

Suction Cup Fabrication

November 1, 2022



The following SOP details the fabrication of CATS suction cups specifically, however, the general methodology is applicable to most injection molding procedures.

1.0 Preparation Before Molding

1.1 Parts, Tools, and Equipment

Gather all necessary components, fasteners, and tools before you start the molding process. The mold components and fasteners for 2 suction cup molds are shown below.



Figure X: Mold Components and Fasteners

The top half of the mold can be 3D printed with PLA plastic since the surface finish of the top of the suction cup is not critical. It is important that the bottom half of the mold has a very smooth finish since this will greatly affect the strength of the suction cup that is produced. Polyjet 3D printing is a good option for this. M3 screws, nuts, and washers were used here, but future molds may require different fasteners. Notice the threaded pieces on the right. A close-up is shown below.



Figure X: Suction Cup Thread

This piece will be fixed inside the completed suction cup and provide the threads that screw into the tag.

The required tools/equipment for this process are listed below

1. Tweezers
2. Drill
3. Injection Molding Setup
4. Pressure Chamber (preheat for faster curing)

Make sure all of the above are available before starting.

1.2 Surface Prep

Clean the inner surface of both halves of the mold as well as the threaded piece with Kim Wipes or some other task wipe that does not leave lint debris. Again, this is not super critical for the top half of the mold, but there should still not be any visible debris. The bottom half should be wiped thoroughly.

1.3 Mold Release

Apply mold release generously to the inner surface of both halves of the mold. Do this in the fume hood as shown below.

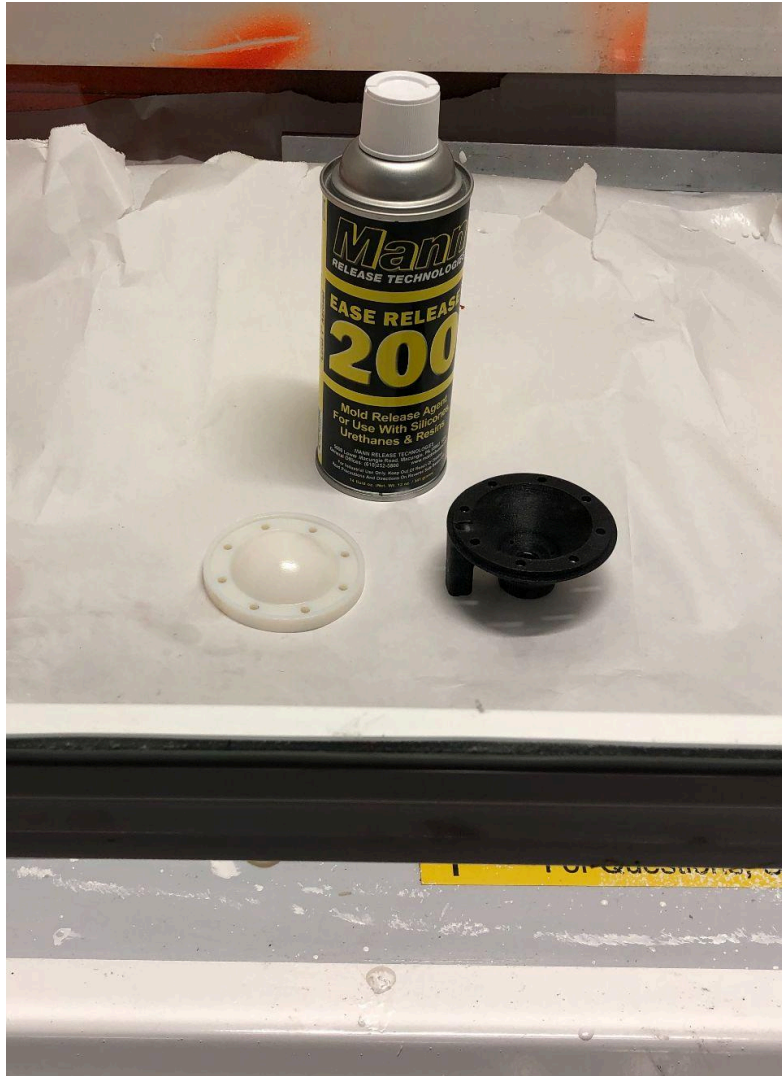


Figure X: Mold in Fume Hood for Mold Release Application

If you are unsure of which mold release to use, ask someone. To help with removing rubber after curing, it is useful to spray mold release directly into the injection hole as well as the small air holes on the top side of the top half of the mold.

Do not apply mold release to the threaded piece which will sit inside the mold.

1.4 Threaded Part Insertion and Fastening

Screw the threaded part into the top half of the mold. It is useful to have tweezers as shown below to avoid getting mold release on this part.

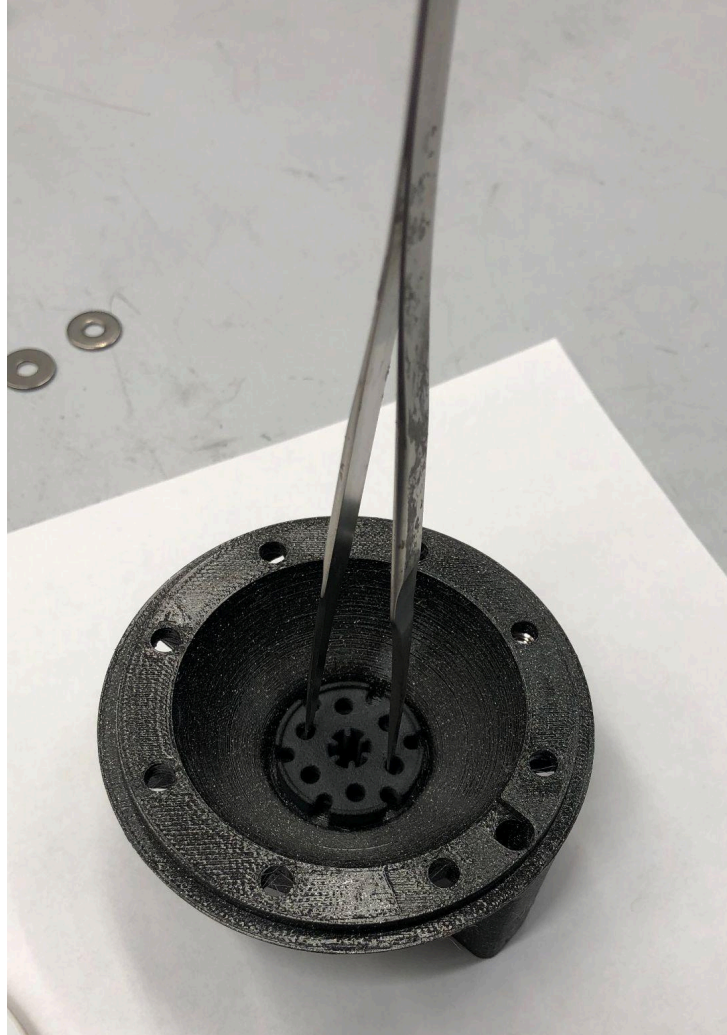


Figure X: Inserting Threaded Piece

This piece does not need to be very tight, just snug. Once inserted, the two halves of the mold can be fastened together. The fasteners do not need to be very tight either. Over tightening them risks having the nuts cut into the PLA and spin.

2.0 Using The Injection Molding Setup

We used Smoothsil-945 for these suction cups. Michael has a great instructional video on how to fill a cartridge if it ever runs out: <https://www.youtube.com/watch?v=9C1yKehtkJQ>

Below is picture of the injection molding setup.



Figure X: Injection molding setup

Remove both the cap and the plug underneath it from the Smoothsil-945 cartridge, then screw on an optimixer nozzle.

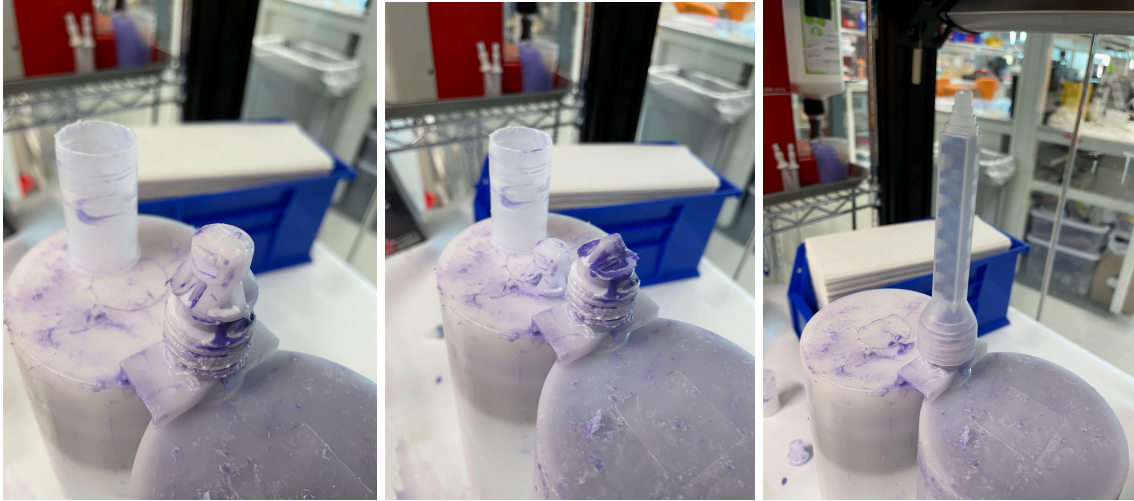


Figure X: Cap and plug removal. Optimixer nozzle.

Flip the cartridge and insert it into the holder.

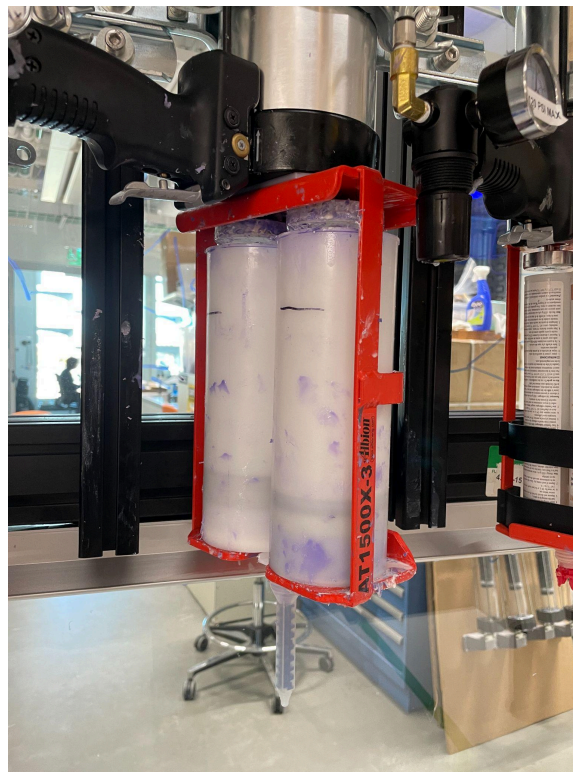


Figure X: Smoothsil cartridge in holder

Pushing the pin near the trigger will change which direction the piston will move when the trigger is pulled.

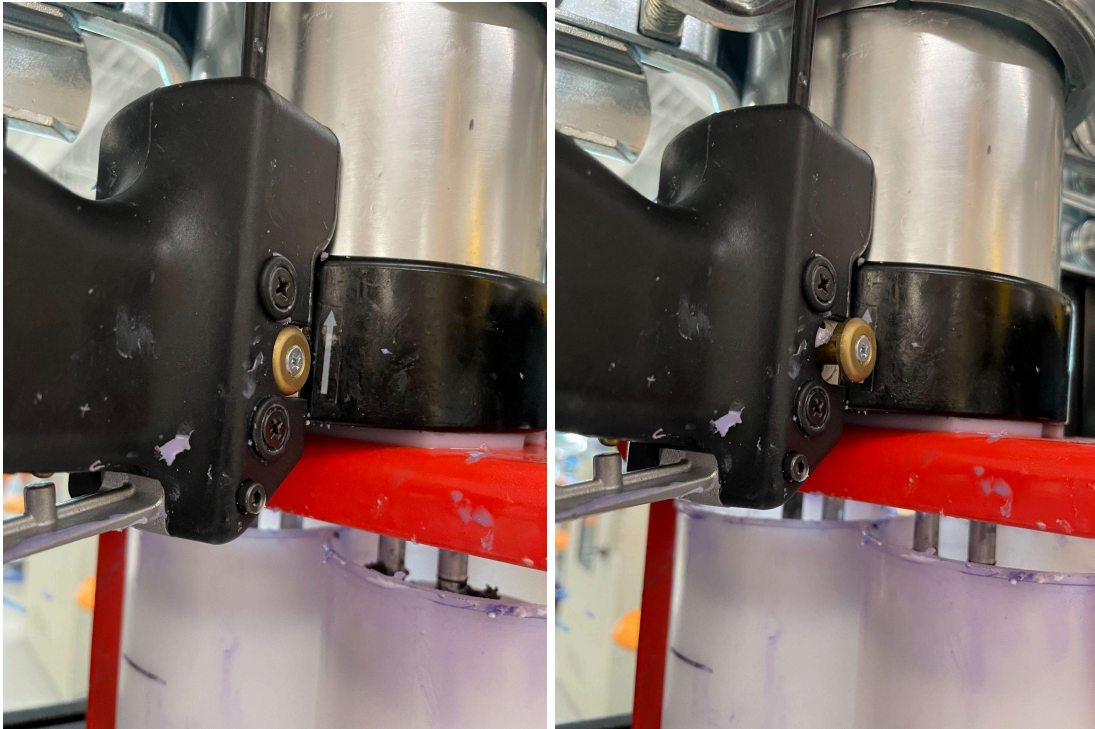


Figure X: Trigger pin positions (left moves piston up, right moves piston down)

Inject a small amount of silicone into a cup to make sure that the 2 parts are mixing well. A solid color should come out of the nozzle ([“Test Injection.MOV”](#)).

Perform the injection. Make sure you have a cup nearby to catch the dripping silicone once your mold injection is finished ([“Mold Injection.MOV”](#)).

Notice how extra rubber is injected so that it comes out of the air holes on the top of the mold.

3.0 Post Processing

Once the silicone has been injected, move the mold(s) to the pressure chamber. Cure the silicone at 122 F (50 C) at roughly 100 psi for no less than 1.5 hours. Place the mold on a piece of paper to keep the pressure chamber clean.

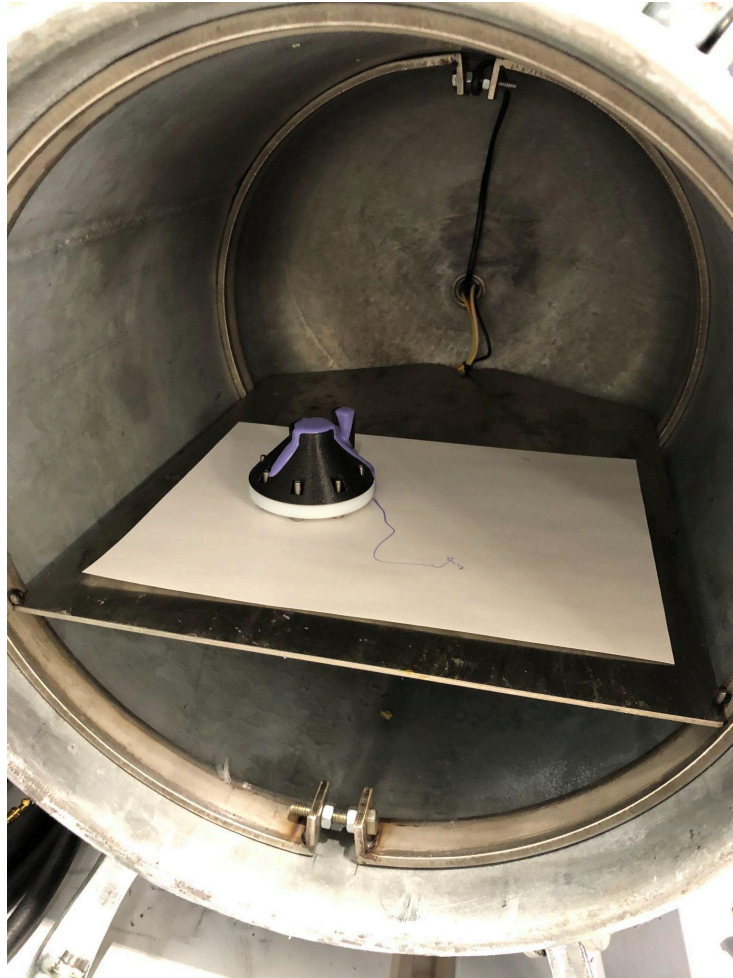


Figure X: Mold in pressure chamber