

ceramic mold making techniques

| Second Edition |



tips for making plaster
molds, slip casting,
and decorating clay

Ceramic Mold Making Techniques | Second Edition

Tips for Making Plaster Molds, Slip Casting, and Decorating Clay

Plaster molds make it possible for you to repeat complicated patterns and create forms not possible to efficiently construct using any other pottery technique. For thousands of years, potters used bisqued clay for molds but the major drawback was that they could not get a lot of detail. With the discovery of plaster in the 17th century, potters immediately saw the advantages and plaster has been the choice for ceramic molds ever since.

How to Make Colorful Slip-cast Pots

by Andrew Gilliatt

Now you can add color to your slip-cast pots during the slip casting process. Andrew Gilliatt demonstrates how to create molds for slip casting then how to use colored slip-casting clays to provide color.



How to Make and Apply Decals to Slip-cast Vessels

by Linda Gates

One of the advantages of slip-cast work is the smooth surface, which is perfect for adding decals. Linda Gates shows you how to slip-cast smooth pieces then how to create decals and apply them.



How to Make Plaster Molds for Double-Walled Vessels

by Hiroe Hanazono

Double-walled vessels are difficult to make—especially when you want the fantastic forms Hiroe Hanazono creates. Hiroe always had a great passion for food and her voluminous serving pieces certainly reflect that. She demonstrates how to make the model and the plaster molds for a delicious ice cream bowl and topping server.



How to Make Casting Slip from Your Clay Body

by Paul Andrew Wandless

You can buy pre-made slip for slip casting in all firing ranges, which is a really practical thing to do in many situations. The disadvantage is that whatever you cast will not match your regular clay body. Paul Wandless shows you how to make casting slip from your regular clay to eliminate this problem.



How to Make Colorful Slip-cast Pots

by Andrew Gilliatt



Andrew Gilliatt's work combines colored porcelain slip, brightly colored glazes, resist patterns, and simple decals to create pots that convey the fun he has working in the studio.

Identifying ways of working that successfully support your ideas can be just as critical and expressive as the ideas themselves.

With my functional pots, I'm designing pieces that, with the use of color and imagery, are expressive, visually inviting, and easily accessible for domestic use.

The process I developed includes sketching, using drafting software, making models with MDF, then making plaster molds from those models. The forms can then be repeated, and each one individualized through surface decoration and glazing.

Making Prototypes

Each new piece begins with a prototype, generally made of wood or MDF, from which I create a plaster mold. The prototypes can be made from clay, but I prefer using wood for its durability. I'm not the savviest mold maker, so if at some point I have an accident

during the mold-making process, the prototype is safe and intact. I've also found that making prototypes from wood is great for achieving sharp, transitional lines and edges (*figure 1*). Once I've settled on a design, I produce two scale drawings—one illustrating the side view or profile, which includes the number of stacked pieces of MDF I will need to make the model, and one illustrating the top view. Using the first drawing as a blueprint, disks of MDF are cut, glued together, stacked, and turned on a lathe to make a solid round form whose shape is close to the side profile of the finished piece (*figure 2*). Tip: You can use a Surform tool to shape the MDF if you do not have a lathe. The second drawing works as a cutting template that is glued to the top of the form (*see figure 2*).

Using a band saw, I cut into the shape of the form, carefully following the outside edges of the glued-on template. The sides of the form are then sanded smooth

to erase any irregularities from sawing. Finally, the prototype is sealed with one coat of Minwax Sanding Sealer and two coats of polyurethane.

The casting slip I use has a 16% shrinkage rate so the prototype must be made appropriately larger to accommodate the final size of the pot (see the reverse shrinkage equation for help with the math). Always test the shrinkage rate of your casting slip before making the prototype.

Making the Mold

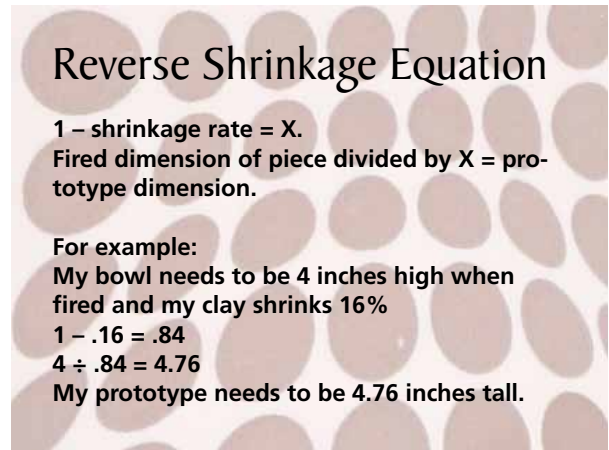
When making molds, it's important to remember that casting, like any other building method, is strictly a means to a desired end. It doesn't have to be an overly technical venture and, depending on the form, can be quite easy. I've learned to make molds simply by reading books on the subject, and by asking for help from others.

The biggest trick to making molds is figuring out the number of parts to cast. Most of my molds are made with four parts—a bottom, two sides, and a top piece used as a pouring gate or slip reservoir. Before I make a mold, I take my prototype and draw seam lines on it with a black marker so that I know how many parts I will need for the mold (*figure 3*). Then I add a clay slab to the top of the prototype for a pouring gate (see *figure 4*). By making my pouring gate just a little taller than need be, I can control the quality of the rim after the piece has been cast.

Next, I embed the form into a block of clay up to the seam lines marking off the first section of the mold, set up cottle boards, seal the seams between the blocking clay and the cottles, and pour the plaster. Parts of the blocking clay are removed as I'm ready to cast successive sections. The image shows the mold halfway through the casting process, with the bottom and first side cast, and the second side and slip reservoir or pouring gate still to be cast (*figure 4*). Note that the location of the seams has been planned so that they correspond to edges or places where planes and curves shift, rather than flat faces of the form. This makes them easier to clean up, and makes them less noticeable in the finished form.

Mixing the Casting Slip

Most of my pots are cast using two different slips—a colored casting slip for the exterior of the piece, and a white casting slip for the interior. Both are made from the same base recipe.



Reverse Shrinkage Equation

1 – shrinkage rate = X.
Fired dimension of piece divided by X = prototype dimension.

For example:
My bowl needs to be 4 inches high when fired and my clay shrinks 16%

1 – .16 = .84
4 ÷ .84 = 4.76
My prototype needs to be 4.76 inches tall.

The colored casting slips are tinted using Mason stains. Using only colored slip would be more expensive, and, lining the colored slip with a white slip allows me to get different color effects on the interior and exterior of a form using only one glaze.

The colored slip is essentially a decorative coating, much like an engobe applied to a thrown or handbuilt form, but in this case, the coating is laid down first.

To make the colored slip, ball mill 100 grams of stain per gallon of white casting slip and let them mix for two hours (14 lbs. of casting slip is roughly equivalent to one gallon). Ball milling gives a more consistent color saturation than blunging and the stain mixes in with the wet slip more easily. If you do not have a ball mill, use a kitchen blender and mix in small batches before combining.

Test shrinkage rates when using more than one slip in the same cast, even if they are made from the same base recipes. If the different slips have different rates of shrinkage, they will crack.

Casting the Pieces

Wet the mold with a sponge. Pour the colored casting slip into the mold and let it set up for approximately ten minutes (*figure 5*). Then pour the colored slip out of the mold and let it drain (*figure 6*). Once the slip has stopped dripping from the mold, immediately pour in the white casting slip. Leave the white slip in the mold for about 30 minutes before draining. The longer you leave the slip in the mold the thicker the piece will be. I prefer to make my pots just a little on the thicker side.



1
Finished wooden prototypes of various vessels sealed with polyurethane.



2
Turn a solid, laminated MDF form on a lathe to get close to the right profile.



3
Finish shaping the prototype on a band saw and draw seam lines.



4
Add a clay slab to the sealed prototype to create a pouring gate or slip reservoir.



5
Pour colored casting slip into the plaster mold first.



6
Drain the excess colored casting slip from the plaster mold.



7
Cut away the pouring gate. Keep the blade flat on the top of the mold.



8
Finish the rim with a red rubber rib. Note the striations of contrasting colored slip.



Cone 10 Recipes

"5,4,3,2,13" Porcelain Casting Slip

Grolleg	5 lb
Water	4 lb
Kona F4 (sub. Minspar)	3 lb
Silica	2 lb
	<hr/> 14 lb
Add: Sodium Silicate	13 g

Colored slip additions (Mason stains)

Black: MS 6600	100 g
Pink: MS 6020	120 g
Yellow: MS 6450	120 g
Blue: MS 6376	50 g
MS 6332 Orchid	25 g

Note: 14 pounds of slip is just under one gallon. To make colored casting slip, add 100–120 grams of commercial stain per one gallon of slip, then ball mill the slip for at least two hours to ensure even dispersal of the colorant.



9
Cast bowl, dried and ready to remove from the mold.



10
Decorate the bisqued bowl using masking tape and stickers.

Blue/Violet Glaze

(fires translucent blue in reduction and purple in oxidation)

Custer Feldspar	28.2 %
Wollastonite	26.5
Grolleg	20.7
Silica	24.6
	<hr/> 100.0 %
Add: MS 6332 Orchid	4.0 %

Green/Maroon Glaze

(fires translucent green in reduction and maroon in oxidation)

Strontium Carbonate	10 %
Cornwall Stone	40
Whiting	15
Grolleg	15
Silica	20
	<hr/> 100 %
Add: MS 6006 Deep Crimson	6 %



11
Remove stickers and tape then clean up after the bowl has been dipped in glaze.



12
Applying the decal onto the fired bowl by sliding away the paper backing.



Finishing the Cast

Remove the top piece of the mold (here the pouring gate section is removed first) when the slip is no longer glossy or tacky. Using an X-Acto knife, cut away the excess clay. Hold the blade flush with the top of the mold as a guide. After piercing the form in one spot, angle the blade in the same direction of your cut so that you're always cutting the interior wall first, then moving through to the exterior. By doing so, you press the form back into the mold walls as you cut, and avoid warping the form by pulling the walls away from the mold (*figure 7*).

Smooth the rim with a damp sponge and a soft, flexible rib (*figure 8*). Let the piece dry sufficiently before removing it from the mold (*figure 9*). Once the piece is bone-dry, remove any seam lines with an X-Acto blade, fettling knife, or metal rib. Smooth away any inconsistencies using drywall sanding mesh and a sponge. **Caution:** Always wear a respirator when sanding pots.

Glazing and Firing

I leave patterned areas on the outside of my vessels unglazed to expose the colored clay underneath. Stickers and masking tape work great as a glaze resist and give a far crisper and better line quality than anything I can achieve using wax and a brush.

Clean the bisqued ware with a damp sponge. Using a pencil, outline the areas you want to leave bare. Follow the lines with masking tape (I use quarter-inch masking tape because it is more flexible than the wider tapes). For curved lines, focus on laying down just the outer edge of the tape rather than trying to lay down the whole width of the tape all at once (*figure 10*). With the resist pattern complete, dip or spray to apply the glaze. Peel away the tape and stickers as soon as the glaze is dry enough to handle (*figure 11*). Make sure to peel away the stickers entirely. Any remaining residue will leave a noticeable blemish even after firing.

One upside to using different colored casting slips is that the glazes you use will have a different color quality on glazed and unglazed areas, depending on the color of the clay underneath, and the translucency of the glaze.

Laser Printer Decals

I make my own decals using a laser printer. I generate the images on a computer and then simply print onto water slide decal paper. HP laser printers work well and some types of copiers also make these decals. I use decal paper from www.papilio.com. You can also make handmade

drawings to scale or use found images and then scan them into a computer or have them photocopied, just as long as they are printed on water slide decal paper. (For more information, you can also refer to the article on laser transfer decals by Frank Gaydos on p. 7 in the Sept/Oct 2006 issue of PMI, or the July 23, 2008 Ceramic Arts Daily feature “The Details on Decal Paper for Ceramics” by Paul Andrew Wandless.)

The iron oxide contained in the toner of laser printers is what makes this method work as a ceramic process. (This method will not work with ink jet printers!)

Laser printer decals work just like traditional water slide decals but with a few exceptions. For starters, the only color they fire to is a sepia or red ochre. Depending on what color clay or glaze you fire them on and depending on the opacity/transparency you select to print them, a broad range in tonality can be achieved. Secondly, these decals have no flux in them so they must be fired hotter than cone 018 (which is generally suitable for lusters, china paints, enamels, and

overglazes) so that they melt to the glaze. I have found that cone 04–2 works best for high-fired ware.

For most glazed surfaces, you must fire the decals to at least cone 04. However, if your glazes are cone 04 the decals will dissolve away, so testing at a lower temperature is in order. For all of my cone 10 clay and glazes, I do a second decal firing to cone 2. At cone 2, the decals will fuse to both the glazed and unglazed areas. Any lower, the decals will melt only to the glazed surfaces.

Applying the Decals

After the glaze firing, sand any exposed areas of bare clay with 400-grit sandpaper for a smooth finish. Cut out the decal you wish to use. Don't worry about cutting away negative spaces, any excess material will burn away and this will make for easier application. Place the decal in room temperature water and wait for it to become fully saturated. Hold the decal onto the piece, ink side down, and slide away the paper (*figure 12*). The decals will still work if you don't place them ink side down, but the image may not be as clear.

With the decal placed on the ware, use a sponge or rubber rib to remove any excess water and to remove any air bubbles that might be trapped under the decal. Trapped air pockets may cause the image to bubble or become distorted. Be careful not to work the decals too hard; they are thin plastic and can tear easily. Make sure there is adequate lubrication when smoothing away air pockets. For large decals, or for decals that need to curve, use a hair dryer to lightly heat the decal to make it more pliable. Always let decals dry overnight before firing.



Op Dot Jar, 7 in. (18 cm) in height, colored porcelain, glaze, fired to cone 10, decals added and fired to cone 2.

How to Make and Apply Decals to Slip-cast Vessels

by Linda Gates



The distressed or worn surface treatment and nostalgic images of paper dolls on Linda Gates' works transport the viewer (and artist) to a different time.

For the last year, I've used images of the paper dolls I remember from my 1950s childhood as the primary focus of my ceramic work. The idea started with my final year's project in the ceramic design program at Bath Spa University in England. I decorated ceramic surfaces using commercial digital decals with imagery of everyday objects from the 1950s, including the paper dolls of that era. Just before graduating, I set up my studio with an electric kiln, a table, and a couple of shelves so I could continue working. Though my studio is small (7×13 feet), I've found that digital technology and the ability to order custom-made decals of my own designs has

made it possible for me to continue and expand upon the investigations started while I was a student.

Image Sources

I use a combination of my drawings and found images to create my surface designs. I search for vintage dolls in my local city of Bath and further afield at book fairs, vintage fairs, antique toy shops, and online auctions. The ephemeral nature of paper dolls means that few have survived. However, some were carefully packed away into attics, and see the light of day again when the attics are cleared (*figure 1*). Many of the lovingly played-

with dolls are tattered and torn and need repair or new clothes drawn for them. For this, I use a combination of sketches and Photoshop images (*figure 2*).

It's important that the dolls evoke the period and match the ones of my childhood memories. As they can be difficult to find, I often draw the dolls and dresses using inks and watercolor paints and pencils.

Life in the 1950s was not yet dominated by blatant consumerism, and I want my work to reflect this time of simple, carefree pleasures. By introducing text with messages such as 'No Batteries Required', I'm highlighting the contrast with the electronic toys of today.

Designing Decals

The decals I use are commercially made from Photoshop documents of my scanned images. In the U.S., compa-

nies like Bel Inc. and Easy Ceramic Decals will produce custom-made ceramic decals of your designs. In England, I've used FotoCeramic. They are based in Stoke-on-Trent, the historic center of pottery manufacture in England.

Using Photoshop, scan the drawings, manipulate and enhance them, and finally put them together into an 8½×11 inches document and make sure the mode is set to CMYK for the color rather than RGB, and the resolution is print quality (at least 300 dpi). Most decal companies will accept documents sent via email attachment when you place your order. The finished, printed decals will then be sent to you in the mail. The paper backing sheets are printed with ceramic inks, then laminated with fritted sheets, which ensure the inks fuse into the glaze when fired (*figure 3*). To save space and money, many decals are printed on the same sheet of decal paper. To keep the



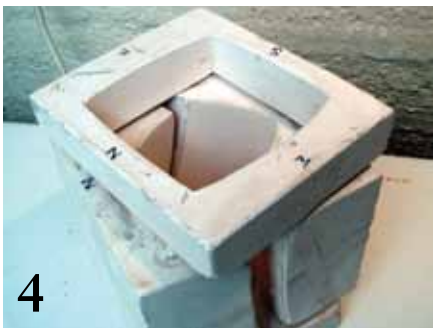
1 Vintage paper dolls used as image sources for custom ceramic decals.



2 Sketches and scanned images can be enhanced and compiled using Photoshop.



3 Sheets of custom printed decals created from Photoshop files.



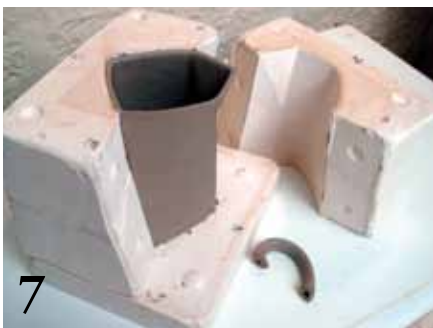
4 Four-part plaster mold used for slip-casting the jug form.



5 Plaster mold for the handle. The two openings allow air to escape.



6 Secure separate parts of a plaster mold before filling with casting slip.



7 Allow the forms to set up before removing them from the molds.



8 While the forms are leather hard, cover surface with a colored engobe.



9 Add border of underglazes to the surface, then bisque fire the piece.

decals organized, clean and dry, cut around each one and put them into individual envelopes until needed.

Casting a Form

Ceramic decals can be applied to any glazed object, but it makes life easier if the ceramic form has smooth surfaces to avoid the problem of trapped air creating bubbles and holes in the image. The ceramic form shown here is a slip-cast jug that I designed as part of a college tableware design project. With a little modification to the original jug design, I made new plaster molds, one for the body of the form and the other for the handle (*figures 4 and 5*). The mold for the body of the jug is made in four parts—the two sides, the base, and the reservoir.

To prevent leaks when pouring the casting slip, secure the parts firmly together with strong bands cut from rubber inner tubes. If you design your mold to include a reservoir, which makes it easier to maintain an even rim thickness, fill the mold to halfway up the reservoir wall using a commercial casting slip of your choice (*figure 6*). As the porous mold absorbs the water from the clay, the

excess is drawn from the reservoir. The handle mold is also filled with casting slip. Once the slip is the desired thickness (check by blowing on the edge of the mold where the slip and plaster meet), pour the extra casting slip back into the container and leave the mold inverted at an angle to drain into a bucket. Placing it at an angle avoids stalactites of clay forming on the bottom of the piece. **Tip: To achieve an even wall thickness in multiple casts, time the first casting and use this as a guideline for when to drain the slip each time.**

When the mold is well drained and the sheen has gone from the wet casting slip (typically about 20 minutes), remove only the reservoir portion from the jug mold, trim the excess clay from the top and clean it up with a damp sponge. I leave the rest of the mold intact for another hour or so for the form to firm up for easier handling. Both molds are then disassembled and the jug form and handle carefully removed (*figure 7*). Both component parts are cleaned up with a fettling knife and damp sponge. The handle is attached, and the form is covered in plastic for 24 hours to ensure a secure join.



10 For a distressed or antique look, coat the forms with a thin wash of iron oxide.



11 Select and cut out a group of decal images for use on each glazed form.



12 Soak the decal in distilled water for a minute to release the image from the paper backing sheet.



13 Prior to firing, the decal retains the color of the fritted laminate sheet (in this case blue). This color burns out.

Decorating Techniques

At the leather-hard stage, I decorate the jugs with colored slips and give them borders of commercial underglazes (*figure 8 and 9*). When the jugs have been bisque fired to cone 04, I give them a wash of iron oxide to dirty them down and give a distressed look because otherwise the bare slip-cast surface is gleaming white (*figure 10*). This surface is further enhanced with underglaze crayons and pencils.

Once you've applied any underglaze decoration to your pieces, they're now ready for a coat of clear

Ordering Your Own Custom Digital Ceramic Decals

United States suppliers

Bel Inc. (beldecal.com)

Easy Ceramic Decals

(www.easyceramicdecals.com)

UK supplier

FotoCeramic (www.fotoceramic.com)

South African supplier (ships internationally)

JT McMasters (www.skolldecal.com)



Make Do and Mend, 5 in. (12.5 cm) in height, slip-cast earthenware, slips, underglazes, oxides, and digital transfers, 2008.

glaze and put into the kiln on stilts, if necessary, for firing. Decal transfer works best on shiny, smooth glaze surfaces, so keep this in mind when selecting a glaze. After glaze firing, the ware must be handled as little as possible as the surface must be clean and free of grease from fingerprints. To ensure this, wipe the surface with rubbing alcohol.

Decalomania

Now comes the fun part—selecting, arranging, and applying the images (*figure 11*). Gather the cut-out decals you want to use together with a shallow tray and some distilled water, which is free of contaminants, a kitchen towel for blotting excess water, and a soft rib and natural sponge to smooth out any air bubbles. Soak the decal in the distilled water for about a minute until you can see the image start to release from the paper backing sheet (*figure 12*). Carefully position the decal onto the dampened smooth glaze surface, gently slide away the backing paper from beneath the image, and smooth out the image using the soft rib or damp sponge. Once removed from its paper backing, the decal is very flimsy and must be handled with great care. There is a short opportunity to reposition the image and rub out any air bubbles using a rubber rib and a sponge while the transfer is still wet and before it dries and attaches itself to the glazed surface. At this stage, the decal will still retain the color of the fritted laminate sheet, which in my case is blue (*figure 13*). This burns out in the firing.

When all the decals are applied and fully dried, the jugs are ready for the final firing. Because it is just high enough to melt the glaze slightly, the ware must again be placed on stilts. During the firing, the fritted laminate will fuse the ceramic inks into the glaze, making them permanent. Cone 014 is the usual decal firing temperature, but reds do tend to burn out. To overcome this, I prefer to fire to approximately cone 015 with a 15 minute soak to make sure the inks fuse into the glaze. **Note:** Always check with the decal manufacturer for the appropriate firing temperature. As always in ceramics, it is very important to test as kilns and materials vary. The kiln used for decal firings must be well ventilated. Make sure all vents are open, and if you have a ventilation system attached to the kiln, be sure to turn it on when firing decals. The fumes are toxic so the room must also be well ventilated and the kiln preferably fired when there is no one around. I have discovered that I can add more layers of decals and fire the piece again as long as the subsequent firing does not to exceed the original decal firing temperature.

With very little equipment—a small kiln, a computer, and a bucket of clear glaze, I am having fun enjoying my second childhood.

How to Make Molds for Double-Walled Vessels

by Hiroe Hanazono



Double-walled vessels cast from original molds, sprayed glazes, fired to cone 6 by Hiroe Hanazono.

I've always had a great passion for food—cooking, eating, setting the table, and sharing in the full dining experience. It's why I make functional pots. The pots I create consist of simple line forms with muted glaze colors, and the work's minimal aesthetic doesn't compete with anyone's domestic surroundings, nor with the food it eventually holds.

I'm especially fascinated with design that's clean and almost severe in its simplicity, and attracted to modern interior design and architecture because both practices work to frame and contain the contents of a

given space. Architects and interior designers must consider how people and furniture fit into the overall design of a space. They consider purpose, and how the space will be used. Potters must consider these same issues—good pots consider purpose, use and that which they will eventually contain.

The minimal design of my forms create an ideal setting for the display of food. Simple forms allow for beautiful relationships between the forms themselves and the elements contained within them.

My surfaces are also simple foils for the display of food. The repeti-



1
Finished wooden patterns sealed with polyurethane and coated with mold release.



2
Mold duct tubing attached to a wire frame that will be embedded into the top section of the mold.



3
Pouring slip into the pour holes using funnels.



4
Draining excess slip.



5
Squeezing slip into pour holes using an ear syringe to fill the pour holes.



6
Flip the mold to allow slip to fill pour holes and finalize the casting.

tion of simple geometric shapes and lines goes beyond the idea of decoration, becoming an element that blends into the form. The patterns that I create could serve as the design of the forms of my pots. They could also be rendered subtly in low relief on the surface of my pots, without interfering with the simplicity of the presentation I desire.

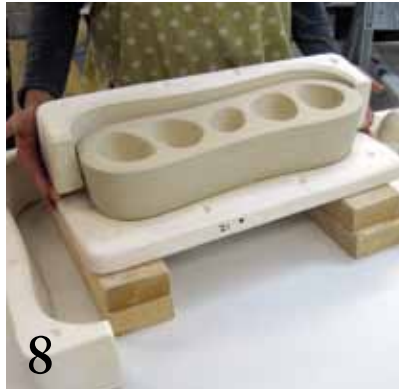
Making the Pattern

I use slip casting in the production of my forms. It's the technique that best satisfies my intent to create immaculately executed and unusual forms. Each new piece begins by carving out a pattern,

generally made from MDF (medium density fiberboard), from which I then create a plaster mold. Once I have settled upon a design, a meticulous scale drawing is made from which I then begin laying out the MDF pattern. Because there is roughly 20% shrinkage in the casting body, I make the pattern larger than the final piece I'm aiming to produce (see box). Many other artists create their patterns out of plaster or clay, but I've found that wood and MDF better suit my needs. I can control these materials better, with the edges of my forms sharper and the transitions fairer. Also, the dura-



7
Use compressed air to release the casting from the plaster mold.



8
Remove the mold when the piece is leather hard.



9
Trace a pattern on the surface using prism projector.



10
Carve the traced lines with a needle tool.



11
Clear away any clay debris and fill the incised lines with a colored slip.



12
Gently scrape away excess slip flush to the surface.

bility and longevity of the original pattern is a definite bonus.

The patterns are fabricated using primarily woodworking tools—band saw, table saw, sanders, router, and various hand tools including scrapers, rasps, files, and chisels. A great deal of time is also spent sanding and refining the pattern. The final step in preparing the pattern for mold making is to seal it with at least three layers of polyurethane (*figure 1*).

Making the Mold

First determine the number of sections the mold will have and identify the location of the plug holes. My

molds are typically made in four pieces—the bottom, two sides and the top. Sometimes I embed moldcut tubing that's been attached to a metal frame into one of the plaster sections to facilitate removal of the wet slip-cast form from the mold (*figure 2*). The tubing creates a porous channel so that compressed air can circulate through the mold and help to release the section from the casting with minimal distortion. With double-walled forms, you need to make special considerations when it comes time to make the molds. Simple open molds are not possible for I have to enclose the pattern entirely in plaster to achieve a double wall. This also necessitates

creating plug holes for pouring the slip into the mold and then for draining it.

Casting the Piece

Pour casting slip into the mold and allow to set until you achieve the desired thickness (*figure 3*). Drain the slip from the mold and allow the piece to set up for awhile.

After draining the slip (*figure 4*), you'll want to fill in the openings in your form left by the drain holes, otherwise the finished piece will have holes in the bottom. Squeeze a small amount of slip into the pour holes using an ear syringe (*figure 5*). Plug the holes to keep slip contained within mold then flip the mold over to allow slip to fill the pour holes and finalize the casting (*figure 6*).

When it's time to de-mold the piece, blow pressurized air into the mold duct tubing and through the plaster, forcing a separation from the slip cast form and the mold (*figure 7*).

Cleaning Up and Decorating

Allow the slip cast form to become firm enough to work on (leather hard) then remove it from the mold (*figure 8*). Use metal scrapers and sponges to clean the edges and any other irregularities that appear on the surface of the form. Using a small drill bit, poke two holes in the bottom of the form to allow air movement between the inside and outside of the piece. This prevents the piece from exploding in the

kiln as the air contained within the double walled form expands during the firing process.

To create a subtle decorative element for the surface of this piece, I decided to use mishima, a slip inlay technique. Using Adobe Illustrator, I create geometric patterns which I then project onto the cast form, tracing them in pencil and finally carving out the lines with a needle tool (*figures 9 and 10*). Colored slip is then pushed into the incised lines using a brush (*figure 11*). Once the slip is dry, the surface is scraped flush with a metal rib (*figure 12*) removing all excess slip from the form. What remains, is a clear and clean pattern with the colored slip remaining in the incised lines.

Firing

After bisque firing to cone 06 I spray all of my glazes and fire them to a very hot cone 6. All of the double-walled pieces are down-fired as well, a process by which cooling is slowed through the gradual lowering of the temperature within the kiln. It allows for a more even cooling of the inside and outside of the form, which produces less stress on the overall form. Larger forms are glazed both inside and outside to maintain a balance of surface tension. The use of both of these techniques has reduced the amount of loss I experience in the creation of these double walled forms.

I've found that the shape and size of the forms I design greatly impacts their survival through

all stages of my entire making process, from casting through firing. This is particularly true for my double-walled plates. Should the interior walls of one of these castings touch, the chances that piece will survive decreases substantially. My failure rate goes up, with losses happening in the casting process itself and in both the bisque and glaze firings. Therefore, I have to remain aware from the very beginning—in the sketching and drafting phase—how thick the walls will be and how that affects the form.

Then, during the casting phase I must be diligent with my casting times to ensure the wall thickness is consistent and accurate, always trying to preserve the integrity of the negative space within the pot and preventing the walls from fusing.

Being a designer, mold-maker, and manufacturer brings me great joy. I enjoy the challenge of creating unusual, well-defined forms for use. The wooden patterns that I create for mold making and the slip casting process enable me to successfully achieve my intent. I have never had formal training in slip casting or in mold making. Working in diverse artist communities I've been exposed to a great variety of artists who have shared their tricks and techniques.

It's through this sharing and this collaboration of sorts that I am able to do what I do.

How to Make Casting Slip from Your Clay Body

by Paul Andrew Wandless

A common studio challenge is trying to keep the number of different clay bodies you have on hand to a minimum. Throwing, handbuilding, casting, and surface design techniques often require different clay bodies to suit the demands of how your work is created. Sometimes the clay bodies also need to be in different forms such as regular moist clay, slip or casting slip. If I'm handbuilding with a cone 6 clay body and want to add a slip-cast element to it, I'd be hard pressed to find a commercial cone 6 casting slip with the exact same shrinkage and absorption characteristics. A singular work made of multiple clay bodies can cause several problems. Disparate shrinkage rates, maturation points, iron content, etc., can all have a negative effect on the final outcome of the work when using different bodies. When possible, it's always best to stick with the same body.

My sculptural work combines moist clay for general construction and casting slip for volumetric elements or for use with various image transfer techniques to address the surface. My solution is to use the clay body I'm working with and turn it into the different types of casting slips I need. This assures that all the parts and surface treatments shrink the same, fire to the same cone, and all the glazes work the same on all the different parts. The great thing about this approach is its simplicity. All you need is a 5-gallon bucket, a drill with a paint mixer attachment, a deflocculant, and the clay body you want to use as a casting slip.

Preparing the Slip

The process of slaking clay to make it into slip is a simple one. Step one is to have a 5-gallon bucket filled 60–75% with your bone-dry clay then add water until it's a few inches below the rim (*figure 1*). Let it slake for 24 hours then mix it by hand a little with a stick (*figure 2*). Once you've mixed the slip for about 5 minutes, use a drill with a paint mixer attachment to mix it into a smooth slurry, which should be the consistency of thick cream. Use the stirring stick to check the consistency and find any lumps of clay that didn't slake down (*figure 3*). Keep mixing until the lumps are gone.

Measuring Specific Gravity

At this point, I normally fill a quart container with the slip to use as a joining or brushing slip. The rest I use for casting slip. You'll need to measure the specific gravity of the slip to determine if the water to clay ratio is correct before deflocculating it with liquid sodium silicate or Darvan. To determine specific gravity, which is a comparison of the weight of 100 ml of water (which is 100 g and therefore has a specific gravity of 1) with the weight of 100 ml of whatever liquid or slip you are working with. First tare (zero out) the weight of a graduated measuring container on a scale then fill it with 100 ml of slip and see how much it weighs in grams. Once you know the weight, you divide it by the weight of an equivalent volume of water (100g). This works out, in essence, to moving



the decimal point in your weight measurement to the left by two places to get the specific gravity. Example: 183 g = 1.83 specific gravity.

In general, a specific gravity of 1.80 to 1.85 provides good balance of fluidity and strength for most casting purposes. This number can vary, though, depending on exactly what is being cast. I've used it as low as 1.74 for volumetric casting and as high as 1.90 for casting flat slabs. Different clay bodies have different optimal specific gravities that are determined by good old-fashioned trial and error. Specific gravity is simply a tool for you to adjust your slip to meet the needs of your particular casting project. Once you find a number that works, write it down and stick with it for that clay body. If you have a specific gravity that is higher than 1.85 and you want to bring it down, add a little water (only a few drops at a time), to your slip, mix and re-test. If the specific gravity is lower than 1.80, let the slip sit 24 hours, skim the water off the top, remix, and measure the specific gravity again.

Deflocculating the Slip

Once you have the correct specific gravity, you need to add a deflocculant to the slip to make it more fluid so it can be poured. Typically just a few small drops of liquid sodium silicate or Darvan is needed to achieve the appropriate fluidity. Clay bodies with high iron content will require less deflocculant than others. Use the drill to mix the deflocculant into the slip and use a ladle or pitcher to scoop some of the slip out to see how it pours. The consistency of cream is what you're going for so be careful not to over-deflocculate the slip, which will cause slow uneven drying and soft spots in the finished piece. Just add a few drops at a time to achieve fluidity and remember a little goes a long way with deflocculants.

Using What Works

I've done this process with commercially bought clay and with home made clay. I've



also had the exact same success slaking down clay that started off as moist clay fresh out of the bag or as 3-day old bone dry clay. I keep a 5-gallon bucket around to throw all my scrap clay into and when it gets about 65–75% full, I turn it into casting slip. I also just slice up a 25-pound bag of commercial clay into 1-inch cubes and fill an empty bucket with them and use that to make my casting slip. I'm aware of the different opinions regarding initial water content of the clay and its effect on the speed of water absorption/saturation while slaking. In my personal experience, I've found if you let clay in any state of moisture slake for 24 hours, it all mixes up just fine. I suggest you simply slake your clay in the state of moisture that you typically have in the past.

*Paul Andrew Wandless is a studio artist, workshop presenter, educator, and Vice President of the Potters Council. He authored the book *Image Transfer On Clay* and co-authored *Alternative Kilns and Firing Techniques: Raku, Saggar, Pit & Barrel*. His website is www.studio3artcompany.com and he can be emailed at paul@studio3artcompany.com.*