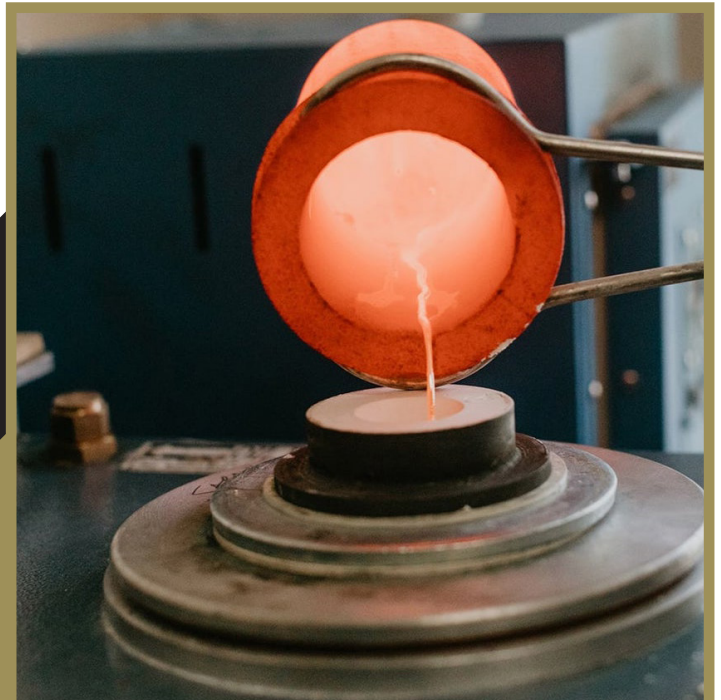


# JEWELLERY MANUFACTURING



This GT Podicle gives a comprehensive overview of jewellery manufacturing techniques, focusing on wax carving, the lost wax casting process, and methods for mass-producing jewellery using rubber and silicone moulds. We will look at the history, and essential tools required for wax carving, the step-by-step process for converting a wax model into a precious metal piece, and the steps needed to prepare a metal model for moulding.





# DEATH & waxes

## A beginners guide to wax carving

**W**ax carving is an extremely versatile technique that can be used to create jewellery. The earliest known recorded wax carving pieces date back almost 6,000 years old. It's popularity is due to its low cost and versatility, making it easy to shape, form and carve, thus allowing an artisan to not only remove material but also add material where needed to fix mistakes and add relief. There are many different kinds of wax, so you can use really hard waxes or soft waxes and combine them to create lots of different shapes, textures and finishes for precious metal jewellery.

In this GT Podicle, we will also look at the lost wax casting process, a technique that allows a wax carving to be turned into a precious metal piece, and how moulds can be used to mass produce jewellery.

So, here is what do you will need to get started?

- Wax tube or blocks
- Wax ring stick
- Scalpel
- Wax blades for your piercing saw
- Wax files
- Wax sculpting tool set
- Spirit Lamp
- Methylated Spirit

### THE BASICS: HOW TO CARVE WAX FOR CASTING

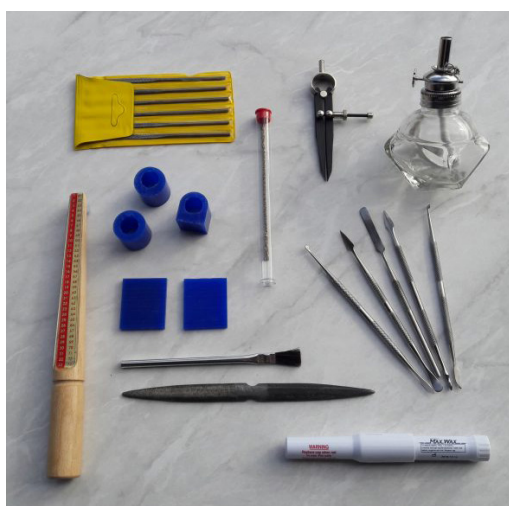
#### Which wax is best for you?

**Wax tubes:** If you're creating a ring then wax tube is the best choice for you. The wax tube can be cut down using a wax cutting saw blade and the excess can be

kept and reused. Make sure you pick a wax tube with a central hole in the middle so that when it comes to sizing the ring as you carve, this can be done easily using a professional wax ring stick.

**Wax blocks:** Making a pendant, brooch, or large charm? Wax blocks will work well when you want to create a raised relief pattern that would be difficult to create using sheet metal alone. Because you can create curves and softer shapes in wax, wax sheets can be used to portray more natural scenes. Think about traditional cameos and how tactile they can be. With a wax sheet, the right wax sculpting tools, and some dedication you can create entire scenes of flowers, animals, or sculptures.

**Wax wire:** Although you may have been slowly taking away wax to reveal your design, you can also add some finishing flourishes using wax wire. Wax wire comes in a variety of shapes such as round, square, oval, and star shaped. These lengths of wax wire are pliable and can be used to add decorative elements to your overall design.



### Types of Jewellers Wax

There are different types of jewellers wax available that are used for different purposes.

**Green:** A very hard wax, it cannot be flexed. Ideal for sharp edges and for intricate carvings and delicate engraving.

**Purple:** General purpose, hard with some flexibility.

**Blue:** Less hard and more flexible than green or purple. Good for rounded surfaces and less intricate designs. This is a popular choice with jewellers.

**Turquoise:** Displays exceptional surface finish, especially in recessed areas. Maintains superior strength, toughness, and extreme flexibility.

**Sheet Wax:** good for cutting, moulding, and modelling but not as good for carving.

**Wax Profile Wire and Tube:** wax in the form of wire or tube, can be bent and twisted, used for hinges etc just like metal wire.

## WAX CARVING TECHNIQUE

### Getting your design just right

If you're creating a cameo or raised relief image in a wax block, the best place to start is with a point of reference. Do you have an image you would like to refer to? Once you have an image that's to scale, fix it to your wax block and gently scratch along the edge of the image that you're using to leave you with a rough outline to work to. This will help to guide you along the way. Remember that all you want at this stage is the outline of your design scratched or marked into the wax. Don't overdo it – the detail will come later.

If you regularly create rings and pendants using wax tube, you may want to use a marker to lay out your plans before you start carving your wax. However, this will need to be reapplied as you carve to stop you from going astray and missing your mark. Some people can carve wax freehand, but this does take a lot of practice and concentration, as you'll need to consistently see where your carving is headed in your mind's eye.

### Scratching, Scraping, Carving

Carving wax for lost wax casting is no exact science. The beauty of it is that you can get started with just a scalpel and some wax files. Whatever stage you're at in your experience, here are our top tips for wax carving to help you get the most out of your supplies:

**Slow down!** There is no need for brute force in wax carving. In fact, it's all about finesse. So, take your time and slowly carve and scrape away at the wax. The slower and more controlled you are in your approach the more likely it is that you will not make a mistake and start over. This will also mean that you don't weaken the overall structure of the wax as you carve.

**Adjust your position** Using carvers and scrapers to carve out your design more precisely? Remember to adjust the position of your tool to ensure you're removing material with each pass of your tool.

**Perfection isn't everything** When you first start out, the whole process of wax carving can be incredibly messy, slow, and difficult. But don't let that put you off.

Remember that the three-dimensional, curved designs you're working towards may not be perfect in reality so don't expect that of yourself when you first get started. Plus, the redeeming thing about wax carving is that if you make a mistake, it can be easily rectified. And once you do carve out that perfect design, it will be cast so that you can re-create it again and again.

**Use heat effectively** Keep in mind that when you're using your scraping and carving tools, you can heat the tip of the tool by carefully and quickly placing it in the flame of your Spirit Lamp. This will make carving much quicker and easier. You can also eliminate unwanted creases and uneven edges with localised heat too.

**Add and subtract** Although wax carving is mainly taking away excess material, keep in mind that you can add hot wax to your existing piece to form raised elements too. Once you really get used to this technique you can even go as far as building pendant bails and findings that are already a part of your design, leaving you with less to do once the wax has been cast.

**Add a soft toothbrush to your toolkit** As you work, you'll notice that your design (and you!) tends to get covered in tiny slivers of wax. By gently rubbing a soft toothbrush over your wax every so often you can make sure that no excess wax gets in the way, and you also have a clearer view of how your design is shaping up.

### Repairing uneven spots with molten wax

Learning how to carve wax for jewellery is undeniably tricky and whatever stage you're at in your jewellery making career, there will be instances when you need to rectify a mistake you've made in your wax carving. Whether you're repairing a crack or you're building up wax to remedy taking too much away there are a couple of things you'll need to keep in mind along the way:

- Use scrap wax to repair any mistakes that you've made. This will keep costs down and it should leave you with enough material to make any repairs you need.
- To create the best possible bond between the wax block/tube and your repair wax, make sure you heat the original wax first. This will help the crystalline structure of the wax re-bond as it cools and dries, making the bond between the two waxes much stronger.

### Finishing ready for casting

There are a few steps you can take to make sure there are no unwanted, rough edges on your wax carving before going through the lost wax casting process.

Run your wax design through a cool flame. This will melt any tiny, unwanted bits of wax and they will become part of your overall design.

Use your wax file to round off edges of rings and pendants for a neat, even finish. Remember to use emery paper after filing to remove the file marks you put into your design.

Working on a design that has flat, flush surfaces? Use fine grit emery paper to tidy up any uneven edges.

Many jewellers claim that using a small piece of an old pair of tights to polish up your wax carving is a great way of making sure that your design is smooth as you go into the casting process.

## WHICH WAX SCULPTING TOOLS WILL YOU NEED?

### Basic Carving Tools

You can buy a basic set of carving tools for under \$ 25 USD, but as you progress you will soon want to use a more precise set of tools. One of the most famous carving sets is the Wolf Precision Wax Carver Complete. This set is not only beautiful, but the tools are super sharp and there is a range of sizes and shapes to help you get the most precise finish to your carvings. The full tool set will cost approximately \$ 225 USD, but you can get small sets and build up your collection over time.

Many wax carvers love using a scalpel to carve wax. An option that can help expand the usability of your scalpel is to purchase a bespoke set of scalpel blades such as the set created by UK master wax carvers, Russell Lownsbrough and Danila Tarcinale.

### Advanced Tools

**Pendant drill or flex shaft tool:** If you work with metal, you may have a pendant drill or flex shaft tool available to you already. With a motorised tool you can pick up specific burs that will speed up your wax carving process significantly.

**Wax Carving Burrs:** If you are a silversmith, you may already have a variety of burs for stone setting. The good news is that you can also use these with wax carving to carve sets for stones or textures in the wax. There are special larger wax carving burs that are particularly helpful for carving seats or removing a lot of wax quickly.

**Wax Trimmer and Bench Mate:** When used in conjunction with a bench mate and your pendant drill a wax trimmer (such as the Wolf Wax Adjustable Wax Trimmer) will allow you to create a completely flat surface or create your own lathe in order to speed up wax carving.

**Wax Pen / Electric Wax Carver:** When you start wax carving, you will soon start creating pieces that involve joining waxes (or make repairs to broken waxes) and a wax pen is the easiest way to do this. You can purchase a battery-operated version relatively cheaply for approximately \$ 35 USD, but you can only use this for about 15 minutes at a time, so it does have its limitations. If you plan to use it frequently, you will soon want to upgrade to an electric model such as the Foredom Electric Wax Carver which has interchangeable tips that will allow you to carve and join wax, or a basic electric wax carver.

**Speciality Templates:** If you plan of creating stone settings in wax, then a set of templates for round and speciality shape settings can be very helpful in getting the most precise designs and settings.

### Wax to Metal Conversion

Metal	Metal to Wax Ratio
Brass	8.5: 1
Silver	10.5: 1
Gold (9K)	13: 1
Gold (14K)	14: 1
Gold (18K)	16: 1
Platinum	22: 1

Example: 1 gram of wax = 10.5 grams of Silver

Don't forget to add extra silver for the sprue (when being cast)

With plenty of practice and a little imagination, carving wax can be the key to a whole host of new jewellery making ideas that you just can't put into practice with traditional metalsmithing tools and techniques. Invest in some basic wax carving tools and equipment before stepping things up a notch and investing in advanced tools.

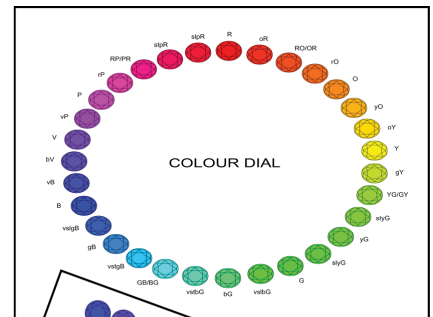
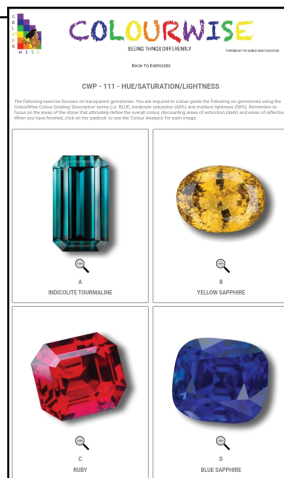
### ABOUT THIS PODICLE

Information in this podicle has been sourced from Cooksongold, the Jewellers Academy and the British Academy of Jewellery.



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# METAL smithing

## Raiders of the Lost Wax

**A**lso known by its French name, *cire perdue*, lost wax casting is a very versatile technique capable of accurately reproducing complex designs in metal, and also an ancient tradition with a rich history spanning more than five millennia.

The exact origins of lost wax casting are shrouded in mystery, and it is possible that the technique was developed independently in different regions, but archaeological records suggest that the method was first used at some point in the fourth millennium BC.

Prior to this, molten copper was transformed into relatively rudimentary tools and weapons using simple open or two-part moulds made from stone or clay. The bright idea of first carving a wax model, around which a clay mould could then be formed and heated – a process which both hardens the clay shell and melts away the wax – meant that much more elaborate metal objects could be cast and opened the door to a whole new world of craftsmanship and artistry.

Some of the earliest known objects produced in this way are decorative copper items found in the Nahal Mishmar hoard, in Southern Palestine, which have been dated back to 3700 BC. Other early lost-wax-cast pieces, from delicate miniatures and dress pins to life-size statues, have been found all around the world, in Europe, the Middle East and Asia, as well as in Africa and the Americas.

As the use of lost wax casting spread, new techniques and variations were introduced to the process. As well as copper, metal workers began casting pieces in bronze and gold. Furthermore, the development of hollow casting allowed for the production of hollow objects that could be made more cheaply, while the introduction of indirect casting made larger-scale pieces viable.

The biggest changes made to this ancestral technique, however, did not occur until the 20th century. Following initial developments in the dentistry sector, the jewellery industry had its own brainwave in 1936, when Danish engineer Thøger Grønborg-Jørgensen patented

a method involving rubber moulds that could be reused to make multiple wax models without having to carve each one individually.

Today, between CAD and 3D printing, jewellers have a wide range of hi-tec design and production tools at their fingertips. But hand carving wax models for lost wax casting allows them to get in touch with the ancient roots of their profession by practising an art which, to this day, is still one of the most accurate methods of reproducing a detailed design in metal.

One of the oldest methods of jewellery making around, lost wax casting dates back to the 3rd century BC. Having been lost and rediscovered many times throughout history, the lost wax casting process is still used today for casting metal alloys. Keep on reading to find out what the lost wax process is and how you can use it for jewellery making.

### What is lost wax casting?

Lost wax casting is a process where wax models are converted into metal replicas. One of the main advantages to lost wax casting is that large quantities of jewellery can be cast at one time, saving time and money. The most common metals used for this process are silver, gold, brass, and bronze.

For this example, we are going to demonstrate the casting of a ring in gold.



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1. Once the wax ring carving has been finished to your satisfaction, it's time to attach a wax sprue. To do so, gently heat the wax ring and then quickly attach it to the sprue.



1

2. Fix the ring and the sprue to the bottom of the casting flask – with a gap of at least 5mm between the edges and the top of the flask and the ring. If a manufacturer is making multiple rings, they will attach the models and sprues to a wax tree.



2

3. Now it is time to prepare the investment according to the manufacturers instructions making sure that any air bubbles are removed – if you stir for too long, the mixture will become too thick to work with.

After allowing the investment to set (anywhere from a few hours to overnight), it is time to remove the rubber base to expose the wax sprue.



3



4



4. With the sprue at the bottom, place the flask in the kiln to allow the melted wax to escape. Set the kiln between 150 and 200°C and leave for an hour. After the hour has passed, turn the heat up to 400°C for an hour and 30 minutes. To finish, increase the temperature to 720°C and hold for another hour – the varying temperatures ensure that the investment is fully dry and hardened, and the wax is thoroughly melted.

5. Next it is time to prepare the correct quantity of gold needed based on the wax to gold conversion ratios allowing additional gold to form the button.

5



6



6. Heat the gold in a crucible inside a melting kiln following the specific melt instructions for the karatage being used.



7. Once the gold has melted and is ready for casting, remove the flask from the kiln and place it in the vacuum casting machine.



8. Next we will remove the hot AF crucible with the melted gold and pour it into the flask.



9. As this is done, the vacuum will start pulling the metal down and through the hollow cavity left by the wax before burnout. A big healthy button leads to a successful cast.

10



10. When the cavity is full, the excess gold will form a 'button'.

11



11. Within 30 seconds of cooling down, the crystalline structure of the gold appears.

12



12. After 15 minutes, the flask can be quenched in water.



13. Now it is time to clean the dissolved investment from the gold ring, sprue and button.



14



14 & 15. Finally it is time to remove the sprue and button and file down the ring ready for final polishing. The finished ring can then be sold or used as a model for future production.

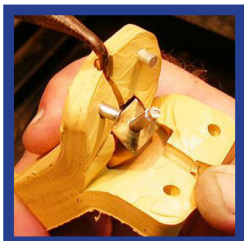
15



#### ABOUT THIS PODICLE

Information in this podicle has been sourced from the British Academy of Jewellery and Precious Ghost Jewellery.

Visit [PRECIOUS GHOST](#)



# MIRROR mirror

## A chip off the old block



The art of cutting a mould

**H**ave to ever wondered how manufacturers make thousands of identical rings, pendants, earrings, or other types of jewellery?

In this Podicle, we have already looked at how you can create a wax model of a piece of jewellery and then convert it into metal using the 'Lost Wax Process'. We also discussed how the 'flasks' can be used to cast numerous pieces at one time but what about replicating a design?

If you want to get into mass jewellery production, there are four things you need to know.

1. Make sure the 'model' you use is made to the highest standard. Remember, every subsequent piece made will be a mirror image of the original, warts and all!
2. You can make a model by wax, convert it into metal and then use this as the starting out point or you can pay a highly skilled craftsman to produce a hand-made model. There are benefits to both strategies. In the first case, the costs are much less but even with a highly skilled wax carver, the detail may not be of the highest standard. If you make a hand-made model, the costs



Rubber Moulds



will be higher, depending on the intricacy of the model, but the detail will be better and when it comes to making high quality jewellery, the devil is certainly in the detail.

3. See this as an 'investment' rather than a cost. Depending on how many pieces you produce, the design cost per piece may be insignificant and well worth the cost.

For example, let's say you have an extremely intricate design, and a model maker charges you \$ 2,000 USD for his time and materials. Typically, models are made from silver but can be made from any metal. If you were to make two subsequent rings, your design cost per unit would be \$ 1,000 USD. However, if you plan to cast two thousand pieces, your design cost per unit is now \$ 1.00 USD. Whether you decide to go this route depends largely on the quantity you plan to produce and the importance you place on the end product. If you are building your 'brand' on quality, this is where you need to make your statement.

4. Make sure your model is approximately 10% heavier than needed. As we saw in the previous article, once cast, they will have to be filed and polished and this will result in a weight loss.

### THE PROCESS

Once you have your finished polished model you will need to attach a sprue, to the thickest part of the design. Now the model and sprue will go through a three-step plating process prior to moulding.

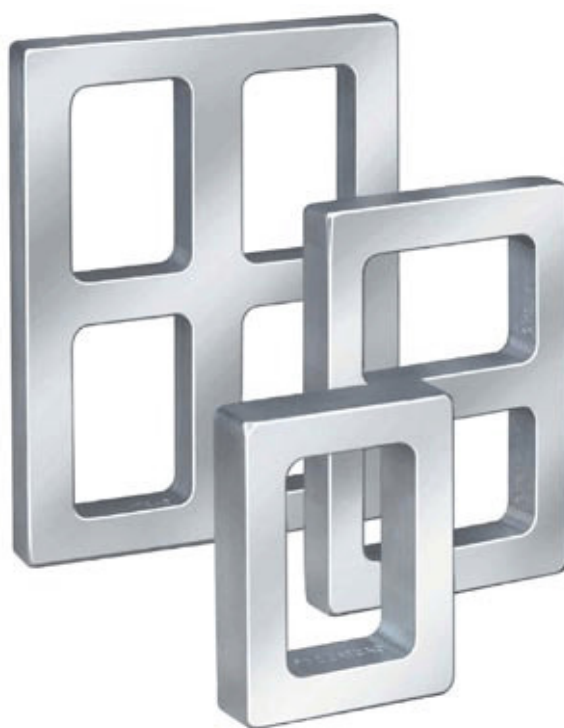
The first step involves copper plating the model and the sprue. Copper adheres well to both the silver and the brass sprue rod and prepares the model for the next step.



The second step involves nickel plating the model. Nickel provides a very tough surface that bonds to the copper and prevents metal oxides from contaminating the rubber mould. Moulds that are contaminated with metal oxides will stick to your wax injections making it harder to remove them. This can be especially problematic in the case of designs that are highly decorative and intricate. The presence of dark, blotchy areas around the model in the rubber is usually the result of copper oxides.

Finally, the model is rhodium plated. Rhodium is a very rare, silvery-white, hard, corrosion-resistant transition metal that is a member of the platinum group. White gold is often rhodium plated to improve its appearance, while silver is rhodium plated to prevent it from tarnishing. It creates a fabulous surface that will not adhere to the rubber. Having a smooth surface ensures that the injection wax will flow easily into your mould and that the wax will not stick.

As with the investment flask, it is important to create a mould that leaves enough room around the model. Depending on the technique used, the mould will either consist of layers of rubber (based on the size of the model), sandwiched together, and fused into one homogenous mass through heat and pressure or will be made from silicone.



Metal Forms

## Vulcanised Rubber Moulds

This is the most common type of mould and works particularly well for base metal masters and other metal objects that can withstand heat. Shrinkage from master to mould is minimal with vulcanised rubber – approximately 1.5-2%, it is cheaper, quicker and creates long-lasting moulds. The life expectancy of a well-maintained mould can be 5,000 cast items.

## Cold Silicone Moulds

This method of creating moulds for wax is more delicate and involves pouring liquid silicone over and around your master, rather than compressing it using heat and pressure. Unlike vulcanized rubber moulds, there is no master to mould shrinkage, it can be used for very detailed and delicate designs, especially hollow objects and will have a life expectancy of between 1,500 and 2,000 cast items from a single mould.

To each his own.....

Each rubber model maker has his own technique, but most will use a metal recessed form (frame) where the layers of rubber will sit. There are a number of options for rubber, including natural rubber, vulcanizing silicone rubbers, and room temperature vulcanizing (RTV) rubbers, a non-shrinking, no-heat option. Each has its advantages and disadvantages, and as a result, each may be the best choice in certain situations. The key to choosing between them is to understand the properties of all three, and then decide which to use based on what qualities are most important for a given situation.

## Rubber

Natural rubber's advantages include high tear and tensile strength and a long shelf life. As the industry standard for decades, it's also a more familiar material to many mould makers.

Tensile strength is commonly measured by the number of pounds per square inch (psi) required to tear a standard sample. Natural rubber can withstand up to 3,000 to 3,500 psi, while silicone rubbers can handle 1,000 to 1,400 psi. RTVs are the most prone to tearing at 100 to 200 psi.

This greater tensile strength means that natural rubber moulds normally last longer in production situations. While natural rubber moulds may be used thousands of times before deteriorating, silicone moulds typically withstand hundreds of uses, while some putty-type RTVs may be usable for only 10 to 30 waxes.

Because they have been in use for decades, natural rubber moulds have been proven to remain usable for up to 50 years under ideal storage conditions. Although

silicones may demonstrate similar staying power, their more recent introduction (in the 1970s) means their storability for long periods of time is relatively untested. RTVs can be less stable, because some are susceptible to moisture and will deteriorate more quickly if exposed to atmospheric humidity. (Pre-vulcanized shelf life for natural rubber and vulcanizing silicone rubbers is about the same at one year. RTV silicones are typically good for approximately six months.)

Although natural rubber was initially less expensive than silicones, the price of vulcanizing silicone rubber has dropped and the two are now nearly equal. RTVs, however, remain more expensive than either natural rubber or vulcanizing silicones.

## Silicone

A relative newcomer, silicone offers many advantages including a higher-quality surface finish and easier release of wax models, as well as the availability of RTVs.

Because silicone rubber moulds are self-lubricating, they don't require the use of spray release agents, reducing problems caused by the build-up of these agents on the moulds. This property also makes it easier to release intricate, detailed designs from silicone rubber moulds on the first try, versus the tinkering occasionally required to get the right amount of release agent in a natural rubber mould.

In addition, silicone rubber moulds typically produce a shinier wax model, which can result in a higher-quality surface finish on cast items. Because silicone is relatively inert compared to natural rubber, it will not react with silver or with the copper in sterling, reducing the need for nickel or rhodium plating of the models. (Certain materials, such as some plastics, will inhibit curing of RTVs. In these cases, coating the model will frequently solve the problem).

Some users find that silicone rubber holds its shape during wax injection better than natural rubber, making silicone more tolerant of variations in injection pressure. Also, silicone rubbers typically produce less flashing, since seals can be tighter.

Silicone's putty-like texture makes it easier to pack a mould, since there's no need to cut the rubber to size, and it is also easier to cut. In addition, different hardness's of silicone rubber can be combined in a single mould and vulcanized together.

Silicone rubber's higher heat resistance makes it suitable for casting metals with melting points of less than 315°F (157 C), such as pewter and tin, directly into the mould. Silicone rubber also has a higher vulcanizing temperature than natural rubber: 330°F (165 C) to 350°F (177 C), compared to 310°F (154 C) for natural rubber.

## RTV Rubber

A third option for mould making is the non-shrinking, no-heat RTV rubber. This two-part mould material is typically mixed and poured around the model, then allowed to cure for 18 to 72 hours.

RTVs offer both advantages and disadvantages over traditional natural rubber and vulcanizing silicone moulds. Room-temperature curing permits the moulding of fragile materials that would be damaged by the pressure of a vulcanizer, such as hollow beads. RTVs also typically offer zero percent shrinkage, compared to 0 to 4 percent for natural rubber and 2.6 to 3.6 percent for vulcanizing silicones. (This is a particularly crucial factor when the manufacturing process involves stone setting).

Clear liquid RTV silicones also provide greater ease for inexperienced mould cutters, since the mould maker can see the model through the silicone rubber.

On the downside, RTVs usually have significantly longer curing times - hours or even days, compared to 45 minutes or less for natural rubber and vulcanizing silicone moulds. They also offer the lowest tensile strengths of all the common mould materials and require careful cutting and gentle use to avoid damaging the mould.

Many RTVs must be mixed in precise amounts, and the working time for the moulds is often quite short at just a minute or two, although there are some RTVs that offer work times of up to 60 minutes. Most liquid RTVs require vacuuming to remove air bubbles, as well.

Before handling any rubber, it is important to ensure that your hands and especially your fingertips are clean. This will prevent contamination of the rubber.

In the case of a 'sandwich' mould, most mould makers suggest using two different colours of rubber (i.e., Castaldo's Gold for the outside layers and No-Shrink-Pink for the inside). This helps the mould cutter to know just how deep he will need to make his cuts. If this is the case, the mould maker will place two layers of 'Castaldo's

Gold in the metal form followed by one layer of No-Shrink-Pink, followed by the metal model.

On the backing material of layers 4 and 5 (also No-Shrink-Pink) it is important to draw an outline of the model so that the rubber can be cut to fit closely around the model. Ideally, the model should be positioned a little over halfway into the mould. This allows for a longer sprue and gives plenty of room to cut large, angular locking keys into the mould.

Gaps in the rubber around the model can cause air pockets in the mould and ruin the wax injections. If there are any large gaps around the model, they should be filled with small pieces of extra rubber. Any open areas, such as the centre of rings, will also need to be filled with rubber.

In the case of our example, the finished mould will consist of eight layers, two gold on the top and bottom and four No-Shrink-Pink in the middle. It is important not to over-pack the metal mould form since this may cause the mould to be too dense with a tendency to warp or curl after vulcanizing.

In order to create a high-quality rubber mould, the temperature

and cooking times must be very precise. This involves using a thermometer to check the temperatures of the upper and lower heating plates. Check each plate separately by placing a block of scrap wood into the vulcanizer and sandwiching the thermometer first between the wood and the top plate, and then between the wood and the bottom plate. Observe the temperature variation through the vulcanizer's entire heating and cooling cycle.

In the case of Castaldo No-Shrink Pink and Gold Label rubber, they recommend a temperature of 307 degrees Fahrenheit or 152 degrees Celsius for 15 minutes per 6mm layer. It is recommended that you apply light pressure when tightening the vulcanizer down and that you adjust it once the rubber has softened.

Once the moulds have cooled, it is a good idea to attach a photo or a sketch of the model inside for quick reference at a later date.



Vulcanizer



Now comes the tricky part, cutting the model out of the mould.

1. ALWAYS use a very sharp scalpel blade. If it is dull or damaged, replace it immediately.
2. The first cut will be across the top and down the two sides of the mould. This provides a guideline for where to begin cutting the 'keys'. Keys are notches, both male and female, that lock the mould into its original position so that it won't twist during wax injection. Keys should be cut deeply and should be geometric in shape to provide good contact.
3. Secure the mould using a pair of vice-grip pliers mounted to a stable work bench.
4. The first key cut begins at the sprue button and slices toward the side of the mould. Do not cut through the wall of the mould.
5. The second key cut runs along the side of the mould to a point about half the length of the mould. Begin where the front cut ended. The cut in STEP 2, now acts as a guide for future key cuts.
6. The next cut defines the top of the key, like a mini plateau. The use of two different coloured rubber sheets provides an indicator of how deep to make the cuts. Try to avoid using a sawing motion, all cuts should be made with a single deep slice of the blade.
7. In order to cut the inside key, you will need to stretch the rubber. Some mould cutters use a 'step cut' for the inside of their keys. Step cuts provide great gripping strength in the finished mould, and they rarely part when the wax is being injected.
8. Certain mould cutters like to cut their keys, so they are both facing the same direction while others prefer the second to go in the opposite direction.

9. It is important to cut the 'keys' so that they extend almost to the edge of the model. This ensures greater 'holding power' close to the model.

10. To cut the rubber inside the side galleries, you will again need to stretch the mould open quite far. This way the seam ends up going through the centre of the side gallery and not along the edge of the model. Cutting the mould so that the seam is inside the gallery makes it easier to pull the wax injection out of the mould.

11. In the case of a ring model that will accommodate a centre stone, in order to make the gallery cuts for the centre stone, you will again need to stretch the rubber mould.

12. Great care should be taken not to touch the metal model with the scalpel blade since this will dull the blade.

13. By leaving about 3 to 4mm of rubber uncut, you will create a hinge at the back of the mould. This hinge acts like a key and prevents the mould from twisting during wax injection. If you are going to create a mould of two separate halves, you will need to cut a third and fourth key.

14. An often-overlooked step is the cutting of air vents. Without proper venting a mould will become air bound during wax injection and high points will not fill with wax.

15. Always use the least amount of air pressure required to fill the cavity of the mould and never over pressure your injections. Ideally, you will need about 4 lbs. of air pressure (4 psi).

## Conclusion

We often equate manufactured jewellery as being cheap compared to hand-made jewellery. Nothing could be further from the truth since both require skilled craftsmanship that takes years of experience. The next time you look at a piece of jewellery, think of the journey (manufacturing process) just as much as the destination (the finished product). It will increase your appreciation of the piece and the efforts of those who created it.

## ABOUT THIS PODICLE

Information in this podicle has been sourced from the following individuals and companies: Geoff Dominy, Suzanne Wade, Dominic Annetta, Steven Blythe, John Davidian, Elaine Corwin, Roger Greene, Michael Knight, Jeffrey Mathews, Lee Mosemiller, Bob Romanoff, Liz Rutherford, Len Weiss, Tom Weishaar (Ganoskin) and Merrell Casting (Photos).



Injecting wax into the rubber moulds



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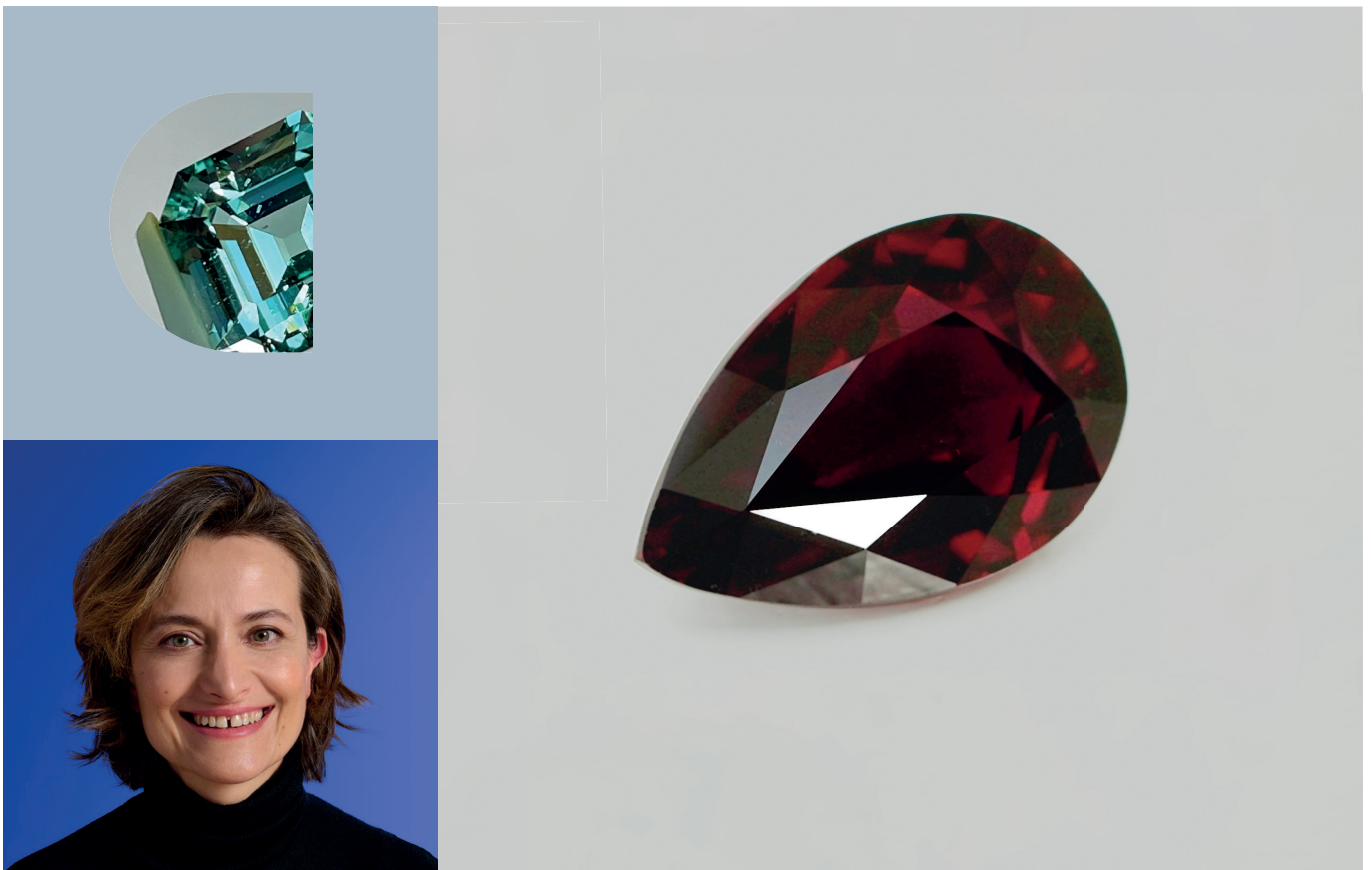
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