All You Need To Know About Making Silicone Molds

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Introduction

Silicone rubber is an ideal material for making molds of lifecastings and other objects used in sculpture, special effects and taxidermy. As with liquid latex, it yields a light, flexible, detailed mold, but has the added advantages of longer life, resistance to chemicals and decomposition. It is the recommended material for making long-lasting molds. A silicone mold also can be made in less time than a latex mold, if “fast” catalysts are used. Among silicone's few disadvantages is that it is more expensive than latex, and not quite as elastic or tear resistant.

The most common silicone compounds used for mold making are RTV or "Room Temperature Vulcanizing" silicones that are mixed in two parts (a base and a catalyst) to induce curing. The silicone mixture is poured or spread over a prepared model or specimen, then reinforced with gauze or other reinforcing material between layers for increased strength and tear resistance.

After the silicone mold is cured a shell mold is often constructed to provide rigidity for the rubber after it is demolded. The shell mold can consist of fiberglass, plaster or urethane. The shell mold is often referred to as a “mother mold.”

Normal curing time for most silicones is between 18- and 24-hours, but cure times may be greatly reduced by using fast-acting catalysts. When making molds in a studio where such equipment is available, de-airing in a vacuum chamber is recommended to remove trapped air bubbles. However, when working on larger molds vacuuming can be avoided by painting on the silicone over the model. The brush will tend to remove the surface air.

Safety Note: RTV silicone rubber compounds are relatively safe and odor free when properly used; however, the curing agents or catalysts may be toxic if ingested and are irritants to eyes and bare skin. Tin-based silicone cannot be used against the skin. Certain platinum-based silicones are deemed skin safe such as ArtMolds' *LifeRite*.

Types of RTV Silicone

There are two common classes of RTV silicones: 1.) Tin catalyzed or “condensation cure” silicones which require moisture to cure and; 2.) Platinum catalyzed or “addition cure” silicones. Silicones in the first group are the less expensive and easier to use. They include *MoldRite*, FXRite and *SkinRite*. They are typically of low viscosity (easily poured) and are not inhibited by many materials. In contrast, platinum cure silicones (often called “elastomers”) are inhibited by many naturally occurring materials, including sulfur, tin, and amines. This makes them unsuitable for certain clays, which contain sulfur or latex gloves. However, platinum-cure silicones have the greatest chemical, microbial, and temperature resistance. LifeRite, the skin-safe silicone, is a platinum cured silicone.

Silicones in the tin group are often used for low-volume plaster casting; those in the platinum group for more specialized resin or epoxy casting (especially in high volumes).

Most silicones are available in 1-lb. kits, and 10-lb. (or 1-gallon) kits, which include a "standard" catalyst for typical cure times

between 16 and 24-hours. Fast catalysts (discussed below) may be purchased separately. Catalysts are mixed with the base in a prescribed ratio depending on the silicone variety. Some use a 50:50 ratio of base to catalyst; others a 10:1 or 100:1 ratio. All of ArtMolds' silicones use a 10:1 mix ratio. As 50:50 ratios must use fillers in the catalyst which add cost.

It is important to know that RTV silicones and their catalysts have a limited recommended shelf life, ranging from 6-months to 1-year according to the manufacturers, so it is best to purchase only what you can use within a few months. However, many silicones may be used successfully up to 2-years from the date of purchase if properly stored in airtight containers in a cool, dry location.

Proper Use of Catalysts
Fast catalysts are available for each type of silicone (tin or platinum), which can reduce cure times significantly--in some cases to less than 1-hour. With most silicones, there is some latitude allowed in the catalyst portion (adding more than the recommended amount will speed cure times, as will using a fast catalyst). However, there are limits to the amount that may be added and adding more than the recommended amount of catalyst, or using a fast catalyst, will shorten the life of the mold, making it more prone to tearing or becoming brittle over time. A catalyst-rich mold may last a year or so; one with less catalyst should last for many years.

Thinners
Thinners or "diluetants" are available for thinning or decreasing the viscosity of some RTV silicones. However, they are expensive and do not seem very effective (one must add a large amount of diluetant to achieve a small effect on viscosity, and thorough mixing is difficult and time consuming). Diluents also weaken the cured silicone. Therefore you should purchase silicone in the desired viscosity rather than using diluetants.

Thixotropic Additives
For applications where a thick, paste like silicone is desired (such as molding an object on a vertical surface), “thixotropic” silicones or thickening catalysts are available.

Mixing the Silicone
Because of settling during storage, always stir the silicone in the original container before pouring into a mixing cup. Stir steadily with a circular motion rather beating it or using an up-and-down motion, to avoid trapping air bubbles, scraping the bottom of the can to loosen any settled material. Then let the silicone rest for a few minutes or more to allow air bubbles to rise to the surface (this small resting time will not cause any re-settling of the silicone itself). Tip: Tongue depressors or craft sticks make good, cheap stirrers for small batches; paint stirrers make good stirrers for larger batches.

Next, pour the desired amount of silicone into a separate mixing container, such as a plastic cup or wax-free paper cup. Select mixing containers with relatively straight bottoms and sides, and little or no inner lip to make stirring easier. Use a gram scale to weigh out the amounts for the proper manufacturer's mix ratios (e.g. 1:1 or 10:1 ratio). Add the catalyst to the base and mix thoroughly scraping the sides and bottom of the container to get a thorough mix.

Adding the Catalyst
After measuring the proper amount of catalyst into a separate mixing container, mix in the catalyst with the base. If you are not in a hurry, it is best to use the recommended dose (or even slightly less) of the standard catalyst. One need not be extremely precise in measuring the amount of catalyst (with practice an "eyeballed" measurement is normally sufficient). One can be off by 10- or 20-percent without much effect in the cure or final product (a little more will speed the cure, a little less slow the cure). Cure time is also somewhat affected by temperature and humidity (heating accelerates the cure). Despite the latitude in the amount of catalyst used, there are minimum and maximum limits. An

excessive amount of catalyst may not allow enough work time and can result in a brittle mold; too little may cause incomplete or uneven curing.

One has at least 20-minutes of available "work time" time with most standard catalysts before the silicone starts to cure or "set up." (Note LifeRite has a 5-minute working time). Stir well for at least two- or three-minutes, and scrape all parts of the container to achieve a thorough mix. However, avoid overly vigorous motions that can introduce air bubbles. After mixing, one may let the silicone rest a few minutes to allow air bubbles rise to the top (which should be broken before pouring), or one can use a deairing vacuum chamber if available. After mixing, it is best to re-pour the silicone into a third container, to avoid using any of the poorly mixed silicone that often exists at the bottom and sides of the container.

Using special fast catalysts the cure times can be reduced substantially, sometimes to an hour or less.

Deairing
If a vacuum chamber is available, use it to remove trapped air from the mixture before pouring. When subject to a vacuum, the silicone mixture should well up as air pockets rise and burst. As soon as the material settles down, proceed to the pouring/application procedures described below. If a fast catalyst was used, you must work quickly to avoid having the silicone cure before it is applied. ArtMolds has an inexpensive vacuum chamber you can use with your own vacuum pump.

Pouring or Applying the Silicone
One of the main concerns when applying silicone to a subject is to avoid trapping air bubbles on the surface. Besides choosing a low viscosity (free-flowing) type of silicone, there are several techniques that are helpful in this regard.

1. One is to apply a thin initial coat of silicone ('face coat') with a fine paintbrush, gently spreading it into all cavities and undercuts (after which more silicone may be poured).
2. Another method to reduce air bubbles (which may be used in combination with the first method) is to hold the silicone container high above the model and allow it to flow down slowly, in a very thin stream. This tends to break air bubbles on the way down.
3. Yet another technique (which again may be used in combination with the others) is to temporarily incline the model at an angle, and pour the silicone onto the higher end, allowing it to flow down over the rest of the specimen. When the silicone reaches the lower end, then lay the model flat and/or tilt or rotate it in other directions as needed to achieve an even coverage.
4. Yet another technique (sometimes used mostly by professional studios) is to use a small compressed air gun to direct small amounts of silicone across the mold surface and into any crevasses or undercuts.

Using any of these methods, you may need to manually push the silicone around a bit to encourage even coverage (using a small tool such as a craft stick), and/or repeatedly pull it from the deeper to the shallower sections (where it tends to pool). As the silicone cures it will begin to "stay put."

If you find there is not enough silicone mixed to cover the model to a good depth, it is better to spread it in a thin layer over the entire model, and then apply a second batch over it, rather than to cover only part of the model and then fill in the second batch (the latter method tends to leave small seams between the pours). To reinforce the mold (and help avoid tearing), one may embed gauze, open-weave cloth, or nylon screening between layers, as described below.

Reinforcing the Mold
After the silicone has started to cure, but while it is still tacky, one may gently apply strips of gauze or cheesecloth to increase the strength of the mold, especially if two layers are being laid down. This strengthens the mold against tearing, a common silicone mold problem. Be sure not to push the

gauze through to the model surface. After the gauze is applied, apply another layer of silicone to thoroughly cover the gauze layer. Typically the finished mold should be at least 1/8

inch thick even in the thinnest sections. One may also wish to only reinforce the edges of the mold (especially any thin edges), which are more prone to tearing than the main body of the mold. When selecting gauze, be sure to get the non-elastic type (the “stretch” kind commonly sold today tends to bunch up). If you cannot find the old fashioned conforming gauze in rolls, an alternative are the gauze bandage pads that can be unfolded to a square sheet, and cut as desired.

Removing the Mold
After the prescribed cure time has elapsed and the outer surface of the mold feels firm and dry, the mold is usually ready for removal or “demolding.” However, if the mold has any deep areas, or time is not of the essence, it is best to wait a bit longer to ensure that all areas of the mold are fully cured. When removing the mold, gently peel up all the edges first, and then the middle section. If any portion seems too soft, immediately stop pulling and replace any lifted sections, allowing more time to cure further.

Adding a Shell Mold
Regardless of whether any gauze reinforcement is applied, most molds will need some type of rigid supporting structure (sometimes called a "mother mold", “backing,” or “jacket”) to ensure that the original mold keeps its shape during storage and casting. Small, uncomplicated molds, or ones that can be poured so that the backside is level, may not need such support. However, in other cases a mother-mold is recommended. The mother-mold may be made of expandable foam, casting plaster, urethane plastic, or fiberglass resin. Before pouring the mother mold material, make sure the original mold is fully cured, lifted off the model, and then replaced back onto it (otherwise it will be difficult to lift the original mold off the subject).

The cheapest and fastest way to create a mother-mold is with a plaster jacket. The plaster may be simply poured over the mold (with a retaining walls created to contain it if necessary), or applied in "plaster bandages" (strips of burlap or open-weave cloth soaked in plaster slip). However, plaster jackets are heavy, prone to breakage, and have no flexibility (which may be needed on some molds).

Cleaning the Mold and Model After Mold-Making
After removing the mold, be sure to clean it and the specimen before storing either. If you used Vaseline or other oil-based release agents, or silicone without a release agent, the residue or discoloration can often be removed or reduced by washing the specimen with kerosene or other petroleum solvents. Avoid getting solvents on your skin, and always use plenty of ventilation. Be sure to test an unimportant specimen first to be sure the solvent does not dissolve the matrix or otherwise worsen the situation.

Making Finished Casts from a Silicone Mold
Rigid casts may be made from silicone molds using common casting materials such as Plaster-of-Paris, Hydrocal, Forton MG, plastics, resins, epoxies, cement, or other materials. Many silicones can even withstand low-temperature metal casting (check manufacturer’s product literature for temperature ranges). Normally a release agent is not needed for plaster casting, but for urethane and resin casts, or complicated molds with severe undercuts or many crevasses, a release agent such as thinned Vaseline and or barrier coat (such as a varnish or paint applied to the mold before casting) is advisable. Depending on the nature of the mold, one may need to build a frame around it to retain any overflow casting compound. Mix and pour the casting material according to manufacturer's instructions. After the cast has hardened completely, slowly peel the mold from the cast. Work around all the edges before pulling up the middle sections. If the cast is deep, the remaining volume may be filled with expandable foam if desired, the same

way it may be used to fill the volume of deep molds.

How to Paint or Color Silicone
Coloring silicones can be a challenge**.** But with a little knowledge and some patience you can master it. On the surface (externally), the trick is to use the correct silicone-based paints.

To color silicones internally, you can add just about any pigment or dye to tin silicone as tin silicone is very forgiving. It will cure under just about any circumstances. The easiest pigments to use for translucent silicone are actual artists' oil paints (but not water-based oils). These oil paints can be purchased at any art store. ArtMolds carries a line of dyes for use in coloring rubbers such as silicone.

But you can paint silicone by using a silicone base as other paint types will not stick to the surface and easily rub off. You can create your own paints using a translucent silicone as a base and simply adding pigment or dye. If your piece was made out of translucent silicone just mix up a small batch of same, thin it with any solvent, add your pigment then paint. ArtMold has a complete line of premixed paints for silicones.

When mixing your own paints, recommended proportions vary. Add pigment to achieve desired color, but do not over do it. Typically, usage is from slight traces to 4% by weight.

The most effective and controllable way of painting the surface of silicone is with an airbrush. You must dilute your silicone paint with an airbrush solvent made for silicone. Paints and airbrush solvents are available from ArtMolds especially for this purpose.

For further information on the silicone products mentioned in this article please call toll free in the US: 1-866-278-6653, or International call: 1-908-273-5401.

Happy mold making.