Preparing for Platinum Bench Work

Sooner or later, most bench jewelers will have to work with platinum. It's only natural: As demand for the white metal has increased over the past several years, the amount of platinum jewelry that needs to be repaired or fabricated has also risen. Platinum bridal pieces, cocktail rings, bracelets, and chains - all these and more will at some point cross the jeweler's bench.

This also gives rise to one of today's most frequently asked questions: How difficult is platinum to work with? The answer: Not very - unless you don't have the necessary information.

To illustrate, let's say a bench jeweler must fabricate a four-prong solitaire ring. It's the same kind of ring he's made many times in his career, except this time it will be made from platinum. He's never worked with this white metal before, but he's not worried. After all, he's had plenty of experience with gold; how different can it be?

Confidently, he rolls the platinum stock to the proper size, creating the wire that will form the gallery for the prong assembly. Placing it on a charcoal-soldering block, he begins to anneal the wire in preparation for soldering. He focuses the flame of his trusty oxygen/acetylene torch and watches as the platinum turns a bright orange. His uncovered eyes squint as he looks into the blinding light, and he has trouble focusing. He's about to take out a pair of sunglasses from his pocket when he notices that his charcoal block is starting to decay rapidly. Since he's already been annealing for about 10 seconds - more than enough time for gold to soften - he pulls away the flame and quenches the wire.

He now attempts to bend the part. However, the platinum offers much more resistance than he expected. He increases his pressure - and suddenly the wire snaps in two. Oh well, he sighs, that's happened with gold too. Taking more wire, he repeats the process. This time, though still hard, the wire bends without breaking, and he solders its ends together.

He is now ready to attach the prongs. After adding a little flux, he grips the wire in his steel tweezers and proceeds to solder. The wire begins to glow, getting brighter and brighter. It's getting awfully hot, he thinks, but then he's heard platinum can do that. But the glow is so intense that he can't look at it anymore. Quickly, he grabs the pair of sunglasses and puts them on.

Finally, it seems the prongs are securely in place. However, the seams don't look quite right. He puts a little pressure on one of the prongs - and it falls away. Not only that, but the wire is cracking in several places, and there is a huge black spot where the steel tweezers had been. What is this? he thinks. What kind of bad metal has someone sold him? Sighing, he realizes that this is going to be one of those days.

Except it didn't have to be. Unfortunately, our bench jeweler made several mistakes, all of which made success difficult if not impossible to achieve:

1. He didn't fully anneal the wire. Unlike gold, platinum takes about one minute at 900°C (i.e., a bright orange) to reach full softness.

2. He used an acetylene torch, which can expel carbon that the platinum then absorbs. Natural gas/oxygen, propane/oxygen, or hydrogen/oxygen fuels should be used for platinum. (Hydrogen and natural gas work best; propane requires more time to melt the platinum because it burns cooler.) A water torch can also work well for welding or soldering.

3. He annealed (and later soldered) the platinum on a charcoal block. This too can release carbon into the metal. Between the acetylene and the charcoal, the metal undoubtedly absorbed enough carbon to become embrittled, and thus snap. While carbon won't always lead to breakage - which explains why the second attempt succeeded - it always poses a threat. Platinum soldering should take place on a special surface, such as fused alumina, fused silica, or other ceramic surfaces. The flat bottom of a Wesgo-type dish crucible can also be used. (The crucible provides an additional advantage in that, when turned over, it can hold platinum snips for melting.)

4. He applied flux before soldering. Since flux has a working temperature far below the melting point of platinum, it is actually useless in enhancing flow. However, it can contaminate the metal with borax or fluoride and cause embrittlement. Never apply flux to platinum. Unfortunately, this also means you will lose the flux's ability to help parts stay in place for soldering. To compensate, try using a tack welder to affix both the prong and the solder in position (this is particularly useful for wire solder). You can also try this trick: Notch the gallery wire where the four prongs would go, then bend the prong wire into a horseshoe shape and clip either end into two opposing notches. Repeat the process for the remaining two notches, and then wedge small

pieces of solder between the gallery wire and the prongs. By doing this, you can solder all the prongs at the same time.

5. He used steel tweezers. Steel can leave a black spot of oxidation on the metal that may be difficult to remove. Tungsten tweezers should always be used to hold parts close to the torch flame.

6. He didn't use the proper eyewear. Platinum emits UV radiation; when annealing, welding, or soldering, welding glasses with at least a #5 protection rating must always be used. Sunglasses are absolutely not suitable.

So not only did the jeweler contaminate the metal, but he also imperiled his eyesight. And he had nothing to show for his efforts but a cracked wire that had to be scrapped.

His failure had nothing to do with skill, though; it had to do with information. For successful bench work, you must know the proper way to set up your workspace, the proper tools to use, and the basic properties of platinum. Because when working with platinum, there are no short cuts.

Cleaning Up the Shop

Platinum work actually begins well before you even sit at your bench and pick up a torch. To be successful, you must set up your workshop properly. And by properly, I mean it must be clean.

That's because, as has already been shown, platinum is easily contaminated. The reason for this resides primarily in the high melting temperatures of all platinum alloys. For example, platinum/iridium has a liquidus range of 1,800°C (for platinum 900/iridium, the alloy preferred by many U.S. jewelers for fabrication) to 1,830°C (for platinum 800/iridium, which is used exclusively in Germany for very fine mesh and chain product). Even its annealing temperature (900°C liquidus) and its soldering temperatures (up to 1,700°C liquidus) either dangerously approach or exceed the flow points of all other metals, including gold's.

While platinum's high melting points drastically reduce concerns about overheating - filigree and other fine wirework can be easily accomplished, as can chain repair—they also create a situation where other metals become potential contaminants. For instance, maybe the file you just used on your platinum ring had small particles of sterling stuck in its abrasive surface, and those particles have now been transferred to the platinum. Or

maybe you were drawing platinum wire through a plate layered with gold splinters, or running sheet through gold-flecked rollers. When that platinum is heated to annealing, soldering, or welding temperature, these foreign particles will start to glow, melt, boil, and enter the surface of platinum, contaminating it. It is the same thing that many jewelers have encountered with lead solders used on karat gold jewelry.

Just as it takes only a small amount of lead to ruin a piece of jewelry, so too does it take only a small amount of metal to contaminate platinum. Of course, a contaminated section of a piece can be cut out and a fresh section welded into place. But it's far better to avoid the need for such reconstruction - which is why you must maintain clean working habits, clean tools, and a clean workspace.

Let's begin with the bench. If you have the room, the best solution would be to have a bench dedicated solely to platinum work. This may not be realistic for everyone, however, considering that many small operations cannot accommodate a second bench. In that case, a second filing tray may be the solution; when you need to work with platinum, simply switch it with your regular tray. And if even that isn't an option, then make sure you clean out your tray thoroughly.

You should also regularly clean your bench top, as well as take the following precautions:

- Clean your rolling mill before running any platinum through it. Remove any stray bits of metal from the rollers, and either steam clean the draw plate or place it in an ultrasonic.

- Use a bench pin dedicated solely to platinum. Any pin contains an untold number of tiny holes and crevices; tap it, and you'll see all the filings they hide. It doesn't take much to have platinum come in contact with them and be contaminated.

- Purchase a set of finishing tools - files, sandpapers, abrasive sponges, polishing papers - to be used exclusively for platinum. (Disposable sponge files - the kind used for filing fingernails - work especially well; they come in several different grits and nicely conform to the curvature of any piece.) Also invest in a file cleaner.

- Maintain a separate buff charged with high gloss platinum compound. Most operations usually have one buff used for all types of jewelry. Through the various polishings, this multipurpose buff removes and

collects fine metal particles, and these particles can then be pressed into a platinum piece. Consequently, the platinum will not become shinier, but instead will reach only a semi-gloss.

Your tools need to be not only clean, however, but also correct: As shown earlier, the wrong equipment can create a very unpleasant experience.

Buying the Right Tools

When equipping your bench, you must always consider what effect a particular tool or material may have on the platinum. Any potential source of carbon should be avoided: acetylene, charcoal blocks - even pencils: If you draw a pencil line on the soldering block as an alignment guide, the resulting carbon from the graphite tip could seep into the platinum. Better to use a Sharpie or similar marker with water-based ink that will easily evaporate.

You should also make sure that not only your tweezers but also your soldering pick is made of tungsten. (Better yet, think twice about using a pick: The solder balls will have difficulty sticking to the tungsten.) Do not use a titanium soldering pick, which in the high heat necessary for platinum will turn into a sparkler; this can not only destroy your tip, but contaminate your ring as well.

Given platinum's high melting points, it's not surprising that most problems occur when the metal is heated. Consequently, two of the most important purchases for platinum bench work may be the torch and the crucible. Always use a Wesgo-type crucible, since the regular crucibles could break down under the intense heat and contaminate the metal with silicon. As for a torch, you must select one that will provide excellent control, flexibility, and comfort. It should also have a tip that's screwed on rather than soldered: Solder could melt in the platinum's reflected heat, causing the tip to fall into the molten metal and splash platinum. Finally, your torch must have a built-in flashback arrestor, to prevent gas from flowing back into the tank in case of a pressure change. This is an important safety feature.

When checking out the various makes and models, take special note of how their features may aid or hinder platinum work. To illustrate, let me compare several torches that I've often used in my own bench work:

- Compact and versatile, a Little Torch can be used with disposable propane/oxygen tanks, which make them particularly useful where local

ordinances prohibit large fuel tanks. However, it does not work with natural gas, one of the preferred fuels.

- A Hoke-type torch offers a needle-tip attachment and can be operated with one hand for maximum efficiency. Though bigger and bulkier than the Little Torch, it can operate with all gases. You can also get different tips for it, depending on the delicacy of an operation.

- A water torch produces a hot, clean flame and makes its own fuel by separating hydrogen from oxygen in distilled water through electrolysis, thus eliminating the need for tanks. However, you must make sure it can produce the heat necessary for platinum, and that the gas can avoid passing through the fluxing solution common to these units. Also, using the torch may require some relearning, since the flame size is adjusted by changing tips rather than turning a valve.

In addition to a torch, you should think about investing in a laser welder. While relatively new to the industry, these welders offer many benefits: they're quick, they eliminate the dangers of high torch temperatures, and they provide strong bonds. They're particularly useful for assembly and fixing porosity, as well as for performing repairs around gemstones: The laser's pinpoint accuracy, coupled with platinum's poor conductivity, helps keep heat from reaching and damaging the stone. While they may be too expensive for some shops (they cost around $30,000), laser welders can save valuable time.

For soldering, you'll want to make sure you have both platinum solder and white gold solder on hand. Most jewelers use platinum solders to maintain the authenticity of a piece, even though these solders have traditionally contained little platinum -12 percent, at most - and the lower temperature formulas create visible seams. (That has changed since the recent introduction of plumb platinum solders; not only do they blend with most alloys, but they don't polish out of a seam the way traditional solders sometimes do.)

Occasionally, though, you may run into a situation where the intense soldering temperatures could lead to greater problems. Soldering gold to platinum, for example, might result in the gold's meltdown. In such a case, white gold solder, with its lower melting points, will eliminate the danger while still providing the needed color. (You could also resort to a laser welder, if one is available.)

Overall, most of the products available for gold will also work for platinum (as long as they're contaminant-free and able to withstand high heat, of course). The only area in which that differs is polishing. Here, you must use compounds specifically designed for the white metal, since ordinary rouges will do very little. For polishing the metal to a high luster, I like green rouges containing chromium oxide, or white or orange carrot rouges that have aluminum oxide. Polishing papers developed by St. Paul, Minnesota-based 3M can also create a high luster with minimal effort.

However, even if you have bought all the correct tools and have cleaned your workspace until it nearly shines, you may still run into problems if you don't employ the proper techniques. As I've said, working with platinum isn't difficult, but it is different. With that in mind, here are a few tips to help ensure success:

- When soldering or welding platinum, always use a sharp, oxidizing flame (i.e., one that is fueled more by oxygen than by gas) and apply it directly to the seam. Do not use flames that are reducing (more gas than oxygen) or carbonizing (equal amounts of both), as you would with gold or silver.

- When welding two pieces of platinum, make sure they are both made of the same alloy, since different alloys have different melting points.

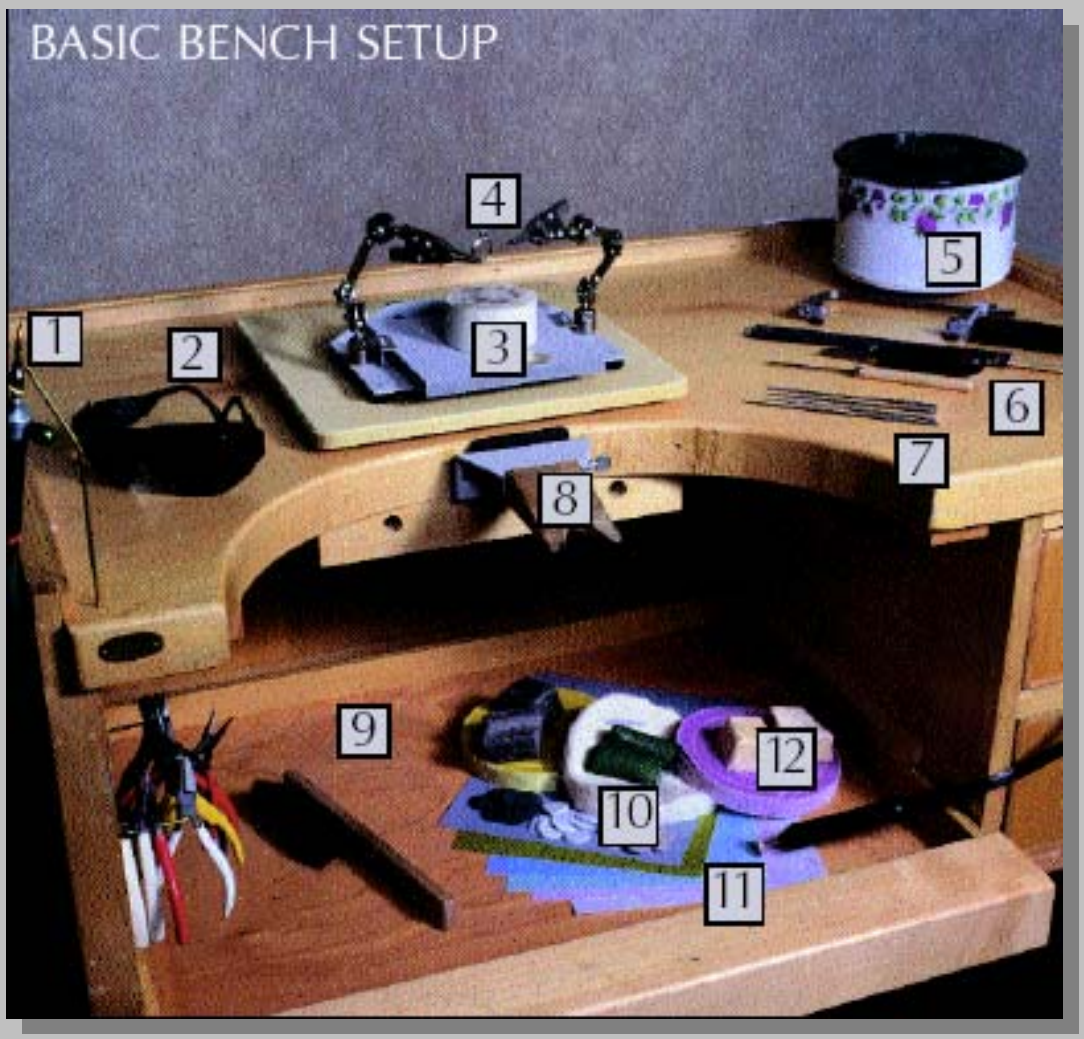
- If soldering 18k to platinum, make sure both pieces are thoroughly annealed; the different expansion rates of the two metals could lead to stress cracking. Also, although platinum by itself usually does not need pickling, a bi-metal piece will.

- Because of its density and softness, platinum tends to "grab" cutting tools such as drills, burrs, files, and saw blades, as well as clog teeth and grooves. Always charge these tools with oil of wintergreen or other burr and drill lubricants. (Drills will freeze up in the hole and break often if they are not lubricated.) Also make sure to lubricate the draw plate in your rolling mill.

- Scratches can't be polished out of platinum (they only become shinier), so make sure you remove them before applying a polish. Platinum usually requires four levels of abrasives: 800, 1,500, 4,000, and 8,000 grits. They are usually available as sanding sticks, abrasive papers, or abrasive wheels. Also, use a highly polished tungsten burnisher on your jewelry before buffing.

- Given the aggressive polishing methods needed for platinum, always polish a platinum part before attaching it to another piece. This is especially true for multi-metal pieces, in which you could over-polish the other metal.

In the end, it all comes down to information. By knowing platinum's basic properties, understanding the threat posed by contamination, and avoiding all short cuts, you'll be able to set up your shop and apply your skills so that you'll always achieve success. And since you know that at some point platinum will undoubtedly cross your bench, it's best to prepare now. After all, there's nothing worse than having several hours' worth of work result in nothing but a cracked alloy, a worthless piece, and a ruined day.



1. Natural gas/oxygen, propane/ oxygen, or hydrogen/oxygen fuels work best for platinum. Never use acetylene, which can emit carbon and contaminate the alloy.

2. Wear at least #5 welding glasses when annealing, soldering, or welding.

3. Solder platinum on fused alumina, fused silica, or other ceramic surfaces. The flat bottom of Wesgo-type crucibles can also be used. (Never use regular crucibles, which could break apart and contaminate the alloy.)

4. Use tungsten tweezers, never steel, which can leave a black spot of oxidation.

5. While platinum by itself doesn't need pickling, bimetal pieces (such as 18k and platinum) do.

6. Use a tungsten soldering-pick, never titanium.

7. Purchase files and other finishing tools for use exclusively with platinum.

8. Use a bench pin dedicated to platinum to prevent contamination from filings hidden in tiny holes and crevices.

9. Use a bench or tray reserved for platinum work. If that isn't possible, keep your tray thoroughly clean.

10. Purchase separate buffs for use specifically with platinum.

11. Platinum requires four levels of abrasives: 800, 1,500, 4,000, and 8,000 grits.

12. Platinum requires polishing compounds designed specifically for it; ordinary rouges will do very little.