A Review of Cast Platinum Jewelry Fabrication Methods

Gregg Todd, Dennis Busby, Dena Landry, Mart Linscomb, Greg Gilman • Stuller Settings, Inc.

In recent years, we undertook a series of studies to compare various working properties of three common platinum alloys, platinum iridium 90/10, platinum ruthenium 95/5, and platinum cobalt 95/5. During that period of time, platinum-cobalt was relatively new to the U.S. market, although it had been in widespread use in Europe for years. And like most innovations in the jewelry industry, this change was met with a healthy dose of skepticism.

At Stuller, we had some serious decisions to make. Do we continue to use platinum-iridium for investment casting or investigate the possibility of using the "new" platinum-cobalt alloy? But, with recasting rates as high as 300% in some product configurations, tough choices were becoming a frequent occurrence. With this motivation, trials were undertaken to critically compare and contrast the behavior of a Pt-Co alloy with the behavior of Pt-Ir and Pt-Ru alloys in jewelry casting and finishing operations.

Investment Casting

The first issue addressed was whether one alloy demonstrated superior casting properties relative to the others. In short, the answer is a definitive yes. Platinum-cobalt 95/5 is a superior alloy for investment casting. The article published in the Platinum Manufacturing Process Volume IV,1998 Platinum Day Symposium, titled "A Review of Cast Platinum Jewelry Fabrication Methods," details the processes and results of our studies.

Platinum-cobalt 95/5 produced castings with better surface characteristics, controlled shrinkage, and less porosity overall. Castings produced with the platinum-indium and platinum-ruthenium alloys under the same condition, resulted in castings that were deemed unacceptable by our standards. The surface of the Pt-Ru sprue was the roughest, indicating a strong driving force for metal-mold reactions. This is confirmed by Johnson Matthey's rating of Pt-Ru alloys as being "very poor" in the relative quality of heavy jewelry. The Pt-Ir sprue post was also quite rough, while the platinum-cobalt exhibited a surface comparable to investment cast 14k yellow gold. Obviously the improved flu-

Fig. 1: (Left to right) Finished "fishtail" ring mountings in Pt-Co, Pt-Ru, and Pt-Ir alloys.

Fig. 2: (Left to right) Finished marquise ring mountings in Pt-Co, Pt-Ru, and Pt-Ir alloys.

idity, achieved with the addition of cobalt in platinum combined with the lower melting point, contributed significantly to the results.

During the finishing and stone setting phases of the trials, subtle differences were noted but were deemed significant enough to be a deciding issue between the three alloys. Assembly operations which included sizing, were easily accomplished in spite of a tendency by the Pt-Co alloy to develop a light film of cobalt oxide. This film was easily removed in subsequent finishing and polishing operations. It is interesting to note in sizing the fusion joint in the Pt-Co alloy produced a small, confined sink from solidification of the fusion zone of the weld. This behavior seems to mirror the general solidification behavior of the alloy observed in investment casting.

Although we did not experience this problem in our trials, care must be taken when using 1700°C seamless solder with Pt-5% Cobalt to avoid producing cold joints. The flow point of the solder is about 30°C (86°F) lower than the melting point of the Pt-5% Cobalt alloy. Due to this narrow temperature threshold, many technicians are reluctant to push temperatures to the levels required to achieve a complete bond.

Pt-Co alloys are slightly magnetic but this feature did not interfere in any way with jewelry manufacturing operations. Finally, the CIELAB color coordinates of Pt-5% Co, Pt-5% Ru, and Pt-10% Ir alloy were measured in a polished and finished condition The numerical values for the color coordinates indicate that these alloys are indistinguishable from one another when observed by a normal human eye.

There are some differences in working with the platinum cobalt alloy over the others (most notably the inability to fuse platinum iridium or platinum ruthenium to it). However, these differences should not pose significant obstacles to the bench jeweler, provided that they are aware of them.

Knowledge and training appear to be the overriding factors in the acceptance of platinum cobalt alloys for investment casting. This brings to mind a saying, "Once you know the nature of the beast, it's easily tamed."

Acknowledgments

The authors wish to express their appreciation to all the employees at Stuller Settings who participated in the production of the pieces used in this project. Special thanks are due to John McCloskey, Executive Director of Metals, for his guidance and support.

References

1. "Platinum Investment Casting Alloys." 0. Ainsley, A. A. Bourne, R~W.E. Rushforth, Platinum Metals Review, Vol. 22, No.3, 1978.
2. John Cullen, Johnson Matthey Precious Metals Division, Private Communication.
3. "Choosing Platinum Alloys to Maximize Production Efficiency", James Huckle, Platinum Manufacturing Process, vol. 1, 1995 Platinum Guild International.
4. "Color Technology for Jewelry Alloy Applications," D.P. Agarwal, G. Raykhtsaurn, Proceedings of the Santa Fe Symposium, 1988, p.229.