



Photo: Leslie Bruning - Bruning Sculpture Studio

Castalite



Castalite

Castalite is a UV-curable ceramic shell resin suitable for 3D printers that utilize SLA, DLP or CLIP technologies with UV wavelengths between 350 - 405 nM.

Castalite is designed for making ceramic shell and sand casting-like molds for metal investment. The molds made from the 3D printer are burned out in a furnace at 2100°F - 2250°F. Once the mold has been properly burned out the metal can be casted much using many industrial techniques.



Castalite Molds sintered and un-sintered



Aluminum cast from Castalite Mold

Recommended Printing Tools



Wire Cutters to remove supports from 3D print



Metal Paint Scraper to remove object from build bed



Plastic Paint Scraper to remove settled clay resin from bottom of resin tank after printing



Kitchen Strainer to filter Castalite



Wear nitrile gloves when handling Castalite



Wear safety glasses when handling Castalite

Foundry Tools for Casting are based on the need for the type of casting

Printing Guidelines

1. Shake the Castalite bottle upside down for at least 5 minutes. Ensure all of the casting material is mixed before printing. Hit bottom of bottle when shaking periodically.

2. Add Castalite to resin tray as directed.
3. The first time printing in Castalite it is recommend to make a small object to test your machine and assess if there is any trouble shooting required before printing at large scale.
4. Remove wiper bar if available. Print five layers and pause printer to assess if design is adhering to the build plate. If it is, attach wiper bar and continue. If not, follow Troubleshooting steps

When recycling leftover Castalite after a print, we recommend pouring the leftover Castalite through a kitchen strainer to break up sediment. Mix leftover Castalite back into the original bottle and shake well before printing again. Do not let Castalite sit out with no UV protection.

Printer Settings

1. Castalite works on most castable settings for SLA / DLP 3D printers.
2. Settings with longer exposure times will result in better parts.
3. Flexible settings can be used for delicate parts.
4. Average first layer cure time is 15 seconds.
5. Average burn layer is 10 seconds.
6. Average general layer is 8 seconds.



Pausing a printer to check for adherence

Printing Tips

1. Castalite is heavier than most 3D printing resins. It may require increased contact size on supports. Increasing the density of the supports will also ensure for a successful print.
2. Clean your build platform with Isopropyl Alcohol. This ensures there is no other resin on the build platform that could interfere with Castalite sticking to the build platform.
3. Scratch the build plate. Castalite is heavier than most 3D printing resins it may need a rough surface to adhere to the build platform.
4. Increase the overall exposure time of the machine if prints are not sticking to the build platform.



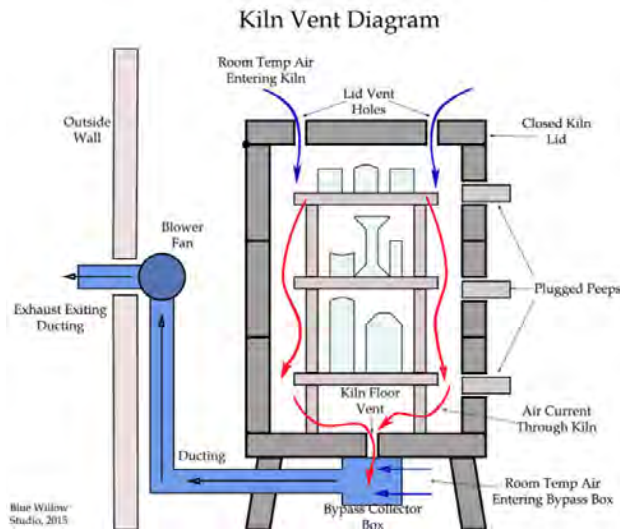
Scratched build plate

Print Finishing

1. Remove object from the build bed by cutting the supports. (Scrape the base and remaining supports off build plate later with the metal paint scraper.)
2. Soak object in Isopropyl alcohol for no longer than ten minutes. (Warping may occur if soaked longer). Rinse with water. Set molds upside down to make sure all excess water and resin has come out of the mold.
3. Cure 5-12 hours in a UV light box . Rotate every hour. Longer curing required for thicker more solid objects. Curing time can be equal to print time or longer.
4. Use the Plastic Paint Scraper to scrape settled resin from bottom of the resin tank.
5. Filter unused Castalite and sediment through a kitchen strainer.
6. Take the filtered Castalite and pour back into the original bottle.
7. Shake Castalite bottle to remix.

Burn Out Instructions

Castalite goes through a burn out process before casting any hot liquid materials into it. Castalite needs to reach a certain temperature for the parts to be strong enough to grab onto when they are hot. The burn out must take place in an oxidized environment. Do not use a reduction firing environment. Castalite shrinks during firing. Molds will shrink between 13% - 17%. This is dependent on the geometry of the part, layer thickness and the final burn out temperature.



Castalite needs to be fired slowly between 300 -1100°F or (150°C - 595°C). Firing as slow as 10°F (5°C per hour) per hour can help reduce cracking in thicker larger parts. This ensures all of the gas escapes from the object. Firing the print too fast will cause the object to bloat and crack in the kiln.

Castalite needs to be fired in a vented kiln. Avoid breathing fumes generated during firing. DO NOT prop open the kiln lid. That allows fumes to escape into the room and may cause combustion of your objects within the kiln. (And yes, you may use unvented kilns that sit outdoors.)

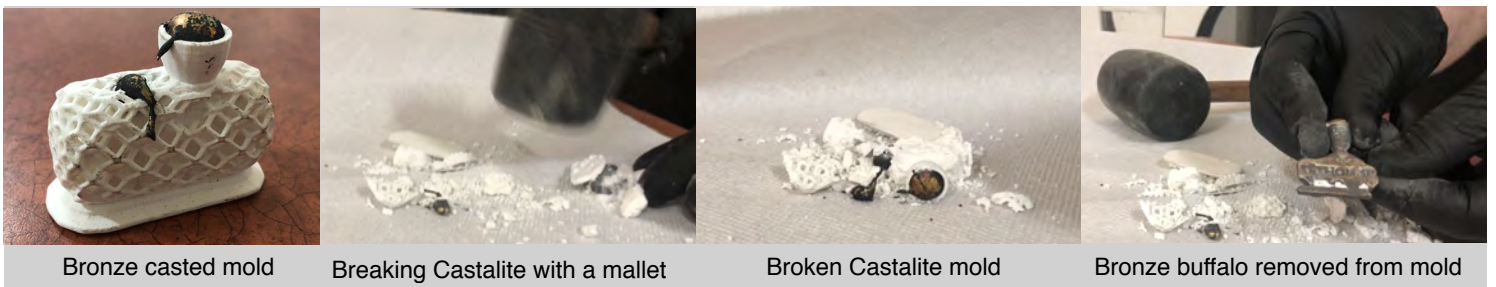
Castalite 3D prints can be supported in the kiln to prevent warping. It is best to design in

the 3D model all of the supports that are needed for burn out

Castalite can be cast directly after the burn out process. Cool the furnace or kiln to the desired casting temperature and remove the mold for casting.

After Casting

Castalite most of the time will need to be broken after casting to get the cooled metal part out. The parts will then need to be taken to the desired finished state.



Bronze casted mold

Breaking Castalite with a mallet

Broken Castalite mold

Bronze buffalo removed from mold

Burn Out Schedules for Castalite 3D Prints

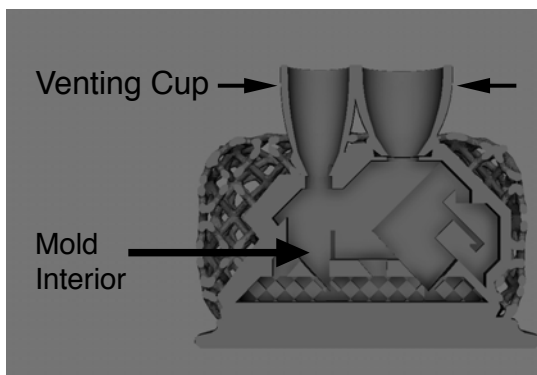
The final burn out temperature depends on the final strength needed during casting, i.e. the specific metal melting temperature. The hotter the maximum temperature of the burnout, the stronger the 3D print for high temperature liquid casting.

A slow ramp up to 1100F is required to prevent cracking.

Temp F	Temp C	Speed per hour	Notes
65-300	20-150	50(25C)	Hold 1 hour
300-1100	150-600	50(25C)	This is the average speed for parts of 1mm thickness. Use a slower ramp of 10F(5C) per hour for parts with walls over 5mm.
1100-2000	600-1100	200(112C)	
2000-2250	1100-1240	270(130C)	Maximum burn out temperature varies dependent upon the metal casted.
Cool			Cool down to the casting temperature. If metal casting is delayed, let mold cool naturally, then reheat the mold prior to casting.

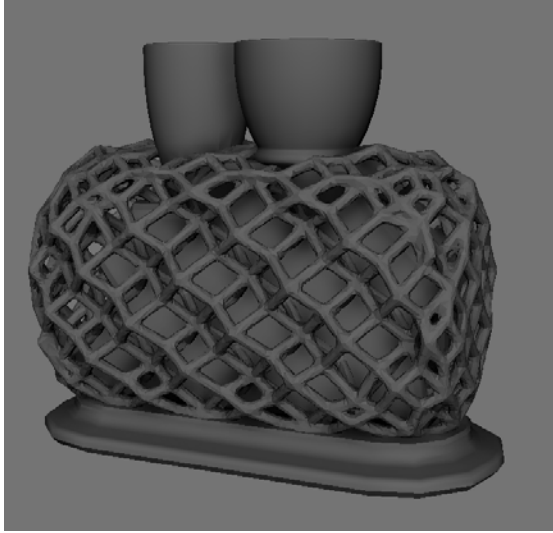
Mold Making Tips

These are some tips to help with 3D mold design. Many industrial mold making techniques can be applied to making mold with Castalite.



A casting cup is needed to pour the hot metal into the mold.

A venting cup is needed for air to escape during casting. This cup is also needed to catch excess metal as it flows out of the mold.



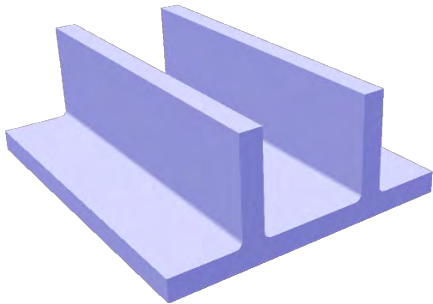
Supports

Adding the the supports for the model in the 3D design can greatly improve the results of the casting. This also allows the shell of the mold to be thinner while the outer supports add strength.

Adding your supports in the 3D file also ensures there are no supports added on the interior of the mold.

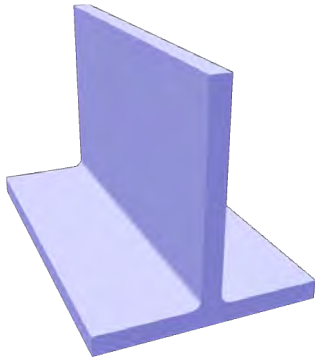
Design Tips

The following tips help achieve uniform shrinking during the kiln firing.



Wall thickness

Structures need to be supported with appropriate wall thickness. Thinner walls will warp. Details can be less than your supporting wall. Thinner walls will reduce cracking

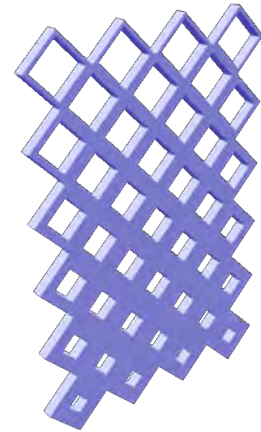


Rounding Corners

Rounding corner and where edges they meet can help reduce cracking during

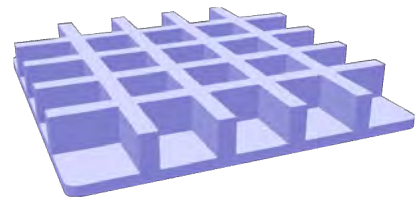
Lattice Thickness

Lattices will benefit from a structure that is thicker on the bottom than at the top. Lattice structures can be



Using Ribs for solid wall supports

Using ribs on the exterior of a thin solid wall will help reduce sagging during firing. A thin wall, with ribs supporting will act similar to a thicker wall.



Troubleshooting

Castalite® works on most UV curing 3D printers. Sometimes there needs to be fine tuning to ensure the best quality molds from your 3D printer. Here are some tips if you are having trouble. Please contact Tethon 3D if problems persist.

Castalite® not sticking to the build plate

First make sure the build plate is clean. Clean with isopropyl alcohol and paper towel. Increase exposure setting on the 3D printer. Flexible or Castable settings often have the longest exposure times.

Lower the build plate further into the resin tank.

Decrease the layer thickness of the 3D model.

Scratch build plate with the edge of a metal scraper putting small groves into the build plate.

Sanding the build plate does not work as well as a metal scraper.

Castalite® has wings or ragging during printing

Filter and remix Castalite® resin.

Reduce exposure settings.

Castalite® is cracking during firing

Reduce firing speed between 300-1200*f.

Decrease wall thickness, use ribs to increase strength and stability.

Increase exposure time for printing. Using castable settings will cure Castalite longer in between layers. This will help reduce cracking as well. Increase the time of curing in the UV chamber.

Wash the parts a final time in isopropyl alcohol and thoroughly dry.

Make sure all of the uncured resin is out of the mold before burn out.

Castalite® warps during firing

See design guides to improve geometry of object.

Use thinner print layers. Use more firing supports to hold the object in place. These are best in the are made in the 3D design.

Castalite® settles during printing

Using a printer with a wiper bar will reduce or eliminate this.

This does not affect how Castalite cures.

Use a plastic paint scraper to remove settled Castalite and remix in original bottle.

Castalite® gives off a strong odor during firing

Vent kiln to outside during firing.

Castalite® shrinks more than 17% after firing

Firing above cone 6 or 2250°F will shrink Castalite® over 17%.

Make sure all of the Castalite® is properly mixed. If all the resin is not mixed together at the time of printing greater shrinkage may occur.

Storage of Castalite®

Store in a dark cool room free from moisture. Shake Castalite® bottle for a few minutes every two weeks. Remove Castalite® from resin tray if not in use for over 3 days.

Examples of Materials Casted

Bronze



Aluminum

