic water to one surface with a brush without scoring and join with a wiggling motion to encourage interlocking of the platelets at the contact surface.

There is some confusion about these methods, since a vinegar slip or slurry is flocculated, while magic water is deflocculated. You would expect opposite effects, but they both work for different reasons. A flocculant like vinegar or Epsom salts causes particles to attract, improving adhesion in the vinegar slip. A deflocculant like sodium silicate or soda ash causes the particles to repel one another. Brushing on magic water seems to “loosen up” the platelets at the contact surface, causing them to interlock, especially with the assistance of a wiggling motion while joining.

Joining or Repairing Dry Greenware (Unfired Clay)

A popular dry-greenware joining or repair medium known as *s poooze* is the invention of the late Canadian potter Peggy Heer. Combine equal parts vinegar and corn syrup and thicken with powdered claybody (the same claybody as the one you wish to repair) to the desired slurry consistency. A few drops of peroxide will retard the growth of mold over time. This repair medium works well, and is capable of filling gaps and fissures. Before applying *s poooze*, moisten the adjacent areas with vinegar.

The capabilities of paper clay are legendary, but a paper-clay slurry can be used to repair almost any dry claybody. Make paper pulp from toilet paper as per the instructions in the “Making Paper Clay” handout. Combine equal parts-by-volume damp paper pulp and powdered claybody and add pure vinegar to achieve desired slurry consistency. Don’t add any water other than what remains in the paper pulp. The resulting slurry is essentially “pickled” and keeps for years without spoilage. In use, moisten connecting surfaces with pure vinegar, lightly score, apply paper clay slurry, and join the parts. Don’t waste your time repairing a broken mug handle. Reserve this medium assembling sculptural work or for repairing large or complex clay forms in which you have invested a lot of time.

Joining or Repairing Bisque-Fired Clay

After bisque firing there are still a number of options for repairing breaks or filling cracks or voids. If a broken piece will sit in place by itself, glaze the contact surface and fire the piece, permanently attaching the sections together. Saturate the contact surfaces thoroughly with water, apply glaze, and immediately press the parts together. If you attempt this without saturating the surfaces, the glaze will start drying immediately upon contact and you will not get a tight joint. Let the piece dry completely and then handle carefully while glazing.

If a sculptural piece is cracked but not broken, saturate the area around the crack with water and feed an appropriate glaze into the crack with the tip of a paintbrush. The glaze will wick into the moistened crack as the water soaks into the adjacent porous clay. Keep feeding glaze into the crack until it will take no more, and then clean off any glaze residue from the surface. Let the piece dry completely and then glaze in a normal fashion.

High-temperature refractory cement such as A.P. Green Greenpatch 421 can be used to repair broken pieces or to fill cracks and voids. In most cases, refractory cements fire quite dark. On a piece that is already dark in color this is not a problem. In other cases, the repair can be finished

with a thick coat of opaque engobe before glazing in order to conceal the color of the cement. These cements need to remain damp as they cure, so mist the clay around the joint and cover with plastic for 24 hours.

Repairing Glaze-Fired Work

In general, when a finished, fired piece has been broken and repaired, it is not appropriate to offer it for sale or as a gift except in the case of a purely sculptural work where the repair does not diminish the intent or appearance of the work. When you do need to repair a fired piece, there are several options.

For earthenware, whether glazed or unglazed, standard yellow carpenter's glue works best. Have a supply of thin strips of duct tape hanging off the edge of the table, and apply these to each joint as you press them together until you have reassembled the form. Wipe any wet glue residue off the surface with a damp sponge. Leave the tape strips on until the glue is completely cured (at least 24 hours).

High-fired pieces are best repaired with two-part clear epoxy. Use new epoxy, and have a bottle of denatured alcohol handy. Make sure the joint is very clean, and be sure to choreograph the proper assembly sequence as you glue individual parts together. When everything is ready, have several paper towels dampened (not soaked!) with denatured alcohol standing by in a plastic bag (so the alcohol won't evaporate immediately). As above, apply the glue, press the pieces together firmly, wipe off extra epoxy with the denatured alcohol, and reinforce the attachment with strips of tape until the glue has cured. With a complex reassembly project, you may have to attach several pieces and let the glue cure completely before proceeding to the next joint. Make sure you press the pieces together very firmly to completely close the joint or else subsequent pieces will not fit. For the most professional epoxy repairs, use acetone to clean off the epoxy residue, but remember that *acetone fumes are highly toxic*, and this solvent can only be used outdoors while wearing a respirator with organic cartridges, or in a proper exhaust hood (like a properly vented spray-booth).

Kintsugi

In Japan, when a pot cracks in the firing or is broken in use, the crack or breakage is often seen as part of the natural life of the piece and shouldn't mean that the piece is ruined. Instead, such cracks or breaks are sometimes celebrated in the repair process. The Japanese term *Kintsugi* translates as "gold joinery" and refers to the practice of repairing or filling a crack with gold lacquer, which in Japan often means actual powdered gold mixed with lacquer. With a significant and documented lineage of ownership such pieces are highly prized among collectors, and in no way inferior to what we think of as a perfect pot. Much of recent woodfiring in North America, Europe, and Australia is rather derivative of the Japanese woodfire tradition, and one could risk the same in attempting this technique, but it could certainly be employed as a comment on the fragility of handmade ceramics and our haste to dispose of things we perceive to be flawed. You might come up with a variation of this concept that is quite original.

Attaching Mixed-Media Components, Joining Multi-Piece Work

Mixed-media has become a major category of contemporary ceramics. Even on functional vessels (not cookware!) there may be occasion for attaching mixed-media materials. Epoxies work well if the attachment point is unglazed. Epoxies are not good for attaching to glazed surfaces, because they risk failure with any prolonged exposure to moisture and/or humidity. Silicone caulking compounds work well as adhesives and some are specifically designated as such, and have the advantages of good heat resistance (in normal day-to-day use), archival stability, and a slight flexibility that decreases the chances of damage in subsequent use and abuse. Silicone will adhere very well even to glazed surfaces and remains unaffected by subsequent dampness and humidity.

Large sculptural work can be made and fired in sections and then assembled after the glaze-firing. If the sections sit together by gravity and the intention is to simply attach them, silicon adhesive works best. If the pieces do not sit together by gravity and the joint will support cantilevered weight, the joining surfaces should be left unglazed, and the best adhesive is epoxy. Two-part epoxy compounds like PC-7 have some body and will not flow from a gap or crack.

Large outdoor work is often assembled with a good concrete mortar, much as one would assemble a brick wall. Hollow sculptural forms are sometimes assembled over steel reinforcing bar (re-bar), and can be cast full of concrete to make a very sturdy permanent installation. More often, sections are joined with a concrete mortar using an acrylic additive in place of water, giving slight flexibility with superior adhesive and shock-absorbing qualities.

Hanging Wall Pieces and Other Objects

For most wall-hanging pieces such as platters or small relief sculptures, plan the hanging mechanism when making the work. That's always much more satisfactory than improvising something after the glaze firing. Some potters choose to trim the foot with a slight outward flare so that picture-hanging wire can be run around the outside of the foot with a hanging loop twisted on one side. As another option on flat panel pieces or platters, trim or apply a foot at least 3/8" tall, and when leather hard spin a 1/8" drill bit between your fingers and make two holes through the foot about 2" apart. Before glazing the piece, poke a wet pipe-cleaner bent in a U-shape through both holes, and remove the pipe-cleaner after glazing. This will prevent the holes from glazing shut. After the glaze-firing, insert a piece of picture-hanging wire through the holes and twist it around itself inside the foot. If it's a functional piece that will be used occasionally, use stainless steel wire in place of picture-hanging wire.

In general, larger wall-hanging work may require improvised built-in hanging mechanisms dependent on the individual piece. For example, a volumetric piece that protrudes from the wall might require steel rods anchored in the wall extending into holes in the piece. Lower-profile sculptural pieces including relief sculpture and flat tile pieces are best mounted on plywood or MDF

(medium-density fiberboard) properly finished for the application. In this case, by far the best hanging device is known as the French cleat. A little research online will show you how to make your own French cleats from wood, or you can purchase sturdy aluminum ones online. This system is often used for hanging kitchen cabinets and is capable of supporting a great deal of weight as long as the wall member is screwed to the vertical studs within the wall.

Permanent Installation of Relief Sculpture and Ceramic Tile

Large relief mural work is always made in sections, and mounted in a fashion similar to ceramic tile. The method used depends on the size and weight of the individual components, and the uniformity of the mounting surface on the back of each piece. For small tiles or relief components that are very flat on the back, ordinary mastic intended for ceramic tile works fine. Make sure the substrate is very sound. If you have any doubts, mount good-quality plywood first as a backup for the tile. In places where water is apt to seep into the surface, use the fiberglass-reinforced cement board designed for damp environments such as tub and shower enclosures. Spread the mastic with a proper toothed trowel. Be sure to apply the tiles quickly before the mastic begins to stiffen, and allow the mastic to cure completely before grouting the seams.

For any tile with irregular mounting surfaces, and for all larger tiles and relief components, use thin-set mortar with an acrylic binder. Thin-set mortar is a fine-grain concrete mortar normally mixed with water and used for installing quarry-tile or other types of irregular tile. In high-stress or high-strength situations, an appropriate acrylic binder used in place of water will give a stronger, more resilient bond. In use, apply a layer of thin-set mortar to the substrate, and press the tiles or relief components into the surface. With larger tiles, you may need to erect a scaffold framework with variable-length sticks to apply pressure against the individual components as the mortar cures. Thin-set mortar is an air-set mortar and must be kept damp for 24 hours or so after application in order to cure properly. This can be accomplished by misting with water periodically, or by wetting and covering with a damp cloth and a sheet of plastic sheet during the curing period.

Whether conventional tile or mural relief components, once the individual pieces are cemented in place and the cement is completely cured, the joints can be filled with grout. Research available grouts and select one appropriate for your application and the width of the seams. As the grout cures, the surface can be scrubbed with a damp sponge, recessing the grout slightly below the surface and washing any grout residue off the tiles or relief components. Once the grout is cured, the surface can be polished with a non-abrasive cleanser to remove any remaining grout residue. For outdoor applications, the surface can be sealed with an appropriate tile or concrete sealant.