

Sand casting

Brief history:

Due to the nature of sand casting it is very difficult to pin down when the process was first used. As you will see, when we start our process, we begin with a pile of sand and clay. When we finish our process, we end up with that same pile of sand and clay. In my research I did manage to find a translation of a metallurgy manuscript written in 1540 by Vannoccio Biringuccio. In book eight he describes how to sand cast or as he calls it "small casting". Cellini (1500-1571) describes sand casting using a frame in book on goldsmithing. Sand casting is still being used today in manufacturing and in jewelry making.

Introduction:

Sand casting can be used to cast many types of objects such as buttons, medallions, tokens, and jewelry. Those objects should be simple with no undercut surfaces. That being said the surface of the cast can be complex and very detailed. When casting an object we want to make sure that we can lift the object out of the sand without the sand coming with it.

Lets start with a simple materials list.

Materials

- 1) Flask – interlocking frame consisting of a cope (top) and drag (bottom) used for holding sand for casting
- 2) Sand – commercial sand consisting of fine sand, clay, oil.
Green sand consisting of 80-90% fine sand, 10-20% bentonite clay, water.
This percentage is just a guide.
- 3) Talc – parting powder to prevent sand from sticking to itself and object to be cast
- 4) Metal such as pewter, silver or bronze.
- 5) Small drill bit – poking holes for air escape in sand
- 6) Hammer – tamping down sand
- 7) Metal ruler or credit card type plastic – scraping excess sand off of cope and drag.
Also used for breaking up sand
- 8) Knife – making air channels in sand and making minor repairs to mold.
- 9) Tooth brush or wire brush – brushing off excess sand from cast object
- 10) Torch to melt metal
- 11) Crucible or ban to melt metal in
- 12) Flux
- 13) Water – cool off & clean cast object
- 14) Solid clean work surface
- 15) Non-relief heavy paper or table cover to protect work surface and to aid in clean up.
- 16) Jeweler saw to remove the sprue and excess metal
- 17) Misc tools to clean up and polish cast objects

Sand:

You can purchase your sand casting supplies in a kit from places like Rio Grande. The Kit usually comes with the sand that is bonded with clay and an oil. The oil holds the sand/clay mixture together. The kit usually also comes with a frame, parting powder, and flux.

The alternative is making your own sand. This is known as green sand. Start with a fine sand such as play sand or art sand. Next you need to add clay. A good inexpensive source is kitty litter. Grind the litter up fine and mix it with the sand starting out with a 80 percent sand to 20 percent clay. Mix it up and add either as needed. The next step is to add a little bit of water. Incorporate the water a little at a time until you can pick up the mixture, squeeze it in your fist until it holds its shape and very little remains on your hand. NOTE: You don't want inhale the dust raised while combining ingredients so please use a respirator or an air filter.

Both sands have their plus and minuses. Green sand tends to be course which means more clean up work, and the water needs to be replenished after a while. Commercial sand is more expensive but the oil never needs replacing and the sand tends to be finer which means less clean up work. Both sands are re-usable.

The only time the sand cannot be re-used is if you are working with high temperature metals such as brass or silver. At higher temps the oil burns off and some of the clay bakes. That being said, the amount of material that is lost due to burning is minimal. I use commercial sand in my casting. At the time I purchased it the cost was around \$20 and has lasted me twenty years. To date I have more than half of it left.

The Frames can be purchased as well or can be constructed at home easily and inexpensively. I built a small frame for under \$5 in less than an hour. If you make your own make sure that there is a way to line up and lock the cope and drag so that both halves match up and don't move. If they do not line up correctly then your cast will not work.

Casting a single or double sided medallion.

This procedure was created while making medallions for a friends elevation to Knighthood.

- 1) Chop up sand so that is fine and loose using ruler or card.



- 2) Fill drag with sand. Sifting sand into the drag is optional. Sifting breaks the sand up a little more. I have the same results whether I sift or not.



- 3) Tamp down the sand using a mallet or hammer.



- 4) Scrape or skree excess sand off with the ruler so the sand is level with the top of the flask. Under or over filling will cause your mold to be unstable which will affect your casting.



- 5) Coat the object to be cast in talc. The talc acts as parting powder allowing you to easily remove your object from the sand.
- 6) Press the object halfway into the sand.



- 7) Coat the sand and the object with talc for easy separation of the cope and drag.
- 8) Place the drag on top of the cope.
- 9) Chop up more sand and fill the drag just like you did with the cope covering your model.



- 10) Tamp down sand as before.
- 11) Scrape off or skree excess sand leaving the sand level with edge of the flask.
- 12) Carefully separate the cope and drag.



- 13) Carefully remove the object from the sand.
- 14) Create a depression on both cope and drag so that the depressions come right up to the edge of the mold and top of the flask. When the cope and drag are re-assembled you will form a cone for the metal to funnel into the mold.



- 15) On either the cope or drag, use the knife to create channels for air flow. The channel should start at the edge of the mold. Draw the knife away from the mold making sure the channel direction is pointing up at angle towards the top of the flask. Keep the knife blade straight up and down. If the channel points downwards then the molten metal will flow out of your mold. If your blade is not straight up and down then you may collapse the channel when you re-assemble the two halves of the flask.
- 16) Use a rod or drill bit to place a hole in each channel to allow the air to escape. Use a twisting motion to “drill” into the sand.
- 17) Use the knife to repair any damage to the mold.
- 18) Carefully remove any sand that may have fallen into the mold.



19) Re-assemble the cope and drag and make sure it is a snug fit. Clamps or a binder may be needed to make sure the halves do not come apart during casting.



20) Melt your metal.



21) Pour the molten metal into the opening that you made in step 14.

22) Let the metal cool. I tap the top the button of metal that is exposed with a drill bit. When the button is hard I know the metal has solidified.



23) Separate the cope and drag.



24) With any luck you have a fully cast object.

25) Carefully remove the object from the sand. Use pliers or tweezers as the object will most likely still be very hot.



26) Dip the object in water to finish cooling or let it air cool.

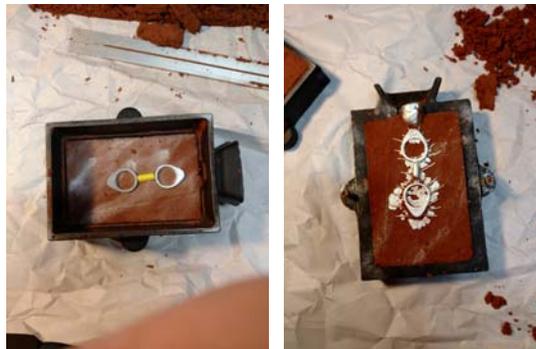
27) Use the brush to remove excess sand.

28) Trim off the sprue and any excess metal.

29) Smooth out edges with a file, sand paper, rubber wheel or any combination.

30) Clean to a shine with steel wool or a wire brush.

The next few pictures show how to cast multiple rings.



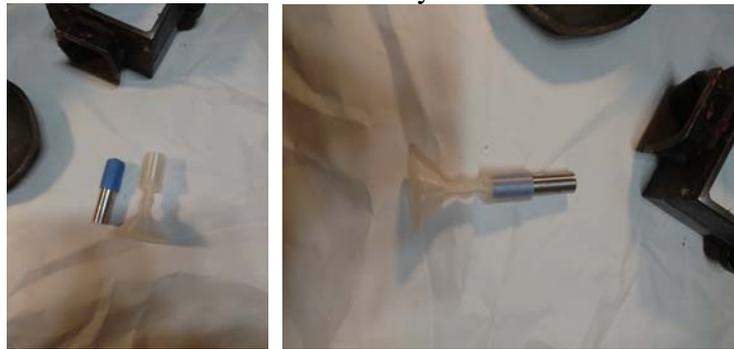
or



Casting with a metal core

When using a core, make sure the material you use for the core can withstand the temperature of the molten metal as it is poured. In this example I am using a metal core. Smooth wood would work as well. Plastic not so much.

Insert the core into model. Make sure it's a good fit. Wrap the core with tape if necessary.



Press model and core into the sand. Prep the sand as usual. Remove the tape (if used) from the core. Return the core into the depression it made in the sand.



Finish prepping as before with the core inside the flask. The left picture shows the top of the core looking down the sprue. Cast your metal. The metal will flow around the core.



Remove the core and clean up your cast.



Be creative with your casting. Experiment with various techniques. You are not limited to using the top of the flask. Some casting may require you to use the side of the flask instead, or it may be more advantageous to cast on the side.

The important things to remember are study what you want to cast to make sure there are no undercuts, and what is the best orientation of the model in the sand is to accomplish your task. Do you need a core? If so what can you use? One technique I have used is making a hole in a piece of slate and casting my metal through that hole so that my cast metal locks itself in place on the slate.

Due to the amount of time it takes to prep an item for casting, this may not be the best method for mass producing an object. There are other more suitable techniques that can be used.

I hope you have found this little write up useful. Have fun and enjoy casting.

Bibliography:

Mcreight, Tim “ Practical Casting a Studio Reference”; Brybmorgen Press; 1994 pp 77-88.

Mcreight, Tim “The Complete Metalsmith” Davis Publications, Inc. Worcester Mass, 1991; pp 86,87.

Smith, Stanly Cyril and Gnudi, Martha Teach. “The Pirotechnia of Vannoccio Biringuccio” ;Basic books, 1959, pp 323-333.

T.p.c Beentjes “ Breaking the Mould: A History of Sand Mould Casting In Western Europe Based on Early Written Sources”

<https://hdl.handle.net/11245.1/e0ef63da-752f-4955-b6cb-33a8419e9db7>

[Cellini, Benvenuto, 1500-1571. n 79064913](#); [Ashbee, C. R. \(Charles Robert\), 1863-1942. n 50002000](#) ; “The treatises of Benvenuto Cellini On Goldsmithing and Sculpture. <https://archive.org/details/b2488697x>