

# Platinum and 18-Karat Gold...Oil and Water?

Paul Klecka • Paul Klecka Design

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In the past five years, we have all witnessed and, I hope, profited from, the increasing popularity of platinum with consumers. This resurgence in platinum's popularity was first catalyzed by the Platinum Guild, but industry analyses of consumer buying patterns now show unequivocally that the public's enthusiasm for platinum has securely taken on a life of its own. This is not to say, however, that across the country platinum is universally popular.

For the past two decades, the American jewelry industry has courted the consumer dollar almost exclusively with yellow gold. And, as I have discovered, old habits are hard to break. Although platinum is certainly the precious metal of the moment, I have learned through my discussions with consumers that many, though intrigued by platinum, still prefer the warmth of gold for jewelry. However, their interest in purchasing platinum rises as soon as I mention the possibility of creating a piece for them which combines the two metals. It is clear from current fashion trends that I am not the only one to have tapped into this consumer secret.

Open any fashion magazine published today and you will find many examples of accessories, even garments, featuring the platinum-gold combination.

But simply because many jewelry lines currently feature platinum and gold jewelry does not mean that this sort of piece is easy to create. The technical considerations involved when working with these metals in combination are considerable. The designer who sets out to create a piece without full knowledge of these metals' properties and individual behavior is certainly headed for surprises.

You will find, as I once did, that such experiments can be extremely expensive. Fortunately, I was able to find a solution to my dilemma. I hope that what follows will help those of you who are considering the same venture.

## The Problems with *Miragé*

Before I go into the technical differences between platinum and 18-karat gold, I would like to tell you a story which I think will illustrate very well what can happen to jewelers when their ideas are more ambitious than their bench skills. This is about the development of my signature design, the *Miragé*, and what happened when I decided to use platinum instead of 18-karat white gold in the design.

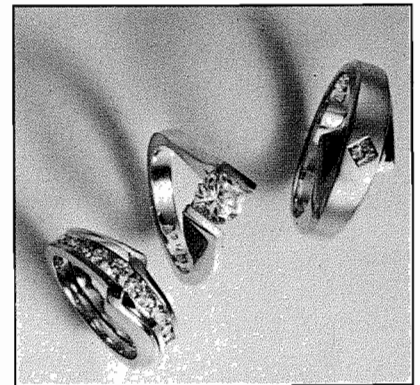
In the early 1980s, when Paul Klecka Inc. was still a manufacturing retailer, I was intrigued by the optical effects created by the intersecting planes of glass on the sheathed buildings which were then on the cutting edge of commercial architecture and were being built all around me in downtown Chicago. I wanted to

create that same sort of reflective illusion for jewelry, but it wasn't until 1985 that I had both the resources and the technical ability to do it. The result was the Paul Klecka *Miragé*.

Using diamonds and 18-karat white gold, the first *Miragé* pieces I created were earrings and cufflinks.

The optical illusion that I was looking for, the visual doubling of the diamonds, was created by the highly-polished plane of white metal set at just the right angle. I was satisfied by the effect created by my design, and when in 1989 I won the De Beers Diamonds Today award with these two designs, I was convinced of *Miragé*'s commercial potential. There was only one problem.

Although the 18-karat white gold reflected the diamonds nicely, giving me the doubling effect I wanted, the slightly dark tint of 18-karat white gold was making the reflection of our F-color diamonds appear at least three grades lower; at best I to J. For me, this was a real aesthetic problem. The obvious white metal alternative was platinum,



*Platinum/18K assembly possibilities Sandwich (man's band), trim (engagement ring), and co-casting (wedding bands). Photo: Einzig Studio NYC*

but I wasn't familiar with the metal, and I was hesitant to try it. The emergence of the Platinum Guild, however, forced my hand.

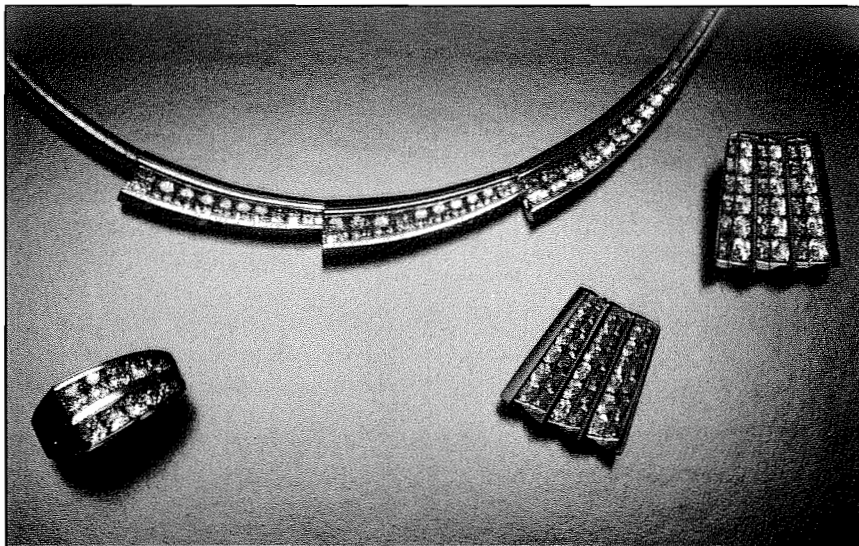
As we all know, the Platinum Guild's influence really began to be felt in our industry in the early 1990's. Being market-oriented, when I saw that the Platinum Guild's efforts were creating a genuine consumer response, I decided that it was time to try platinum, and the appropriate starting point was with *Miragé*. The results of my attempts were decidedly mixed.

The first *Miragé* design I created using platinum in place of 18-karat white gold was the disk earring, and my success with it lead me to think that working with platinum was easier than I had thought; and, platinum and 18-karat gold were compatible.

Why? Because I had beginner's luck in the way I had designed the piece. The only meeting of the metals involved in the disk earring was a one millimeter edging of platinum wire joined to the half-millimeter disk to visually thicken the edge, and this was not enough contact to create the stress between the two metals which was later to cause me many headaches.

But the headaches began soon enough. Flush with my success introducing platinum into the *Miragé*, disk earring design, I tried to introduce it into fashion rings and wedding band designs. Disaster. Months of work were lost, not to mention orders.

The problem that we had was a heart-breaking one because it only appeared with the final polish. Suddenly, in a piece which had appeared structurally sound in every way, tiny fissures would



*Cast and fabricated Platinum in ring, earring and necklace suite of Miragé total weight designs. Photo: Einzig Studio NYC*

appear in the metals, especially the 18-karat gold. Time after time, these pottery-like cracks would appear with the final polish. With each splintered piece we scrapped, it became clear that we had a systemic problem, and if we were going to keep customers, we were going to have to find a solution fast. So, we started searching.

We began the process by trying to eliminate possible causes. Was it a defect in our casting gold? A defect in the platinum? A technical issue having to do with our assembly procedures? Or could the design of our model be at fault? Of course, the caster blamed the jeweler, the jeweler blamed the caster, they all blamed me, and so on.

After much information-gathering and with the cooperation of numerous industry colleagues and several of our suppliers, we determined that the source of our cracking problem was entirely in-house. When we

added a jeweler to our bench staff who had extensive experience working with platinum, it was clear that half of our difficulty had been caused by inexperience in proper handling of the metals. The other half, unfortunately, was created by my design.

What we discovered through our research is that the way in which we had been interpreting my designs was fundamentally flawed given the two metals' distinct characteristics. Not only were we attempting to combine them in incompatible proportions, we were also trying to join them in a way which was guaranteed to create the stress fractures which were driving us crazy.

The changes we made were: First, we made the platinum elements in each design much more delicate, so that their thickness would generally be less than that of the gold components.

It was apparent that because platinum and gold respond very differently to heating and cooling,

without controlled cooling after soldering, the platinum elements in each design would create enough stress on the gold to literally tear it apart. By reducing the volume ratio of platinum elements to gold, we greatly reduced this problem.

Second, we changed our method of bonding the metals from sandwiching, in which the internal stress was distributed laterally throughout the piece, to an end-to-end joining, which distributed the stress perpendicular to the bonded area.

This change accomplished two things.

First, changing the direction of the stress in the piece, and distributing it throughout the design greatly eliminated and redistributed the amount of pressure put on the gold during cooling, resulting in a much improved success rate.

Second, substantially diminishing the amount of contact between platinum and gold also minimized the amount of stress at the joint.

These changes created a difference of as much as five to one in the amount of contact between the two metals, which therefore reduced the possibility of stress by approximately the same ratio.

Today, our bench staff has had enough experience joining platinum and gold that the sandwich method which had failed us earlier is now possible to execute. The *Miragé* experiment taught us a great deal about the complexities of working with 18-karat gold and platinum in the same piece. Although our initial results were not promising, we now know the two metals' technical parameters and have been able to find ways to

successfully join them. But it would have been nice not to have discovered these processes by trial and error. This is not to say that joining platinum and gold still does not present us with challenges. Of those we still have plenty.

Let's review the technical considerations of which any jeweler must be aware when joining platinum and 18-karat gold.

### Technical Issues in Joining Platinum and 18-Karat Gold

Rather than fighting against the behavior of gold and platinum, learn to exploit their differences in characteristics and behavior to your advantage. First of all, your design must reflect a knowledge of how the metals will respond to each other in combination, and must take into account numerous issues that can be aligned to your advantage. Let's briefly review some of the most important points to consider.

Success begins with good housekeeping. Contamination is probably the leading reason for failure in joining platinum and gold, so in our shop, we make an effort to completely separate the gold and platinum at every stage of the manufacturing process. While this is nearly impossible to achieve, especially when we are working with combination designs, there are some advantages to being conscientious. As we are changing between metals often, we receive an optimum return on bench sweeps since all metals are kept separated. And, because each artisan keeps his bench organized and clean, we create an impressive image for visitors to our shop. How many of you work at a bench

piled high with envelopes, burrs, and scrap that represents fifteen years of accumulation, topped off by last Tuesday's lunch? Watch out for the archeologists!

Let's go step-by-step through typical shop procedures and review potential problem areas in working with platinum and gold.

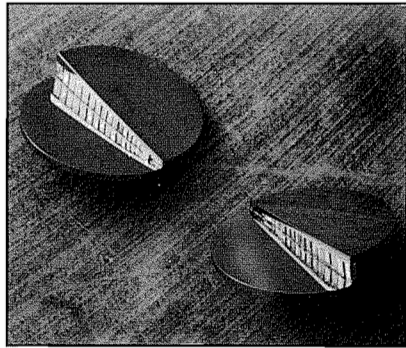
#### *Silica contamination*

The first step after casting platinum is to completely remove any trace of investment compound from the raw casting. Silica can create cracking and inclusions that are nearly impossible to remove later. And it doesn't take much to cause a problem down the line. A single silica particle can ruin a piece, and may not show until the final polish. Tech-Form Casting of Milwaukee, Ore., suggests that a cold bath of hydrofluoric acid will dissolve any silica investment and will not harm the platinum.

#### *Steel contamination*

It is inevitable that metallic contamination will occur during routine shop procedures. The metal will contact various steels during rolling, hammering, sawing, filing, grinding, and drilling, and this will create cracking and inclusions if not removed.

Chris Cart, former manager of technical education for Platinum Guild USA, tells the story of a refiner who experienced contamination from the steel trays that were being used for weighing platinum in various departments. The contamination was revealed as discoloration that eventually led to cracking later. To solve this problem, not only did the refiner switch to plastic trays, but the firm keeps dedicated trays for individual metals, separating silver,



*DeBeers Diamonds Today award-winner features a single row of baguette diamonds mirrored in polished metal. Photo: Einzig Studio NYC*

gold, and platinum, as well as any alloying metals. With containers and tools dedicated to a specific metal and separating filing, sawing, grinding and assembly operations, we greatly reduce the risk of failure at Paul Klecka. Cart also recommends a bath of sodium bisulfide acid before heating or melting and a subsequent pickling to remove any ferrous metal from the platinum surface.

#### *Precious metal contamination*

It seems ironic to mention in a paper about combining platinum with other metals, but gold, silver and copper will also create problems if not handled properly. Since these metals do not alloy but instead form compounds with platinum, the result of contamination will be cracking and inclusions in the platinum elements. When combining platinum with other precious materials, we certainly want all elements of the design to be clean and unblemished. A nitric acid bath will remove any non-ferrous contaminants from the platinum surface.

#### *Heating and cooling behavior*

As I mentioned earlier, we

experienced tragedy in the heating and cooling of combination pieces because we were not attentive to the great difference in the expansion coefficients of platinum and gold. Care must be taken not to quench a combination piece, but instead allow it to air cool in a slow, controlled manner, thereby minimizing the stress at the joint. Overheating will produce a similar effect upon the gold, breaking down the crystalline structure and causing stress cracks to form.

An additional recommendation is to keep separate heating pads for platinum and gold, as well as a combination pad. Each must be kept free of small particles and filings which could become embedded in the hot metal. A set of solder picks and tweezers should be dedicated for platinum use only, and should be made of tungsten, which has a higher melting temperature than platinum.

#### *Assembly techniques*

Platinum and gold's characteristics dictate not only how a piece will be designed, but also how it can be assembled. There are three traditional ways of making combination jewelry. For a custom, one-time design, you may choose to combine components, each of which is finished as far as possible in different alloys. This is assembly. Combining a platinum head to the shoulders of a gold shank is a common example.

A second method is to finish the form of the piece in one alloy, and then to add an element of different color or texture. This is decoration. An obvious example is the inlaying of gold into platinum. This can be as simple as melting 18-karat gold solder into

a drilled, engraved or recessed area of platinum. To decorate a larger area, you might cut sheet gold to roughly fit an open area in the platinum design and heat wire to melt the gold into place to fill the edges. Or the decoration could be achieved by hammering the gold wire into a groove in the platinum. If prepared with a slight undercut, this will form a cold weld and will not require any heat. Certainly the reverse is possible by hammering platinum wire into a channel cut into the gold surface.

The third method of joining the two metals is co-working, where bars of alternating metals are assembled, or a pattern is created in sheet or ingot and then rolled and worked as a single piece of stock.

There is another, non-traditional way of introducing platinum elements into 18-karat gold which avoids the whole problem of joining the metals manually. We have found success joining platinum and 18-karat gold by setting platinum elements into our waxes and then casting 18-karat gold around them. In the casting process, the gold and platinum solidly bond, forming a complete weld.

Our general method for this process is to prepare and pre-polish the platinum element as fully as the design permits and then attach or embed it in the wax model. We usually add a protrusion, or we dovetail or bevel the joint for alignment of the parts and a secure fit. The model, with platinum elements attached, is then invested, burned out, and the gold cast as usual. The beauty of this operation is that it eliminates the painstaking and time-

consuming process of fitting together two pre-finished parts for soldering, not to mention the devising of an apparatus to hold the pieces for assembly. Instead, we finish only one element, the platinum one, and let the characteristics of the molten gold do the rest for us. If the finished piece fails to fully join in casting, whatever gaps exist can subsequently be touched up with gold solder.

#### *Welding and Soldering*

In the conventional process of joining platinum and gold elements, there are two basic rules to follow which reflect the behavior and characteristics of each metal. If you are joining platinum and 22-karat or higher gold alloys, platinum techniques are used to form the weld. No flux is needed, since both materials are pure enough to resist oxidation. In general, temperatures over 1000° C are needed to complete the weld.

If you are joining platinum and 18-karat gold, however, you need to use basic gold techniques, i.e., temperatures generally well below 1000° C, the use of a solder with a lower melting point than the two metals to be joined and the use of flux to prevent oxidation of the gold.

#### *Hardness, Cleanup and Finishing*

Since platinum does not oxidize when heated and retains its polished finish, all platinum elements should be finished completely before any assembly to gold. Think of working backwards from the usual gold methods, where all assembly is complete before finishing and polished operations begin. Certainly, you are doomed to frustration if you work platinum with gold methods.

Platinum's hardness and its resistance to finishing and polishing require an approach exactly opposite that of gold: you must pre-polish and finish all platinum elements before assembly. Personally, I find this requirement appealing in the sense that it requires a higher-level approach not only in bench techniques, but in concept as well. Every part of the design must not only be perfectly finished, but must be well-conceived from the beginning to the finished piece.

There are two hazards to be aware of in polishing a combination gold-platinum design because gold is so much softer than platinum. First, gold will create a step at the joint because it will polish away much more rapidly than will platinum. Once assembled, there is no possibility of building up the gold to match that of the platinum surface. The only option is to file down the platinum to match, requiring further lapping and polish. As you might imagine, this creates a never-ending cycle of filing and polishing in the attempt to even out the joint. The solution is to carefully avoid the pre-polished platinum area and very carefully lap and buff only the gold. This brings us to the second problem, which also has to do with the different hardnesses of gold and platinum.

If a platinum and 18-karat gold combination piece is polished in the wrong direction, from the gold surface towards the joint, the wheel will pull the gold over the joint, smearing the line of demarcation. The key here is precision. Pre-polish all platinum elements, avoid sloppy file strokes, wrong wheel speeds and cross-transfer of abrasives.

#### **Conclusion: Words of Encouragement**

Working with platinum and 18-karat gold is a challenge, both from the designers and the jeweler's perspectives, and it is a project which should not be entered into lightly. Why risk the loss of your time, materials, and client confidence?

Any time you invest in learning how these metals interact is time that you won't be spending pounding your fist on your workbench when project after project fails. My final recommendations for successful platinum-and-gold work are these:

- Know your metals' properties;
- Design for your metals' properties;
- Exploit these differences to your advantage.

Proper preparation is crucial to the successful joining of platinum and gold. Your time invested on the front end will be repaid many times over in the success of the final piece.

#### *Acknowledgments*

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