Ceramic Handbook

ABOUT

INTRODUCTION

Our journey began with extensive research as a foundational step for our project aimed at producing 3D-printed molds to simplify the creation of intricate ceramic vases. Understanding the complexities and nuances of ceramic design was essential, so we delved deeply into the history and techniques of ceramic art. We explored various styles, materials, and methodologies to gather a comprehensive understanding of what makes a ceramic piece both functional and aesthetically pleasing.

To understand our vision, we created a moodboard featuring a curated collection of existing ceramic vases that served as our inspiration. This visual representation helped us identify key design elements, such as form, texture, and color, that we wanted to incorporate into our own creations. Each piece on the moodboard was carefully selected to reflect a range of artistic influences and technical challenges.

With inspiration in hand, we transitioned to the design phase, where we began sketching our ideas. Our goal was to push the boundaries of traditional ceramic vase design by improving the precision and versatility of 3D printing technology. We aimed to create molds that would not only make the production of complex shapes easier, but also allow for consistent replication of intricate details.

After several refinements, we finalized a distinct vase design. Our project is a testament to the seamless integration of traditional craftsmanship with modern technology. Through careful research, inspired design, and innovative 3D printing, we have created a mold that makes it significantly easier to produce complex ceramic vases. This opens up new possibilities for artists and hobbyists.

WHY IS UNDERCUTS SO DIFFICULT?

Undercuts are challenging to maintain when working with traditional plaster molds due to the inherent properties of plaster and the mold-making process. Here are the primary reasons:

Difficulty in Mold Release:
An undercut creates an area where the model or cast part is wider than the opening of the mold. When the plaster sets around an undercut, it locks the model in place, making it extremely difficult to remove without damaging the mold or the model. As well as for the increased friction.

Fragility of Plaster:
Plaster is a relatively fragile material. When attempting to remove a model with undercuts, the stress and strain can easily cause the plaster to crack or break, leading to mold failure. It also has a structural weakness.

Complexity in Mold Design:
To accommodate undercuts, mold makers often need to create multi-part molds with separate pieces that can be carefully disassembled to release the model. This adds complexity to the mold-making process, requiring precise alignment and additional work. Ensuring that multi-part molds align perfectly and are properly sealed to prevent leaks during the casting process is technically challenging and time-consuming.

Potential for Incomplete Casts:
Undercuts can create pockets where air can get trapped during the casting process, leading to incomplete or flawed casts. It is important to ensure that the casting material flows correctly into the undercut areas without leaving holes is difficult, particularly with more sticky materials.

Demolding Process:
During demolding, any applied force to release the model can cause damage to both the mold and the cast if the undercut is not properly accounted for. Techniques to release the cast without damage, such as the use of flexible molds or specialized release agents, add another layer of complexity and potential for error.

SOLUTIONS TO HANDLE UNDERCUTS

By understanding these challenges and employing specific techniques and strategies, mold makers can better manage undercuts and produce high-quality molds and casts.

Flexible Molds: Using flexible mold materials like silicone rubber can help accommodate undercuts since these materials can stretch and flex during the demolding process.

Multi-Part Molds: Designing multi-part molds that can be carefully disassembled helps in managing undercuts, though this requires additional skill and precision.

Undercut Fillers: Temporary fillers can be used during the mold-making process to eliminate undercuts. After the mold is set, these fillers are removed, leaving a manageable space in the mold.

PROBLEMS WITH PLASTER CERAMIC MOLDING

Problems with plaster ceramic casting molds and casting slip can be interesting, but they can usually be rectified. Here are a few of the major slip casting problems and suggestions for correcting them:

The mold leaks when pouring slip into it.
The mold parts don’t match up correctly and/or your parting line has some serious issues. It could also be issues with the model itself. We advise looking at the model from another point of view to see if it needs to be fixed.

The casting surface has a very rough or textured surface, and the cast piece’s surface mimics this.
Chances are that the plaster was mixed incorrectly. Make sure that the soak time is correct and that all lumps are broken up as you mix. Try pouring the plaster part through a handheld sieve to catch any unmixed plaster lumps and use a pour spout. Check your parting compound application.

Its impossible to move the mold.
The mold is too heavy or the walls of the mold are too thick. The weight can be reduced by making the clay walls proportional to the shape. You can remove extra weight by cutting the corners of the mold at 45° angles.

The plaster slip casting mold is soft and kind of crumbles in places.
This is a plaster issue—incorrect plaster to water ratio, old plaster, plaster has become damp or wet in the bag, insufficient soaking time, or improper mixing technique.

DON'T GIVE UP DARLING

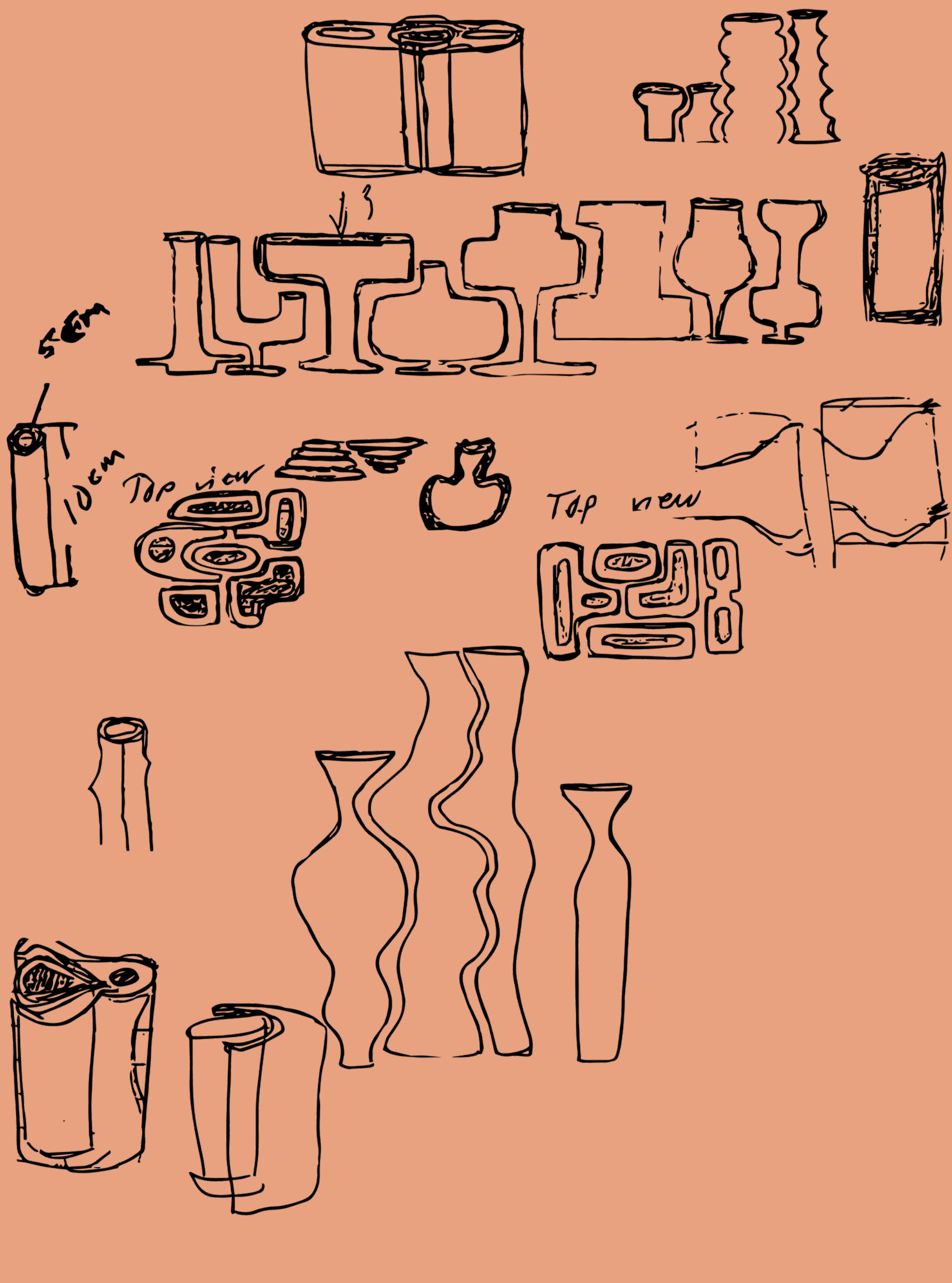
The cast greenware does not want to release at certain places in the mold.
You may have poured the plaster to make that mold part so that its stream hits just one part of whatever it is being poured onto forming a hot spot. It could also be that if it is in a corner, there is a hang up due to draft issues. To help your cast clay object release from these troublesome areas, fill an old sock with corn starch and knot the open end. In the locations where there are release issues, pounce that sock so that some corn starch appears on the mold surface. You don't need to cover that area with a large quantity of material. Just lightly pounce so that you can barely see the powder, and that should help the cast release in that area. Any corn starch left on the greenware simply burns off in the bisque firing. It could also be an undercut, a return, or other mold design issues.

Cast object retains water after excess slip is poured from the mold. Casting rate is too long. This is a casting slip issue and is due to incorrect specific gravity or viscosity. It can also be due to too much ball clay in the mix.

Some parts of the mold do not come apart.
This is most likely a parting compound/mold soap issue. Not enough has been applied to the mold surfaces.

MOODBOARD

SKETCHES



HOW TO MAKE THE CERAMIC

STEP 1:
Download the 3D file of the mold or create your own, and 3D print it, making it a few centimeters larger than the original object to account for ceramic shrinkage when it dries.

STEP 2:
Once the 3D mold is printed, mix the liquid silicone according to the package instructions. We use BL20 X2 Medium silicone. Stir it in one direction to avoid air bubbles. Pour the liquid silicone into the mold, then tap the sides and bang it against the table to release air bubbles. Pop any bubbles that appear. Set the mold aside to dry.

STEP 3:
Build a box around the silicone mold using duck tape, ensuring it is completely sealed to prevent plaster leakage. Once the silicone mold is dry, place it inside the box and secure it to the bottom with double-sided tape to prevent movement. Apply vaseline to the plaster mold for easy ceramic release. Mix plaster with water, stirring in one direction to avoid air bubbles, and work quickly as it dries fast. Pour the plaster into the box with the mold, tap the sides to release air bubbles, and pop any that appear. Set it aside to dry.

STEP 4:
Once the plaster is dry, clean the edges with a knife. Apply vaseline to the plaster mold for easy ceramic release. Assemble the mold and secure it with rubber bands. Pour in the slip casting and let it dry for about 10 minutes, depending on the drying time of the slip. Slowly pour out the excess slip from the mold. Set it aside to dry completely.

STEP 5:
Remove the ceramic and clean the edges with a knife for a smooth surface. Optionally, glaze the ceramic and burn it.

VOILA - FINISHED

END RESULT

The vase showcases the remarkable capabilities of our 3D-printed molds, featuring intricate geometric patterns and dynamic textures that challenge traditional ceramic methods. This design demonstrates how modern technology can transform artistic vision into reality, with structural elements requiring high precision. The detailing and complex shape are difficult to achieve without advanced tools since traditional techniques often lack the precision needed for such designs. Our 3D-printed molds revolutionize this process, ensuring each piece meets the highest standards of quality.

Our vase, along with the comprehensive handbook, represents a significant advancement in ceramic art. This project highlights the capabilities of 3D-printed molds and serves as an educational tool, expanding the possibilities in ceramic design.

SOURCES

https://community.ceramicartsdaily.org/topic/20025-plaster-mold-making-problems/

https://www.meaningfulspaces.com/how-to-make-a-plaster-mold-for-pottery/

https://ceramicartsnetwork.org/daily/article/10-slip-casting-problems-and-how-to-solve-them