Seeing Sprues

CASTING A COMPLEX FRAMEWORK RING IN PALLADIUM

"When this CAD file came in for casting, we stopped in our tracks," says Teresa Fryé of Techform Advanced Casting in Portland, Oregon, who specializes in casting custom designs in platinum and palladium. "When you think about metal flow in this complicated design, your head starts spinning."

The saving grace of this framework ring, which was designed by Krikawa Jewelry Designs in Tucson to be cast in palladium, was that it had relatively uniform cross sections throughout its web-like structure, so there aren't a lot of thick-to-thin transitions. "If you're going to do a framework design like this, one of the best things you can do as a designer to promote fill and internal density is to stay uniform in your cross sections," says Fryé.

That said, when the file arrived at Techform, the suggested spruing method was not ideal. "The original nine sprues were all feeding the center of the ring, while the thin rails on the outside were just hanging out there with expectations of being fed through 0.7 to 0.9 mm connections over a comparatively large surface area," says Fryé. "While this approach might work fine in metals with excellent flow, such as silver or yellow gold, it is very risky for 950 palladium."

Instead, the Techform team suggested a whopping 19-part sprue system: the original nine sprues feeding the center of the shank and five sprues on each outer rail. "Because you have so many thin cross sections, you need a lot of feeding points in high temperature metals or you'll risk no-fill, sub-surface shrinkage porosity, and gas porosity," says Fryé. "Metals like platinum and palladium have much faster solidification rates than gold or silver, so you need more sprues to achieve complete fill and a high density casting."

In addition to ensuring fill and preventing shrinkage porosity, an ample amount of sprues is necessary when casting palladium to ensure degassing upon solidification. "When I first started casting palladium in 2005, I had extensive conversations with Hoover & Strong's metallurgist, Stewart Grice, about palladium's behavior during solidification," says Fryé. "Stewart coined the term 'gas magnet' to describe how molten palladium will fiercely seek out hydrogen, which can leave your casting full of gas porosity if you are not diligent." While palladium is always cast under a protective environment using argon cover gas or partial vacuum, Fryé says some degree of gas will nevertheless be present in the metal during solidification, and multiple sprues help it escape.

In situations like this one, where so many sprues are necessary to successfully cast a design, Fryé says working with the client to add sprue pads to the CAD file is critical to prevent headaches during cleanup and polishing. "By adding the sprue pads at the outset, the bench jeweler isn't faced with dozens of messy wax welds from sprue applications done without pads," she says. "They are uniform and quick to remove, resulting in faster cleanup."

Fryé is quick to note that to some casters, her company's spruing of this ring might look like overkill. But, she adds, when it comes to casting a unique custom design for a client, you often have one chance to get it right without significant downstream effects on your customer and his or her client. "We can't afford to lose pieces—ever," she says. "In custom casting, you have to err on the side of caution, so we may potentially oversprue a design because we need success the first time through. If our goal is to deliver a high quality and dense casting to our customer in a very short time frame, we just have to think this way."

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This complicated framework ring was designed by Krikawa Jewelry Designs to be cast in palladium by Techform Advanced Casting. The open design gives a big look using less metal.

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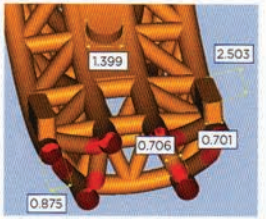

This image shows the measurements of the relatively uniform cross sections in the framework ring, as well as the dimensions of the round and rectangular sprue pads. ◆