

PLATINUM

MANUFACTURING PROCESS
VOLUME VII



1999 Platinum Day Symposium • Los Angeles
PLATINUM GUILD INTERNATIONAL USA

PLATINUM MANUFACTURING PROCESS

Platinum Day Symposium • Volume VII

Platinum Casting in a Small Shop	2
Edward J. Friedman • THE BUEHN COMPANY	

Developing Plumb Platinum Solders	10
Daniel Ballard • PRECIOUS METAL WEST	

How to Make Wearable Platinum Jewelry	11
Michael Bogosian • MICHAEL B	

Comparatives in Mass Media Finishing of Platinum	12
Curt Hensen, Elizabeth Brehmer and Steve Smith • RIO GRANDE	

Fusion of Platinum Findings	30
John J. Alves Jr. • TRIAD INC.	

Machining of Platinum Alloys for Jewelry	35
Costantino Volpe, TIFFANY & CO. • Dr. Richard D. Lanam, ENGELHARD CLAL-LP	

High Speed Platinum Casting	50
Jurgen J. Maerz • PLATINUM GUILD INTERNATIONAL USA	

Platinum Casting in a Small Shop

by Edward J. Friedman • The Buehn Company

Due to the huge increase in customer demand for platinum jewelry, more and more small shops are needing to add platinum jewelry design and manufacture to their in-house services in order to stay viable. Completing jobs on time and under budget with minimal expense and with the least amount of down time has always been a hurdle for the smaller shops. Adding platinum production comes with its own set of additional hurdles ... or so I was led to believe.

As I began to research platinum in my own shop, I was initially daunted by all of the conflicting information "out there." I'd heard platinum was hard to work with, that I'd need to purchase specialized and more expensive equipment. I wondered whether I could work with platinum in-house and still turn out a quality product that met my high standards.

In the end, weeding through the mounds of conflicting information proved to be the most daunting part of my investigation. The biggest misperception about platinum is that it is difficult to work with. Platinum is not a difficult metal to work with, it just has different properties than other

metals. It's very dense, making it difficult to polish (some say) or flow in casting. It melts at extremely high temperatures, and solidifies extremely quickly. Once platinum's unique properties are properly understood and allowed for many find that working in platinum is actually easier than other metals. And most important for any size shop, while platinum is an expensive metal, it is also a forgiving metal. Unlike gold alloys, if your casting fails, the platinum can be re-cast over and over again.

I believe that every goldsmith can learn to work with platinum. I hope that this paper will dispel many of the misperceptions surrounding platinum and encourage everyone to take up the torch.

MISPERCEPTION #1: SPECIALIZED EQUIPMENT IS NEEDED

Because of platinum's unique properties many assume that they will need to buy special equipment to cast with it. This is only minimally true. I discovered that many of the tools I already had in my own shop were more than sufficient for casting platinum. Through practice and much experimentation on my own and with the encouragement and support of Platinum Guild International and the Revere Academy of Jewelry Arts, I was able to perfect a number of methodologies and uncovered a valuable time-saving investment product which I will share later in this paper.

Casting Machines/Models

The vertical, horizontal and the induction casting machine models are all acceptable for casting platinum. For most small shops the induction casting machine is irrelevant due to its high price tag (\$30,000), so I will not spend time addressing it here, nor have I done

much experimentation with it.

I use a Neycraft horizontal centrifugal spin caster in my shop. I like a horizontal centrifugal caster better than the vertical centrifugal casters, because it has a rotating drum. The drum is preferred for several reasons: it protects the caster from metal flashing out of the caster and possibly hitting him and thus prevents metal loss which is expensive; it is easier to control in comparison with the vertical caster and most small shops are already outfitted and used to this type of casting machine. My Neycraft casting machine has held up for at least 600 platinum castings to date, and I see no end in sight.

Crucibles

There are special crucibles on the market designed to withstand the high temperatures (3250°F) required to melt platinum without breaking down as readily as crucibles designed for other metals. They will break down eventually and should be replaced more frequently than crucibles used for gold. The standard platinum casting crucible is the large Wesgo A type fused alumina crucible from Rio Grande. A GAAB crucible holder can be purchased for the Neycraft to hold a large Wesgo A, however the Neycraft casting machine already comes with high temperature casting crucibles which seem to work just fine.

MISPERCEPTION #2: PLATINUM IS DIFFICULT TO CAST

Platinum's density is what gives it its satisfying weight, but what also makes it flow less easily and solidify very quickly. In casting, this poses problems that are easily overcome by preparing waxes properly. As with other metals the correct placement of

Casting Machines

- Centrifugal
 - Vertical
 - Horizontal



sprues is critical to making a successful casting.

Preparing Waxes

As with other metals, before investing check waxes for problems: make sure that the piece being cast has an even wax thickness throughout the piece to ensure correct solidification (cooling down) of the metal. If the wax is uneven the platinum will cool at an uneven rate creating shrinkage porosity. Check for imperfections, smooth surfaces and for the placement of sprues or gates. Larger gates are required for platinum than for gold, and the use of extra gates are strongly recommended as platinum solidifies in approximately three seconds. The larger gates enable the molten platinum to reach its destination more quickly and feed the piece during solidification.

Investments and Flasks

All platinum investments have specific mixing instructions and must be followed to the letter. This will ensure full set-up of investment and a smooth surface on the casting. To mix platinum investments a heavy-duty mixer is needed and mixing takes about 12 to 20 minutes depending on the investment used. The first eight minutes of mixing reminds of mixing gravel. Eventually it will become somewhat "fluid," (if one can call it that); the consistency seems thick and gooey while at the same time dry. It may not seem wet enough, however believe the instructions on the package and never add more liquid to the mixture than the prescribed ratio. Once over the initial shock of the length of time it takes to mix platinum investments, one realizes that the procedure is just like mixing regular casting investment for other metals.

Unlike with other metals, platinum investments are mixed with distilled water and phosphoric acid. Unlike the water, phosphoric acid does not evaporate. In order for the investment to set up the moisture must be absorbed somehow. To accomplish this task, the invested flask must be set on an absorbent paper to drain and an additional cylinder of absorbent paper is placed around the upper edge of the flask to wick away the moisture gradually.

Platinum investments take anywhere from 12 to 16 hours to set-up and harden. During this time period they need to be checked every three to four hours and shaken down if necessary to make sure that the investment has not climbed up the sides of the absorbent paper cylinder. If this occurrence goes unchecked the climbing investment will create a hole in the center of the investment and expose the wax model. The burnout cycle ramping the investment up to 1600°F takes around five to eight hours. The entire investing process ties up the small shop jeweler for almost a 24 hour period - how many of us have that kind of stamina or time?

Jeweler's Choice

The investment I use, *Jeweler's Choice*, was created originally for the dental industry by a company called, Precident Alloys/Talladium. I was asked to Beta test this product before it was formally introduced to the jewelry trade. The results I got were fantastic, and I have never looked back.

What can I say other than *Jeweler's Choice* is FAST. It sets up in only 15 minutes and burns out in 45 minutes ready for casting! While there are some other fast-setting brands on the market (see: list following this section), I prefer *Jeweler's Choice* exclusively for al-

most all of my castings in all metals. It truly makes the most sense for the smaller bench jeweler who has enough to do without having to baby-sit investments all day and all night.

Jeweler's Choice is so strong it can withstand the high temperatures and impact of the molten platinum without using a metal flask. A metal flask can be used, but a liner must be used inside the flask. The liner does two things: it helps in divesting, and it helps with the expansion of the investment. The expansion around the wax aids in minimizing metal shrinkage.

Mixing the investment can be done in a special mixer made for the investment called the *Whipmix* machine. The *Whipmix* mixes the investment and vacuums it at the same time taking only 1.5 minutes. It is then poured into the flask as it is vibrated on an attachment on the side of the mixing machine.

If the *Whipmix* machine is not used the investment must be mixed by hand for 1.5 minutes, then poured into the flask, then vacuumed for another 1.5 minutes. If the investment begins to overflow during vacuuming release the pressure slowly to settle the investment during the 1.5 minutes of vacuuming. The total time for mixing and vacuuming is still only about four minutes.

Based on a 90 gram flask, the *Jeweler's Choice* invested flask sets-up in only 15 minutes. Once set, the top of the investment must be scraped to enable air to escape out through the top of the flask. At this point the flask has reached the temperature of 180°F pre-melting the wax and the flask is ready to be placed in a kiln that has been heated to 1500°F. The flask is then placed in the kiln and burnt out for only 45 minutes (it can be left in longer until jeweler is ready to

Flasks and Bases

- Wax cones
- Absorbent paper
- Perforated bases
- Perforated flasks
- Vinyl flasks



cast) evacuating the remaining wax, cintering the investment and hardening it.

Just prior to casting the flask is removed from the oven and set in the cradle of the casting machine centrifuge and the platinum alloy is placed in the crucible. The flask will rest for seven minutes to lower the flask to around 875°F before casting.

As with any investment procedure, a dust mask is recommended to protect the lungs.

Platinum Investment: Types and Vendors

- Water based: Astrovest form R&R, Opti-cast, and Plaitinite 1 & 2 from Kerr,
- Phosphoric based: Supra from Gesswien, Prevest, R&R, and RJ-10 from Romanoff,
- Fast-setting Dental based: Star vest, Zap cast, and of course *Jeweler's Choice* from Precident Alloys/Talladium

IT'S TIME TO CAST PLATINUM ALLOYS

The choice of casting alloy varies obviously depending on one's budget and the desired use of the metal. The standard alloy mix used to be a 10% Iridium/90% Platinum. Now several alloys are available and becoming standards. The most popular of the "standards" are the 5% Cobalt/95% Platinum or the 5% Ruthenium/95% Platinum alloy. Several "specialty" heat treatable alloys (HTAs) are on the market, such as *SKS* from Hoover & Strong. *SKS* is a 95% Platinum/to a 5% proprietary metal mix. Another alloy from Imperial Smelting provides a 95% Platinum/5% Gallium and Indium mix. *If you are looking to export product you must consider one of the 95% platinum alloys.*

Gas, Torches and Pressure

As in most small shops I use a propane and oxygen gas mixture. I prefer propane as it is excellent for its low carbon content making it less likely to contaminate the molten platinum when using an oxidizing flame which must be used to achieve a fast melt. I also like propane since it is easy to obtain and highly effective due to the high BTUs of heat it provides under low pressure. When casting the pressure on the oxygen regulator should be 60 to 65 lbs. while the regulator on the propane tank should be around 4½ to 5 lbs.

The torch I use is the Meco Weld Master for its versatility, heavy body and long neck. I use it with a large rose bud tip #2. This torch can deliver the pressure and the heat needed to melt 1½ ounces of platinum in approximately 20 seconds. This torch can also be used with a hydrogen and oxygen mix. When casting with hydrogen, the hydrogen regulator should be at 30 lbs. and the oxygen should be at 50 lbs.

The pressures above are approximate and will depend on hose diameter, torch type, type of tip: (single or rose bud) and tip orifice size. All of these variables combined determine melting time. Additionally the size of the crucible also plays a role in determining melting time. The larger the crucible the more heat it takes for the metal to absorb heat and the longer it takes to melt.

The right pressure mix is very important no matter what gas mixture is being used. I recommend that beginners take an ounce of platinum and place it in the crucible of their own machines and practice melting the metal striving to achieve the fastest melt while timing oneself. The average time should be around 15 to 20 seconds. Practice ensures confidence

in melting and in the use of one's machine and equipment

Melting Technique

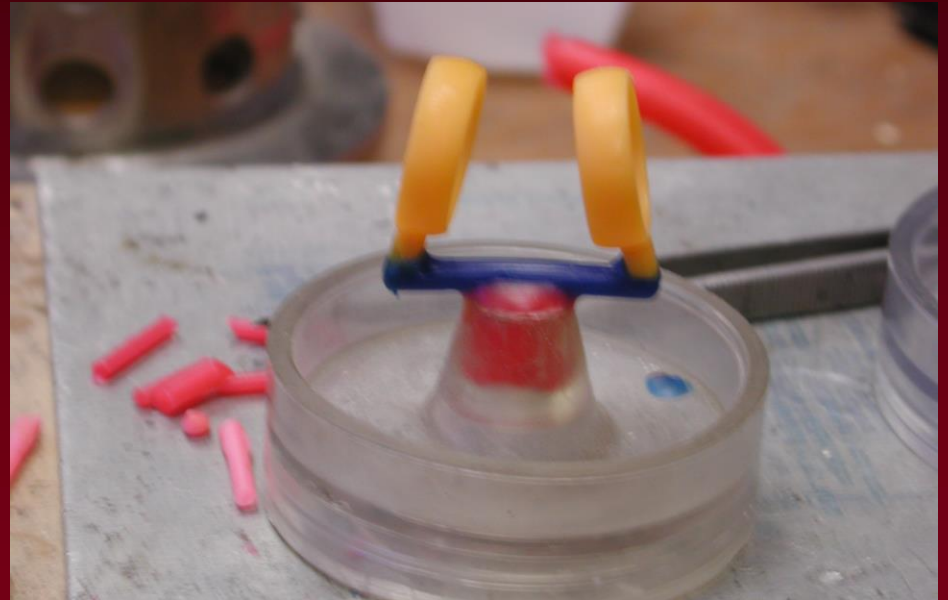
The flame to use is a hot oxidizing flame with the full amount of gas being used and all the oxygen that can be forced into the tip without the torch going out. The small blue inner cones should be about 1/4 inch long. The torch tip should be placed very close to the metal (about 2 to 3 centimeters), and the flame should be played directly on the metal. The metal will begin to melt on the surface and become fully molten within seconds. At this time the flame is used to force the metal up and down in the crucible. This should be done at least twice. When the metal is completely melted it should not stick to the bottom of the crucible and the whole mass of metal will be forced up into it. The flame is actually being used to mix the metal ensuring complete fluidity. It is crucial at this point to remove the torch while simultaneously releasing the machine. If the metal is kept at a molten state for too long it will begin to absorb gas which as mentioned above can cause gas porosity and brittleness.

Eye Protection!

Platinum melts above 3250°F; the high white radiation of the molten metal is very damaging to the eyes. To protect the eyes when casting one should have flip-type welding goggles with a #6 top plate and a #5 inner plate. During the first phase of meltdown the #5 plate is used alone; when the metal starts to glow a cherry red the #6 must be used as well for more effective eye protection. As the metal reaches the white phase of heating one can see very clearly. This layered combination of filters is rated at an #11.

Spruing or Gating

- Keep wax even in thickness and weight
- Large sprues
- Short sprues
- 6 guage in size
- Sprue to thickest section of item
- Add extra sprues if needed



Investment Breakout

After casting the flask is left to set for about five minutes. Using a heat resistant glove the flask is picked up and the investment is hit with a hammer or other striking tool to break the investment away from the cast piece of jewelry. Most of the investment will break away by this striking action. The tiny bits remaining can be removed with a pick or probe type instrument. If the casting retains any investment due to undercuts, holes or gallery areas it must be removed by an investment divester. Investment divesters such as *Strip-It*, *Safe-T-vest* and others are all alternatives to hydrofluoric acid which is very dangerous and should be avoided. Alternative divesters like these may take a little longer, but the health hazard is greatly reduced.

Addendum

Platinum Casting at The Revere Academy of Jewelry Arts, San Francisco

I've been lucky throughout the last 15 years that I've been working in platinum to be able to use the Revere Academy of Jewelry Arts in San Francisco as a laboratory for further platinum exploration and experimentation.

Additionally, about four years ago, the technical advisor of Platinum Guild International USA at the time, Christopher Cart, approached The Revere Academy with the desire to develop a 3-day workshop that would provide platinum casting instruction to bench jewelers. I loved the idea and together we designed the first

and only platinum casting course ever held in the United States. In this course we explore a variety of casting machines and methodologies, so that virtually any bench jeweler will be able to work in platinum with equipment that is already familiar to him. Basically everything I have spoken about in the preceding paper is explored first-hand in the course and we are always adding and evaluating new products and techniques as the industry progresses. I am very grateful to have been given the support for this course from Platinum Guild International USA and Alan Revere and look forward to instructing and sharing experiences with many more jewelers in my continuing platinum course offerings at the Revere Academy.

Investments

- Water mixed
- Phosphoric-acid binder mix
- Ceramic or Glass binder mix (Rapid-Fire)

Investing Machines



Using the WhipMix

- 2 minute mix time
- 15 minute set-up time
- Flask heats to 180° aiding wax elimination
- No need for metal flask



Burn Out Cycle for Rapid Fire Investments

- 1500° F. oven temperature
- 90 gram flask goes in oven for 40 minutes
- Flask removed and bench-set for 7 1/2 minutes
- Flask is ready to cast

Torch Technique for Casting

- Propane at 5 lbs/ Oxygen at 65 lbs.
- Sharp oxidizing flame
- 1.5 oz of platinum melts in 18 seconds

INVESTMENT REMOVAL

- Hammer and dental probe
- High pressure water jet cabinet
- Hydrofluoric Acid (Safety Precaution)
- Devesting solutions

Complete Castings

- Good penetration
- of metal
- Smooth finish
- Casting 850° F.



Resources

- Platinum Guild International
- Educational Programs
- Your Local Jewelry Supply House
- Metal Suppliers
- Internet