

Neoprene Maskmaking

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Neoprene is a synthetic latex compound. Most people are familiar with it in its foamed form, but in maskmaking we use liquid neoprene, similar to liquid latex. The basic maskmaking technique involves "slip-casting" the neoprene into a plaster mold. There is no foaming or baking to worry about! Plus, when the neoprene piece comes out of the mold, it is pliable for a few minutes so the cast shape can be further altered by hand.

Neoprene is fairly durable, although it is best to store cast neoprene pieces out of the sunlight as UV can discolor them over time. Masks cast from neoprene are fairly waterproof (as long as the paint is waterproof!), lightweight, and slightly flexible making them quite comfortable to wear. They are also long lasting. After 20 years, the neoprene masks from the film *Labyrinth* are still in decent shape!

How to get Neoprene

At this time, there is only one company in the USA that still makes liquid neoprene available to individuals and small businesses. They are [Chicago latex](#), a division of [Spartan Adhesives](#) in Chicago IL. They mail-order it in the following quantities:

Chicago Latex Neoprene Pricelist, November 2004	
1 gallon pail (shipping included)	\$60.00
5 gallon pail (shipping included)	\$250.00
55 gallon drum (shipping included)	\$1086.25

Casual hobbyists will probably find a 1 gallon pail sufficient to make a

mask or two. Goblin Art usually buys four or five 5-gallon pails each year.

The neoprene compound is available in three formulas. Goblin Art and most other maskmakers use compound #521, as its slight flexibility makes masks more comfortable to wear.

Chicago Latex Neoprene Casting Compounds		
#501	Rigid casting material	Best for cast puppet heads and puppet body parts
#521	Semi-rigid casting material	Best for maskmaking
#613	Flexible casting material	

Material Safety Data Sheets (MSDS) for Neoprene 521: http://www.goblinart.com/about/neoprene/Neoprene_521_MSDS.pdf

Neoprene is destroyed by freezing temperatures, so it must be shipped during the warmer months. It also has a limited shelf-life (about 6 months).

When Goblin Art was located in the Midwest we were able to order Neoprene from mid-Spring to mid-Fall, transit time from Chicago was 2-3 days, and we didn't have to worry about the UPS truck driving though any high altitude (extra cold) regions. Now we are in Portland, Oregon, and we can only order it from late Spring to early Fall, transit time is 7-9 days and we have to pay extremely close attention to USA temperature prediction maps for that time period. If the UPS truck drives though below-freezing temperatures in Rocky Mountains, a very expensive pail of destroyed neoprene will be delivered to us.

Making the Mold

A note on plaster:

We do not recommend using Plaster of Paris, as the mold will be delicate and short-lived. We prefer using TB Hydrostone for the **detail coat** and **reinforcing coat** of the mold, and Ultracal 30 for the **finish coat**. These products are made by [US Gypsum](#), and there is a list of local US and Canadian distributors at <http://www.gypsumsolutions.com/distributor/map.asp>. One other option is Hydrocal gypsum cement, available from many building suppliers. Hydrocal isn't as strong as Hydrostone and Ultracal, but it is far stronger than Plaster of Paris.

The term "Plaster" however, is often used to refer to various forms of Gypsum Cement including Hydrostone, Ultracal and Hydrocal. So to avoid confusion in this document, I have tried to avoid using the word plaster unless actually referring to Plaster of Paris.

Mixing Gypsum and plaster:

Product	Mixing ratio by weight (water: powder)	Setting time	Percentage of expansion (correlates to degree of mold warping)	Compressive strength	Notes
Hydrostone	32:100	17-20 min	Expansion: 0.24%	10000 PSI	Very strong, and resists wearing out faster than many other gypsum compounds. Also ideal for casting positive art pieces.

Ultracal 30	38:100	25-35 min	Expansion: 0.08% (low)	6000 PSI	This is one of the hardest, most resistant gypsum compounds available, but because it does not absorb water well, it is not suitable for casting neoprene directly into. However, it is ideal to use as the final coat of a neoprene mold, because of the added strength and resistance to warping.
Hydrocal White	45:100	25-35 min	Expansion: 0.39 % (very high)	5000 PSI	This is a cheap and readily available gypsum compound, but molds made from it tend to wear out quickly.

Plaster of Paris (Also known as No. 1 Moulding Plaster)	70:100	27-37 min	Expansion: 0.2% - 0.6% (very high)	1700-2000 PSI	A cheap and easy to find mold-making material, but fairly weak. Not recommended for making neoprene molds, but fine for making plaster face casts.
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Safety Equipment - A dust mask should be worn when measuring and mixing gypsum cement. Gypsum dust poses a minimal health risk, but a dusk mask should be worn to reduce the chance of respiratory irritation. Latex gloves may also be worn during mold-making to reduce dryness and skin irritation.

Material Safety Data Sheets (MSDS):

Hydrostone - <http://literature.usg.com/pdf/52-140-052.pdf>

Ultracal 30 - <http://literature.usg.com/pdf/52-140-018.pdf>

Hydrocal White - <http://literature.usg.com/pdf/52-100-106.pdf>

No. 1 Moulding Plaster - <http://literature.usg.com/pdf/52-100-016.pdf>

Measuring - You should use a scale to measure water and gypsum powder quantities. A cheap "portion scale" will work, (make sure it goes up to at least 2 lbs), but ultimately you will be much better off with a precision Triple Beam Scale. (Check local Pawn shops to get a good deal). 2.5 and 5 quart graduated plastic buckets (from the hardware store paint section) are also handy when measuring and mixing gypsum cement.

Combining - Start with the pre-measured powder and pre-measured water in separate containers. Slowly add the powder to the water container, sifting it through your fingers. The powder may start to mound up in the center of the water, this is normal.

Soaking - After the powder has been added to the water, allow it to sit for at least 2-4 minutes before mixing. Any mounds of dry powder sitting on the top of the mixture should also be allowed to fully absorb the water.

Mixing - Hand mixing is OK for small quantities, but mechanical mixing is better. If you plan on making a lot of molds you should invest in a "[Jiffy Mixer](#)" or paint-mixing drill attachment (see image at right) and a cordless drill driver. 3-4 minutes of mechanical mixing should allow Gypsum to obtain maximum strength. Then run the mixer briefly in a bucket of water to clean off the residual material.



Additional info on molding and casting with US Gypsum products can be found here: <http://www.gypsumsolutions.com/usage.asp> and here: http://www.claymaker.com/ceramic_central/info/plasters.htm

Making the mold:

Mold-making Steps	Tools and Materials	Tips and Directions
1) Sculpt the mask	<ul style="list-style-type: none"> • Water clay • Sculpting tools • Foam core • Plaster face casting (with handle in the back, OR 2 lengths of strong ribbon or nylon tape) 	<ul style="list-style-type: none"> • Water-based clay is the best material to sculpt your original in*. • If you build the mask on top of a piece of foam-core, you can later use it as the floor of the mold box. • For best results with wearable masks, It is best to sculpt the clay right over a plaster face casting. • If you make a plaster face casting, leave the back slightly hollow, and embed a length of dowel between the ears to create a handle. This

		<p>will make it much easier to remove the face casting from the final mold.</p> <ul style="list-style-type: none"> ● OR, if you forget to add a handle to the face casting, you can embed a couple of strong, flat pieces of ribbon or nylon tape inside the sculpted clay, with the ends under the casting. When you are ready to separate the face casting from the final mold, turn the mold over and pull on both ends of the ribbon to pop the face casting out. ● While sculpting the mask design over the plaster face casting, remember to use clay to build up any undercuts that could make it impossible to separate the final mold from the face casting. ● For a smooth final finish, brush a soft, wet brush over the surface of the sculpt.
<p>2) Apply a mold-release</p>	<ul style="list-style-type: none"> ● Disposable 1" chip brush ● Vaseline OR Murphy's Oil Soap 	<ul style="list-style-type: none"> ● Use a soft brush to apply Vaseline or slightly diluted Murphy's Oil Soap to any exposed plaster from the face casting ● Do not get mold-release on the foam core.

3) Build a mold-box

- Foam core
 - Hot glue gun and hot glue sticks
 - Metal yard stick or T-square
 - Craft knife
- Measure and cut out foam-core pieces to create a box around the clay sculpt, and tall enough to contain the gypsum for the mold.
 - There should be at least 1 inch of space between the edge of the sculpt and the foam-core walls. But you don't want the walls to be too thick, or the final mold will be heavy and awkward to use.
 - Use hot glue to join the wall pieces, and attach them to the foam-core base. Keep adding more glue around the seams until there is little risk of any liquid Hydrostone being able to escape.

4) Detail coat

- Rubber gloves
 - Dust mask
 - TB Hydrostone
 - Disposable 1" chip brush
 - Spray bottle full of water
 - Air compressor with small nozzle, set to very low PSI
- Mix up a small batch of Hydrostone, and carefully apply to all surfaces of the sculpt, trying not to touch the delicate clay.
 - Use paint brush to drizzle Hydrostone over the sculpt, and air compressor nozzle to pop bubbles and help blow Hydrostone into sculpted details.
 - The Hydrostone coat should be about 1/4" thick, cover all protruding features, and all undercuts.
 - *If needed*, squirt detail coat with a water spray bottle, to keep from

		<p>drying while mixing the next batch of Hydrostone.</p>
<p>5) Reinforcing coat</p>	<ul style="list-style-type: none"> ● Rubber gloves ● Dust mask ● TB Hydrostone ● Dampened hemp fiber rolled into balls (approx. 2x2" to 3x3" square) OR dampened strips of burlap (1x2" to 2x4") ● Small lengths of wood and saw to cut them to size ● Spray bottle full of water 	<ul style="list-style-type: none"> ● Mix up a second batch of Hydrostone. ● Dip burlap hemp fiber into the Hydrostone mixture, and apply to the mold. Cover all surfaces of the mold in this manner, stroking material down to remove air pockets. If using burlap, build up 2-4 layers, particularly over protruding details. Leave surface roughened to allow finish coat to better adhere. ● You will probably also need to build the foot of the mold up to be flat, so when it is finished and turned over it, it will rest level. (This can be done with the hemp fiber balls, or in case of a very uneven mold, you can even embed 2 or 3 wood "legs" in the gypsum).

6) Finish coat / Beauty coat

- Rubber gloves
- Dust mask
- Ultracal 30

- The Ultracal layer gives the mold a finished look, and helps strengthen it and make it last longer. If you are doing a small or simple mold, you may be able to skip it entirely.
- When mixed, Ultracal remains liquid for longer than Hydrostone, then suddenly becomes creamy. When it becomes creamy, it is very easy to smooth it, and a putty knife or joint knife may even be used.

7) Demolding the sculpt

- Plaster rasp
- Wooden sculpting tools
- Flathead screwdriver
- Air compressor with small nozzle, set to about 60 PSI
- Patience!

- When the final mold surface has started to cool, you can start peeling off the foam-core mold walls.
- Lift the mold off the foam-core base, and flip over.
- Use a plaster rasp to remove sharp or jagged mold edges.
- Carefully remove the plaster face casting, by pulling on the handle inside the face casting, or the ribbon or nylon straps. This may be the hardest part of the process, but be patient. It may also help to use wooden sculpting tools to remove the layer of clay between the mold and the face casting. In really difficult cases, use a flathead

screwdriver to help pry the face casting out of the mold, or soak the space between the face casting and the mold with very hot water.

- When the face casting has been removed, carefully remove clay from inside mold. Wooden sculpting tools may help, but be careful not to scratch the mold's inside. Once most of the clay is gone, I usually place the mold inside a utility sink, squirt it with warm water, and clean with a soft toothbrush. Any clay trapped in deep cavities may be loosened by alternating sprayed warm water, and spraying air from the air compressor nozzle.
- When the mold is clean, place it somewhere warm and well ventilated to dry, ideally for 24-48 hours.

*It is possible to use oil-based clay when making molds for the Chicago Latex neoprene formula, but the oils may cause significant problems. Neoprene casting requires a mold that can absorb water, and oil-clay residue blocks the "pores" of the mold. Oily molds can be cleaned with rubbing alcohol, Citri-solve cleaner, and 3M Citrus cleaner, but the process can take a lot of time and multiple cleanings. And even then, the mold may absorb the water from the neoprene very slowly and unevenly, leading to poor-quality castings.

Casting Neoprene:

Mold-making Steps	Tools and Materials	Tips, tricks, and directions
<p>1) Prepare the neoprene</p>	<ul style="list-style-type: none"> ● 1 gallon water jug(s) ● Extra large oil funnel from an auto supply store ● Pump for 5 gallon water bottle 	<ul style="list-style-type: none"> ● It is much easier to pour neoprene into molds if it is in a 1-gallon or half-gallon water jug. ● The easiest way to get neoprene out of a 5 gallon pail is with a pump for 5 gallon water bottle from Harbor Freight Tools, and a large funnel. This specific pump is not exactly the right shape for the neoprene pail, but it is cheap, easy to use, and easy to rinse afterwards. ● Pour neoprene into water bottles the day before, or at least several hours ahead of when you want to cast it, to allow time for frothy air bubbles to dissipate. ● Rinse funnel and/or pump pieces.

<p>2) Clean the mold</p>	<ul style="list-style-type: none"> ● Utility sink ● Soft nail brush or toothbrush 	<ul style="list-style-type: none"> ● Rinse mold with water to remove dust. ● If the mold has developed any efflorescence, gently remove it with the brush. ● Pour the water out of the mold ● Use a very small soft paint brush to pop any air bubbles
<p>3) Cast the Neoprene</p>	<ul style="list-style-type: none"> ● Air compressor with small nozzle, set to very low PSI, OR drinking straw ● Stop watch with alarm. 	<ul style="list-style-type: none"> ● Slowly pour neoprene into the mold, till mold is 1/4 full. ● If you pour it so it hits the side of the mold first, (instead of the bottom of the mold), you will get fewer air bubbles. ● Gently rock the mold in different directions, allowing the neoprene to flow over all the mold's inner surfaces. ● If there are air bubbles, blow very gently on them with a compressor nozzle or drinking straw to pop. ● Pour more neoprene into the mold until it is almost full. If the top of the mold is not level, you may need to prop it up slightly to compensate. ● Allow neoprene to sit in the mold for 1-4 hours while it builds

		<p>up on the inner walls of the mold.</p> <p>Remember to check it every 30-60 minutes, so it doesn't get too thick. I recommend setting an alarm so you don't forget!</p>
4) Drain the neoprene	<ul style="list-style-type: none"> ● Paper cup or small yogurt cup ● Large "oil" funnel from an auto supply store ● A small section of window screen material 	<ul style="list-style-type: none"> ● When the semi-solidified neoprene on the walls of the mold is about 1/4", it is time to drain the liquid neoprene out. ● The liquid neoprene should be poured back into the neoprene bottle to be reused later. ● There are different ways to pour out the neoprene, depending on the size, shape and weight of the mold, and in particular, how full it is. Some molds can simply be picked up and poured back in, using a large funnel. Others may need to be bailed a little bit first. A paper cup or small yogurt cup may do the trick, but be careful not to touch the cup to the semi-solidified neoprene built up on the inside of the mold. ● Sometime the neoprene in the mold develops a "skin", rather like cooling hot

		<p>chocolate. You do not want to pour the skin straight back into the neoprene bottle, but you can filter it. I have had good results using a small section of window screen placed inside the funnel before pouring. Even if you rinse the screen after use, it will still eventually get clogged up. But if you buy a roll of screen, you will have long lasting supply of "neoprene filters".</p> <ul style="list-style-type: none"> ● If you set the mold down for a few minutes after you pour out the neoprene, then pour it a <i>second</i> time, it can help drain a lot more of the liquid neoprene.
<p>5) Set the mold (and freshly cast mask) to dry</p>	<ul style="list-style-type: none"> ● A work surface you don't mind dripping neoprene on 	<ul style="list-style-type: none"> ● Prop the mold up on its side to dry in a warm place with good air circulation. ● Make sure any last liquid neoprene will drain out of the mold, instead of puddling inside it. ● Wait 24 hours.

6) Demolding the mask

- Talcum powder
- Disposable 1" chip brush
- Sharp, curved nail scissors
- Plaster face casting or (other rigid base) to set drying mask over

- Sprinkle a small amount of talc inside the mold/mask, and spread with the paint brush. Take extra care to get talc inside of deeper parts of the casting.
- Start separating the entire edge of the neoprene from the mold.
- Once the edges are free, gently flex and pull the casting to free it from the mold.
- Set the mold aside to dry (in a warm, well ventilated place)
- Carefully trim the excess neoprene from the mask.
- Set the mask on a dry plaster head form, and wait 24-48 hours for it to cure.

7) Finishing the mask

- Dremel with Alum. Oxide Grinding Stone (I like #952)
- 120 and 150 grit sandpaper
- Acrylic molding paste
- Self-adhesive nail wrap tabs (Find at Sally's beauty supply)
- Super glue (we prefer Zap CA, by Pacer)
- Paint
- Leather punch
- Elastic and/or ribbon

- Every casting has a few imperfections. Use the Dremel to grind off the worst of them, and the sandpaper to smooth out the small ones.
- Small air holes can be patched with molding paste.
- Cracks and joins can be repaired with nail wrap tabs and super glue, then re-texturized with molding paste.
- Paint the mask! If you like, you can even base paint it

	<ul style="list-style-type: none">● Miscellaneous decorative material	<p>first with spray primer.</p> <ul style="list-style-type: none">● When you are happy with your painting, seal the mask with Krylon Crystal Clear, satin or matte spray paint, or Dorland's wax medium.● Use a leather punch to make holes to tie on elastic cord and/or ribbon.● If you like, glue on decorative materials like rhinestones and trims. E-6000 is a particularly durable adhesive for such this.
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Other Neoprene Resources

Books

James, Thurston. The Prop Builder's Molding & Casting Handbook.

A theatre-prop guide to using neoprene, plaster, resin, latex, silicon, urethane, vacuum-forming and more. 230 pages, 450 photos, 1989.

Websites

Ravenwood Masks - Neoprene maskmaking workshop photos

A photo tour of Alyssa Ravenwood's 2004 workshop.

<http://www.alyssaravenwood.com/photo-albums/bradley-mask-making/index.htm>

Arlecchina's Masks - Maskmaking

Paper mache maskmaking with notes on adapting to steps to Neoprene maskmaking, by Wendy Gough.

<http://www.arlymasks.com/interest.htm>

Ping Pong's Puppet Workshop - <http://www.puppetmuseum.com/FREECOLL/WORKSHOP/workshopindex.htm>

Neoprene: Where to Buy, How to Use.

This article is from 1995, so the supplier and pricing information is out of date. By freshwaterpearls.

<http://www.sagecraft.com/puppetry/building/neoprene.html>

Classes

Dell Arte School of Physical Theater - Blue Lake, CA

Two or three week summer workshop: Maskmaking and mask performance with Dell'Arte Instructor Bruce Marrs. The two week course includes a demonstration of Neoprene mask construction. The optional third week allows time for the full process of neoprene masks, mold-making and all.

[http://www.dellarte.com/mainpage.php?](http://www.dellarte.com/mainpage.php?parent_id=1&sub_cat_id=11&action=sub_menu_des)

[parent_id=1&sub_cat_id=11&action=sub_menu_des](http://www.dellarte.com/mainpage.php?parent_id=1&sub_cat_id=11&action=sub_menu_des)

Manhattanville Dance and Theatre Department - Purchase, NY

DTH 1020 Mask Theatre. 15 week workshop includes design and construction of neoprene mask.

<http://www.mville.edu/Dancetheatre/DTH%20Syllabi/FA04%20Syllabi/1020%20MaskThWrkshp%20Syll%20FA04.htm>

www.goblinart.com