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How To Cast Platinum

Introduction

Casting platinum is not difficult and is similar to casting gold or silver. In some ways, it's easier than casting gold or silver because it requires no fluxes or degassing. The main difference between casting platinum and casting gold or silver is that platinum requires higher heat—so special equipment is needed—and platinum alloys lose heat rapidly when cast. The high fluidity of molten platinum makes it ideal for filling small areas and showing details. The cast weight of platinum is about 30% higher than gold. The equipment you need to cast platinum is available in your current Rio Grande *Tools & Equipment* catalog and is listed at the end of this document.

Caution: To avoid serious injury when casting, use the safety equipment recommended and follow the precautions given in the Material Safety Data Sheet (MSDS) for the product used. MSDSs are available online or simply contact us.

Casting Grain Specifications

The pre-mixed casting grain you have purchased from Rio Grande is either 90% platinum and 10% iridium or 95% platinum and 5% iridium.

U. S. market regulations require that products made with the 90%/10% casting grain be stamped "900" and the 95%/5% casting grain be stamped "Platinum." The procedures and temperatures given here are for general reference. They may vary depending on the desired results and other factors.

Type	Melting Point	Flow Point	Specific Gravity
90% platinum/10% iridium	3218°F (1770°C)	3254°F (1790°C)	21.54 g/cm^3
95% platinum/5% iridium	3272°F (1800°C)	3317°F (1835°C)	21.49 g/cm^3

Sprue Parameters

Because molten platinum solidifies rapidly, shrinkage porosity is a major problem when casting. To combat this problem:

- Keep sprues short.
- Orient sprues to coincide with the G force exerted by the casting machine's centrifugal arm.
- Use thicker sprues than you would casting gold or silver to increase the volume of molten metal fed into the cavity, and to increase the evenness of solidification.

Investment and Burnout Schedule

Because platinum alloys are cast at extremely high temperatures, investments must be used that offer the most resistance to refraction, thermal shock and metal penetration. We recommend a phosphate investment. Here is the burnout schedule for phosphate-bonded investment:

Step	Action
1	Start the initial burnout at 200°F (93°C) for one hour.
2	Raise the temperature to 360°F (182°C) for one hour.
3	Over the next 2½ hours, raist the temperature to 750°F (399°C) and hold for 30 minutes.
4	Over the next 2½ hours, raise the temperature to 1600°F (871°C) and hold for one hour, then lower to the desired casting temperature and hold for one hour.

Safety Equipment for Investing

Use an OSHA-approved dust mask for mixing investment and for devesting the castings. The mask must be able to screen out the very fine particles found in platinum investment. Follow all recommended precautions in the MSDS.

Flasks and Flask Temperatures

Use metal flasks that:

- can be used many times at high burnout temperatures, and
- are large enough to comfortably contain the cast pieces, leaving at least 7mm between the inside of the flask and the nearest wax. Flask liners are no longer necessary with the high-refractory investments now being used for platinum casting.

Flask Temperatures:

Piece Weight	Flask Temperature
Heavy, such as men's ring mountings	1300°F to 1500°F (704°C-860°C)
Medium, such as heavy findings & filigree mountings	1600°F to 1700°F (871°C-927°C)
Light findings	1850°F (1010°C)

Cast Temperature

Because the investment assembly cannot be heated much over 1832°F (1000°C), a 1382°F (750°C) gap is left between the freezing temperature of the melt and the investment surface. This high chilling factor means that solidification time is only three or four seconds compared with gold at more than 20 seconds. To avoid premature freezing of the platinum alloy, use a superheat of about 392°F (200°C) for a heavy cross-section, increasing to about 752°F (400°C) for a light cross-section. To find the casting temperature, add the superheat to the liquidus temperature of the metal. Casting temperatures will range from about 3362°F (1850°C) to 3992°F (2200°C).

Cast Method

An oxygen/fuel flame is used to melt platinum because only oxygen produces a hot enough flame. Use a platinum casting torch system to melt the metal. The melt does not oxidize, so no flux is needed. High-temperature, refractory crucibles, such as fused silica, are used because they will not make the platinum brittle like carbon-based crucibles will. To protect against thermal shock, pre-heat the crucible before melting metal in it. Using a spring-powered vertical spin casting machine, set the centrifugal arm at maximum speed. If the surface of your casting is textured or, if flashing occurs, lower the speed. The platinum is ready to cast when it reaches a liquidus state and the color of the metal matches the crucible.

Safety equipment for casting: Use ultraviolet protective lenses #7 or higher to protect your eyes from splashes or from having an image burned into your retina—they will also let you see the liquidity of the platinum before casting. Use protective lenses #6 when soldering.

Quenching and Devesting

After the metal is solid and the sprue button has cooled below red heat, hold the flask in a pair of tongs, quench it in cold water, then hammer the pieces out. The investment around the casting will begin to break up. ***Do not quench the flask when it is red hot—this could result in a scalding eruption.***

Finishing

Soak the cast pieces in a hydrofluoric acid bath (1 part acid to 3 parts water) to remove residual investment. Carefully clip sprues as close to the piece as possible. Caution: Hydrofluoric acid is a very aggressive liquid that requires careful handling to avoid serious injury. Use complete protective gear (goggles, gloves, apron and respirator) and closely follow the MSDS procedure. You can mass finish the pieces using tumbling or vibratory methods, or you can hand finish the pieces.

To hand-finish:

Step	Action
1	Sand off sprues using #220 grit paper. Sand in one diagonal direction, then in the other.
2	Lightly rotary file the insides of rings. Then sand them, first using #280 grit paper and then #320 grit paper.
3	Go over the outside of the surfaces with a rubber wheel. First, use a coarse grit wheel, then a medium grit wheel and a fine grit wheel. Be sure to move the wheels diagonally, alternating directions and overlapping strokes.
4	Go over flat surfaces with a buff stick, first using #280 paper, then #320 grit paper. Alternate directions diagonally and overlap strokes.
5	Take out any surface scratches left by using emory papers with a unitized wheel. First use a #400 grit, then a #500 grit and finally, a #600 grit wheel. Again, alternate your directions diagonally and overlap strokes.
6	Lightly burnish or hammer any pitted surfaces. Use a reciprocating hammer or burnisher with highly polished surface.