



Jurgen J. Maerz

Technical Consultant
The Platinum Expert Consulting Service
Hawkins, Texas, USA

Jurgen J. Maerz was born and raised in Germany, he learned the trade of bench jeweler at a young age through a formal apprenticeship. Before opening Jurgen Maerz Jewelry Industry Consulting service, he held the position of Director of Technical Education for PGI for over 15 years and became a recognized expert on working with platinum; he specializes in platinum casting issues, and has spearheaded several new casting techniques. Jurgen has lectured around the world, including in Italy (at the JTF in Vicenza, Italy), India, China, South Africa (at the Universities of Cape Town and Johannesburg), and the United Kingdom (at the University of Central England in Birmingham). His was especially honored to speak at the prestigious Goldsmiths' Hall in London, home of the renowned Worshipful Company of Goldsmiths.

Jurgen is the author of the two award-winning books *The Platinum Bench: An Illustrated Guide to Easy Platinum Repairs and Fabrication* (MJSA Press, 2001) *Adventures at the Bench, Tips and Tricks for the Platinum Smith* (MJSA Press 2005) These books are based on a series of "how to" articles in MJSA Journal, the monthly magazine of Manufacturing Jewelers & Suppliers of America). Jurgen has published several papers at the Santa Fe Symposium on Jewelry Manufacturing Technology, where he is a frequent presenter and recipient of the Ambassador Award.

There are several different kinds of platinum solders in use today. Some contain up to 95% platinum, other contain no platinum at all. Each vendor tries to have their own mix, but in principle they are all pretty much the same except for some minor content variations. They are divided into traditional solders and plumb solders. In this paper I will explain the different types of solders, discuss the proper solder for the application, be it sizing, fabrication or assembly. We cover safety and eye protection. Solders used in the US and abroad are discussed.

Detailed information when to solder, when to weld, soldering picks, soldering techniques, torch use, fuels, flames will be addressed.

Platinum Solders: Proper Use and Application in Jewelry Making

Platinum solders

There are two basic types of platinum solders in use today: Traditional solders and the “Plumb Solders”. The traditional solders contain very little or no platinum.

These platinum solders, mainly used in the United States, come in a variety of flow temperatures. Platinum extra easy 1000, platinum easy 1100, platinum medium 1200, platinum hard 1300, platinum extra hard 1400, platinum welding 1500, platinum special welding 1600, platinum seamless 1700, and platinum weld 1773. (The number behind each solder corresponds with the approximate Celsius flow point.)

Plumb platinum solders which have a very high platinum content and range from about 1300°C for easy flow, 1400°C for medium flow and 1500°C for hard flow.

Patented in the 90's, Plumb Pt solder contains 900ppt platinum for easy flow, 925ppt platinum for medium and 950ppt for hard solders. This is a very important development, because it is now possible to solder pieces without fear of under-karating.

Gold alloys in the U.S. have a tolerance of 3ppt for alloying and 7ppt for solder seams. This is not the case for platinum, where the alloying tolerance is zero. Metal providers have, however, placed a small safeguard in platinum alloys by “sweetening” the metal. This means a Pt950 alloy contains 2ppt more platinum, making it 952ppt. This allows for the use of solders that contain little or no platinum.

When heat treatable platinum alloys came about, it was discovered that they had a much lower melting point than regular alloys. This natural gap was the foundation for high purity solders. In the past the traditional solders contained little or no platinum, as it was not possible to lower the melting point enough to make a functional solder containing high platinum purity.

Platinum Solders: Proper Use and Application in Jewelry Making

Traditionally platinum solder seams were almost invisible as they were difficult to be found. There were few exposed seams and the jewelry was designed with many diamonds, engravings and such so that the seams were hidden, or the solder was used to close jump rings and connections. If the ends to be soldered were lined up properly and only the smallest amount of solder was used, the seams were practically invisible



Photo 1 Pt Necklace by Christopher Design

The jewelry of late, with large surfaces, high polish and open design make it more difficult to hide solder seams.



Photo 2 Three Stone Pt Ring by J. Birnbach

Because of what they are made of, the traditional solders tend to turn gray over time, are difficult to polish as they drag if the polishing direction is wrong and they can be polished out of the seam, as they are usually much softer than the host metal. Thus soldering platinum has often presented a challenge to the bench jeweler.

Soldering techniques

Joining parts together, adding sections and such to a piece of jewelry is a very important technique in the field of jewelry production. Therefore it is useful to know, what kinds of different joining techniques are possible. The addition of the Laser has made many more techniques possible, and things that could not be done with a torch are now possible. It is however still very necessary to learn and understand soldering, solders and preparation.

When soldering platinum at temperatures above 1,300 degrees Celsius or 2,327 degrees Fahrenheit, there is no need for flux or coating to prevent fire-scale, since platinum does not oxidize. (Some jewelers use flux to hold a small piece of solder in place, but at the high temperature being used, the flux burns away and can enter the grain boundaries of the metal, causing brittleness. Many jewelers use saliva). Flux can be used for the lower temperature solders, which are usually made of palladium and silver and contain no platinum.

Only high temperature solders contain a percentage of platinum. Most fluxes use their effectiveness above 1000 degrees Celsius. As the main job of flux is to keep the seam clean of oxidation and heat scale to aid in flowing the solder, it is not needed for most platinum alloys as they do not oxidize. There are specialty fluxes available for lower melting Pt solders.

Since platinum solders do not flow over distances, to solder a seam one must place many small pieces of solder close together and follow the seam with the flame. It is recommend to roll the solder very thin and then cutting the metal into pieces. This way, only small amounts of solder will be used at one time. Also, the solder should not be used to fill gaps; all joints should fit closely together. When finished, a properly soldered joint will look shiny and clean. When soldering prongs to a base, one can also pre-melt solder to the prong wire and thus apply it where it needs to be. The heat will melt the solder and make the connection.



Picture 3, soldering a prong

There is a distinct difference between soldering gold or silver and soldering platinum. Most of the gold and silver alloys are soldered using the conduction method. This means that the metal is pre-heated with the torch until the solder is ready to melt. The solder is melted by the reflected heat of the metal soldered. Platinum on the other hand requires no pre heating at all. One directs a sharp and somewhat large oxidizing flame directly to the seam and let the torch melt the solder.

Soldering platinum is very different from soldering other metals. Platinum solder does not flow the way most solders flow and one is well advised to use several pillions of solder to make a seam. The pressure of the torch often blows solder away before it is melted. It is advisable to clip, spot weld or wedge it in position before soldering. It is not a good idea to melt it into a ball and apply it with a soldering pick as many jewelers do with other metals. If one is using a soldering pick at all it is important not to use anything other than tungsten. Standard picks, Titanium and such do not work well. Standard picks will melt and Titanium picks will spark and decay.

Gold and silver soldering also required both fire coating and flux. None of this is needed for platinum soldering. Yes there are exception and some lower purity Pt alloys require flux as they oxidize, but in general it can be said that flux is not required for platinum and neither is fire coat. When soldering Platinum and gold together, the project becomes a gold project, rather than a platinum one and all rules used for gold soldering apply. Flux is needed to ensure that gold solder flows and does not oxidize. Fire coat will prevent the gold portion from getting blackened.

Platinum solders are generally available in sheet, wire, chips and paste form. Pre-cut chips are convenient, because they are uniform in size, but they are often wasted, as the container may spill and solders can no longer be identified as easy, medium or hard. If one cuts solders from sheet, it is possible to use a permanent marker to mark one side with different colors for different solders. Green could be easy , yellow could be medium and red could be hard for example. When cut in small pieces, it is easy to identify the solder by the color speck. It is also good practice to roll solder thinner before clipping , thus using the smallest amount possible.

It is possible to choose different possible soldering techniques. Soldering by torch, soldering in a furnace or soldering by induction with a generator. Soldering with a torch is the most common method for bench jewelers. Furnace and induction soldering are used for mass production and industrial manufacturing.

Soldering by torch is something most every bench jeweler can accomplish without use of expensive equipment. It is actually less difficult to solder platinum as one does not have to worry too much about melting small components during soldering.

Another advantage platinum has over other metals is the fact that the polish stays polished on most alloys during soldering. Especially well suited are Pt/Iridium alloys. It is always a good idea to have each component perfectly polished before soldering it together, Then, after assembly, only minor polishing is required.

Some of the traditional platinum solders can be polished out. While that is a disadvantage when sizing, it can be a great plus when polishing basket settings and such. As it is softer, the solder can be brushed away without changing the wire dimensions too much. But because they contain little or no platinum, they tend to show the seam as a grayish line

The newer "Plumb" solders polish flat and very closely match the color of most Platinum alloys. They are also hard and thus make polishing the soldered area far easier. While any of the traditional solders tend to show a line, the hard and medium plumb solder seams are almost invisible.

When is it good practice to use a white gold solder while working on platinum? Many of the reasons to use white gold solder when working with platinum have become invalid with the use of lasers. Re-tipping a diamond, Sizing a Semi-mount, working near stones were the reasons to use a lower temp solder. As diamonds burn way before 1000 °C any platinum solder will damage stones. So it is wise to use a lower flowing substitute and this is where white gold solder comes in.

Eye protection

When soldering platinum at high temperatures, UV radiation is being released which can hurt your eyes. It is therefore important to protect your eyes. Welding goggles with a #5 rating are sufficient. Do not use ordinary sunglasses as they offer little or no protection of your eyes.

As these goggles impair your view, some jewelers prefer to use a little trick when soldering. By placing a lens from a welding shield between the work and the torch, one can see through the protective lens when soldering without having the vision obscured by the goggles. Whatever the preferred method is, it is very important to protect the eyes.

Fuels

There are several options of fuel to run a torch. Many shops run acetylene/oxygen torches. While this is a good choice for gold and silver, it is not recommended to use when soldering platinum. Acetylene expels carbon in the flame, if it not adjusted to burn all the fuel. This can contaminate platinum and be a cause of cracking.

Natural gas/Oxygen is a far better choice, as is Propane/Oxygen. So called "water torches" work very well. They separate Hydrogen and Oxygen and burn very clean. However, some have a feature whereby flux is added to the flame. Unless one disables that feature those flames are not suitable for platinum, as the flux can be absorbed and contaminate the platinum. Hydrogen/oxygen is a good choice for soldering platinum. Flame should range from oxidizing to neutral. Reducing flames are not recommended.

Another consideration is the alloy that is going to be soldered. Some Platinum alloys do oxidize when heated and need to be soldered rapidly. One of the common mistakes made soldering Platinum/Cobalt for example is the flame being too small. This will extend the time it takes to melt the solder and gives the metal ample opportunity to oxidize. By the time the solder finally melts, it might be adhering to the oxidation and the seam will fail.

Traditional Pt. Solders in the U.S.

While every metal provider has their own formula for platinum solders, they are actually quite similar

Solders	Gold %	Silver %	Platinum %	Palladium %
REPAIR :				
P1000	33.95	59.27	6.78	0.00
P1100	44.54	44.88	0.00	10.58
P1200	63.35	23.37	1.39	11.89
P1300	77.17	0.00	0.00	22.83
P1400	65.28	0.00	3.87	30.85
P1500	58.41	0.00	2.59	39.00
P1600	0.00	0.00	8.88	90.39
P1700	29.35	0.00	16.66	53.99

Repair solders have flow temperatures from 1000C to 1700C. These solders are used for minor soldering & repair works on Pt jewelry.

As you know the Pt solders often also double as the Pd solders:

1100=soft. 1200=medium. 1300=hard.

They are called Pd soft, Pd medium and Pd hard.

The contents of Plumb solders are proprietary, but when one looks at the patent application, the contents are listed as Platinum, Gallium and Copper in various combinations to make easy, medium and hard solders.

Solders	Gold %	Silver %	Platinum %	Palladium %
Alloy Name				
1000	31	57	0.	12
1100	39	47	0	16
1200	52	32	0	16
1300	70	14	0	17
1400	65	0	5	30
1500	55	0	5	40
1600	45	0	15	40
1700	22	0	23	55
Pt Weld	13	0	38	50
Pt Plumb Weld			95	

These solders have the following flow temperatures

1000	1110°C
1100	1135°C
1200	1200°C
1300	1250°C
1400	1460°C
1500	1480°C
1600	1535°C
1700	1600°C
Pt Weld	1650°C
Pt Plumb Weld	1740°C

The 1000 and 1300 are available in paste form. 1100 and 1200 can be made in paste as a special order. All other solders are available from stock in sheet form and as wire as a special order.

Metal content of Platinum solders in the U.K.

Solders	Gold %	Silver %	Platinum %	Palladium %
Alloy Name				
Pt X-Easy	0.00	90.20	0.00	0.00
Pt Easy	39.00	46.20	5.40	4.70
Pt Medium	52.74	31.64	0.00	15.67
Pt Hard	64.74	0.00	5.21	30.10
Pt 1700	22.00	0.00	30.22	47.78

These solders have the following flow temperatures:

Pt X-Easy	990°C
Pt Easy	1060°C
Pt Medium	1260°C
Pt Hard	1480°C
Pt1700	1740°C

Here are a few examples as to what solder is used for which operation.
When doing structural soldering, such as attaching a shank to a bezel, either 1700 traditional or Pt950Plumb solders are recommended. There will be stress on the seam and thus a harder solder is required. This applies to most sizing jobs as well.



Photo 4, Solder shankto bezel.

To solder a jump ring to a bezel or a loop to a pendant, medium flow solder is desired. Traditional 1300-1500 solder or Pt925Plumb solder.

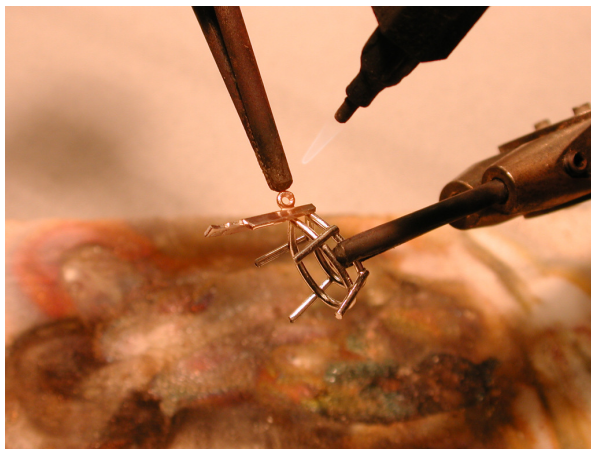


Photo 5, Solder jumpring.

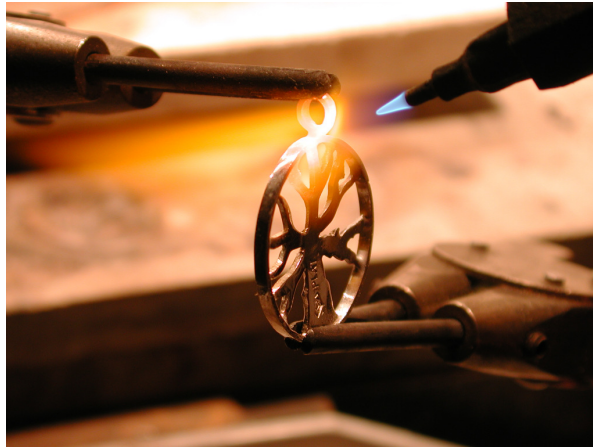


Photo 6, Solder loop

When tinning a Tie tack with solder or installing a component to piece such as this name to a heart, easy solder is preferred. That would be the traditional 1000-1200 solder, or Pt900 Plumb.

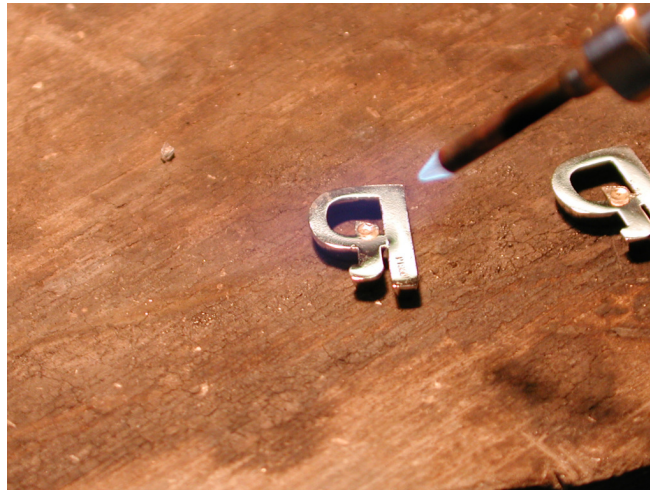


Photo 7 tindivotwsolder.jpg



Photo 8 solder post



Photo 9 soldername to heart.jpg

Conclusion

Traditional platinum solders are made by different companies in different compositions. Most contain very little platinum. Many double as palladium solders.

It is ok in some cases to use white gold solders to get a job done if it keeps stones or other things from being damaged.

To allow for lower purity platinum solder, metal provider sweeten the alloys sold by adding 2 ppt additional platinum to the mix, ie Pt950 being actually Pt952.

Plumb solders have made a big difference as its high platinum content and color and polishing feature added a new dimension to working with platinum.

Credit

Many thanks to Cookson, Krohn Industries, PM West and United Precious Metals for their assistance with this paper.