

Slip Casting by Richard Juckel

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If you have never tried slip casting, you might be a little anxious at the thought of introducing slip cast work to your inventory. However, slip casting is not really as difficult as it might seem. A number of commercial casting slips are available, including a versatile cone 06-01 low-fire white casting slip suitable for most production operations,* as well as various stoneware, porcelain and colored slips.

In general, casting slips are formulated much like ordinary water-based pottery clay, but the addition of deflocculants* liquefies the medium to make it easier to pour into prepared plaster molds. With the right preparations and production standards, you can easily achieve success with slip casting.

Preparation

The first step to success is quality slip preparation. Do not assume that buying a commercial slip ensures that no preparation is needed. Maintaining stringent controls on slip viscosity is crucial. Keeping your slip covered will decrease the rate of water evaporation, but you will also need to check the slip's specific gravity using a tool called a hydrometer each time you prepare for production. A hydrometer is a clear Pyrex-like glass with a lead weight at the bottom and a paper insert that reads vertically, like a ruler, from 2.000 to 1.000.

Once you've thoroughly mixed the slip, stop mixing and allow the slip to come to a rest. Place the hydrometer tip on the slip's surface and let it drop. The hydrometer will act like a bobber in water, floating at a level that gives you a reading for the slip's specific gravity. The rule of thumb is to have the reading fall somewhere between 1.65 and 1.75; the lower the number, the less viscous, or more liquid, the slip will be. A more liquid slip will translate to less vertical wall thickness, an easier pour out of the mold and a faster turnaround between castings.

*Deflocculants

If the specific gravity of your slip is too high, you will need to add a deflocculant. In deflocculation, an element— typically sodium— is used to change the electrical charge on each clay particle to negative. The presence of water in the casting slip provides just enough saturation to float each independent particle, and the negatively charged particles repel one another as they move toward each other. Imagine the force exhibited by two negatively charged magnets— if you try to force them together, the magnets seem to slide past one another. This is exactly what happens between individual clay particles when the casting slip has the right viscosity.

The majority of slip casting formulas call for sodium silicate as a primary deflocculant— a 50/50 blend of sodium silicate and water can typically correct viscosity problems. Soda ash is often listed as a secondary deflocculant, but it's important to note that the presence of too much soda ash in a formula can decrease the life expectancy of your molds by accumulating into a condition known as salt scumming. Soda ash provides elasticity to your slip cast formula and therefore can be an important addition; just be aware of the potential for salt buildup. Salt scumming can be reduced by periodically scrubbing the molds with a mild detergent.

Other, more concentrated varieties of deflocculants include Darvan 7 and Darvan 811.** Where a formula might call for 0.25-0.5% sodium silicate, only half that amount might be required to deflocculate a clay body using either of the Darvan solutions.

While this information is most important during the preliminary formulation of a casting slip, it is also worth considering every time you check the consistency of your slip, as well as during any recycling procedures. Always work in small increments when adjusting your slip to avoid over-deflocculating the slip— over-deflocculation will result in a slip that quickly gels—as it sits, making for an extremely difficult slip cast.

anteed loss ratio. Some pieces will break, while others will not slip cast bodies, the average water weight is approximately 40

lbs of water to every 100 lbs of dry material, and this ratio can be used to implement a recycling procedure.

To reclaim your used scraps, use approximately 25% table scraps to 75% of new dry mix and 40% additional water weight. First, add water to a blunge tank (if you were using 100 lbs of total dry material you would need to add 40 lbs of water). Next, add just the recycled clay and let it soak (slake) for one to two hours.

Once you've finished slaking, add your primary deflocculants. Remember that the recycled scraps already contain deflocculants, so you'll need to use less deflocculant in your recycling process than you would if you were mixing an original batch. Mix the water, recycled clay and deflocculants, and then add the remainder of your dry ingredients. Allow this mixture to blunge for 8-10 hours, then test the specific gravity and make any necessary adjustments.

The unused slip poured from your molds can also be recycled, but be sure to sieve the recycled slip before using it for slip casting. Recycled slip often contains fragments of plaster, wood splinters and other potentially contaminating ingredients. If left in the slip, these contaminants can lead to a loss of ware during the firing process.

Important Considerations

As a production potter, much of the equipment you already use in your day-to-day operations will satisfy the needs of a small slip casting operation. However, if you plan to work in quantities greater than 5-10 gallons at time, you might want to consider purchasing some additional equipment.

~ For large batches, consider using a large-capacity blunge tank with an attached fan-cooled motor equipped with a heavy-duty shaft and large propellers. It's best to have your motor mounted at a slight (15-20 degree) angle to deter funneling during mixing, and a medium speed is preferred rather than fast.

~ Provide enough space for your operation to take place. You'll need ample room for your molds during pouring, and receptacles for the excess slip. You'll want to make sure that you will be able to move swiftly from one mold to the next. Many different types and sizes of slip tables are commercially available.

~ A hydrometer is a very important tool. If you don't already use one for your glazes, be sure to use one for slip casting. A scale can also be used to determine the specific gravity of your slip. Water has a specific gravity of 1.00 (one hundred cubic centimeters [cc] of water equals 100 grams). The desired weight of a 100 cc volume of slip should yield between 165 to 175 grams, or 1.65 to 1.75 times the weight of water.

Troubleshooting Common Problems

Once you have successfully removed the casting from the mold, handling the wet castings is much like handling any of your other greenware. However, slip cast work tends to dry faster than hand thrown pottery, so beware. This is not much of a concern for simple forms with no attachments, but for more complex forms you will need to slow the drying process to avoid cracking. If small cracks appear in your greenware, you can easily repair them using your wet slip and a small paintbrush. Simply fill the cracks with slip and then smooth the surface with your brush.

All of this assumes that the casting has been successfully removed from the mold. The most important thing you can do to ensure a safe casting is to take your time. Do not rush to remove your castings. Once you've poured the slip out of the mold, be sure that the interior of the form is completely dry before attempting to remove the casting. Also, remember that your mold absorbs water each time you pour a casting. As the mold becomes increasingly saturated, the set-up time for each casting will increase.



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atic as a saturated one. Before pouring your molds, it's a good
m in water or wiping them with a wet sponge. A damp mold
notes faster water absorption, a quicker turnaround time, and
decreased cracking when the castings are released from the mold.

Releasing your casting can be more difficult with complex, multiple-piece molds, and in this case you may need to dust your mold before pouring. Fill an ordinary cotton sock with your dry slip ingredients and use it to gently pat the dry, empty mold. This will help create some separation between the mold and your clay, and because it's the same recipe as your clay body, nothing will show up in the final firing.

Attaching handles to slip cast ware can be another common problem. Pieces with handles need to dry more slowly and evenly. Always use the same deflocculated slip that you cast with when you attach your handles. A small paintbrush and some water or slip can go a long way toward finishing and repairing any cracks that appear.

Overall, the slip casting process is simple. Just remember these simple suggestions, and you should have no trouble adding this process to your operation. There is no substitute for an efficient and well-planned slip casting operation. Most importantly, the proper timing and a well-mixed slip cast body will tremendously aid your overall success rate.

References:

*This slip is supplied by Continental Clay Co., Minneapolis, Minn.

**Darvan is manufactured by R.T. Vanderbilt Co. Inc., Norwalk, Conn.

For more information:

For more information about casting slips or equipment, contact:

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ADDITIONAL INFORMATION

Richard Juckel - director of Glaze Operation and Research and Design for Continental Clay Co., Minneapolis, Minn. He received his bachelor's of fine arts degree in ceramics from the University of Minnesota and has assisted in the development of clay and glazes at Continental Clay. He has also taught several Community Education classes at the Northern Clay Center in Minneapolis.

