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RIDGES AND RIPPLES OF RETICULATION

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A technique that is only a couple centuries old has studio jewelers making waves.

by

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The beauty of metal lies in the way it reflects light. The brilliance of a highly polished piece of gold jewelry or sterling vessel can be breathtaking. However, metalsmiths can change the direction, shape and intensity of reflections of light from a surface through texturing. The common texturing methods of hammering, engraving, florentining, and brushing all are ways of breaking the flash of light into smaller dimensions. Unlike these techniques which use force to reshape the surface, reticulation, used exclusively by studio jewelers, produces a ridged or ripply surface through controlled heating.

Reticulation is a fairly recently developed process, says Oppi Untracht, in *Jewelry Concepts and Technology*. He says it was first used in the late 1800s in Czarist Russia, where court jewelers such as Faberge, created textured objects--card, eyeglass and cigarette cases, as well as liquor flasks--to please the hand.

Many of Faberge's craftsmen were Finns, writes Finnish metalsmith Heikki Seppa in *Metals Technic: A Collection of Techniques for Metalsmiths*, published by Brynmorgen Press. When the Faberge studios closed during the Bolshevik revolution, the Finns brought the technique back to their homeland. From there it spread throughout Scandinavia. Untracht says reticulation was not used in jewelry until jewelry artisans developed an interest in textured surfaces. Seppa, who trained with one of the Faberge artists, helped popularize the technique in the U.S.

Silver is the metal most commonly used for reticulation. Sterling silver (92.5% fine silver and 7.5% copper) works well for the process. However, silver alloyed with a higher proportion of copper gives a more dramatic pattern. Seppa reports that Finnish smiths use an 82% silver/18% copper alloy. In the U.S., commercially manufactured reticulation silver alloys of 80% to 83% fine silver and 20% to 17% copper, are available. Reticulation can also be done on karat golds. The result is similar to that of silver.

Reticulation generally involves first heating the metal (sterling, reticulation silver or gold) two to ten times to oxidize the copper at the surface; then pickling to remove the oxide to leave a thin layer of pure metal on the surface. This is the process called depletion gilding. (Depletion gilding is also used to prepare a gold surface for granulation.) Once the sheet is depletion gilded, it is heated with a torch.

Artists who use the Japanese copper/silver alloy shibuichi also texture the metal with a process they call reticulation. However, the process is different--Seattle artist/jeweler Andy Cooperman says it is probably more correctly called torch texturing.

"I can make it weirder for you," says Maine artist/jeweler and author Tim McCreight. "Jewelry bronze--an alloy of 88 percent copper and 12 percent zinc--reticulates automatically, no dipping or quenching. Just heat it with an oxy-acetylene torch and it wrinkles up." He also describes a process of reticulating then stripping nickel silver. In this article, we will talk strictly about the reticulation process used for silver and gold.

The Process

Reticulation is not difficult, but it does take practice, concentration, and a deft torch hand. The pattern and appearance of a piece of reticulation is not predictable. You probably won't get the same results twice. (However, Michigan artist/jeweler Gene Pijanowski can almost draw with reticulation by using two torches.)

Because of its unpredictability, most jewelers start with sheet of metal larger than they expect to use. (There is also some shrinkage involved in the reticulation process.) Usually a sheet of metal 3 or 4 inches square gives you a good margin for error, says Portland, Oregon, artist/jeweler Sara Sanford. Later, you'll remove the most interesting sections of reticulation and incorporate them into jewelry. Even small pieces can be used as accents in earrings, pendants, or cufflinks. There will almost always be some metal scrapped, however, so take that into consideration when pricing.

Thickness of the sheet affects the amount of texturing. You can use 16 to 24 gauge; Sanford recommends 22 gauge. Although thinner gauges increase the chances of meltdown, they create a more textured surface.

1.) The first step in the reticulation process is to coat the surfaces of the sheet with fine metal, either gold or silver, through depletion gilding. (Pijanowski says he's always wondered what would happen if the sheet was simply plated with fine gold or silver, but he has never tried it.) Heat the sheet to annealing temperature, about 1100°F, or not quite a dull red. You can use a torch, but a kiln gives better control. (To facilitate moving the sheet in and out of the kiln, you can place it on a wire enameling screen.) Hold the metal at 1100°F for at least two minutes.

(For production work, the less frequently the metal is handled the better, says McCreight. In that situation, he recommends heating the metal only twice, holding it at 1100°F for five minutes the first time, then 10 minutes the second time.)

2.) Quench the metal in fresh, hot pickling solution, such as Sparex, and leave it there for two to three minutes. It is not a good idea to pickle gold sheets in pickle that has been used to pickle a quantity of silver as the silver may plate itself onto the gold and may be stubborn about coming off.)

3.) Clean the sheet under running water with a brass scratch brush and liquid detergent as a lubricant. (Pijanowski and Seppa say that Faberge and his contemporaries used stale beer--more available at the time than liquid dishwashing detergent!) Dry thoroughly.

4.) Repeat this annealing-pickling-cleaning process. Sanford uses six cleanings for silver, eight for gold. After the last pickling bath, clean thoroughly again, BUT DO NOT use the scratch brush.

5.) With a torch or kiln, pre-heat the soldering pad or charcoal block on which you will lay the metal sheet during reticulation. A hot soldering surface helps keep the metal heated evenly during the process.

6.) Lay the prepared sheet on the heated pad. Using a large, bushy, reducing flame, heat the metal. You want to be able to cover the entire sheet at one time with the flame. Gas/compressed air torches work well for reticulation; so do propane or natural gas/oxygen torches with large tips. An oxy-acetylene flame is too hot and the flame too small for heating the whole sheet evenly, says Sanford.

Pijanowski, however, uses a technique that incorporates this hotter flame. When working on a very large sheets of metal, he uses an acetylene/air Presto-lite with a large soft flame to keep the entire sheet hot during the process. In the other hand, he wields an oxy-acetylene jeweler's torch with a small, hot flame to create the texture. "By changing the angle of the torch and the closeness of the flame to the sheet," he says, "you can actually start drawing the texture and creating rows and circles." (See the section on reticulation in Oppi Untracht's *Jewelry Concepts and Technology* for photos of Pijanowski using the two torch method.)

7.) If you are using only one torch, as the metal turns red and approaches reticulation temperature, reduce the flame to a small, more pointed tip. Slowly move the flame closely over the metal. The tip of the INNER blue cone of the flame--the hottest part--should be very close to, if not right on the metal.

8.) As the metal begins to crinkle, move the flame onward. This is the most critical part and you have to watch the surface very closely. If you hold the flame too long in one place, you are likely to end up with a hole in the sheet. Only the part of the sheet on which you focus the flame will reticulate. So if you choose, you can leave part of the sheet plain for contrast.

9.) When the entire sheet, or as much of it as you want, is reticulated, remove the heat, allow the metal to cool slightly, and quench in pickling solution.

10.) Clean with water, brass scratch brush, and detergent. Finish to a satin finish. Attempting to high polish the reticulated metal tends to diminish its impact.

Reticulation is a serendipitous process--the challenge is to use what does come out, regardless of your hopes and expectations. You will, however, gain more control over the process with practice. One thing to remember is that both sides of the sheet will be reticulated, not only the one on which you held the torch. Sometimes the hidden side shows better results than the visible one.

Patination can bring out the drama of the ridged surface. "It's all about relief," says McCreight, who colors his reticulated pieces with liver of sulfur, "and a patina shows up the relief more dramatically." Baldwin's Patina, made by Phil Baldwin and distributed by Reactive Metals Studio, Inc., in Clarkdale, Arizona, has the benefit that it will not oxidize

silver or gold, which is convenient when using a reticulated metal that you want to patinate with another metal that you do *not* want patinated.

There are some caveats to using reticulated silver. It is somewhat porous and will "soak up" solder when you join it to a non-reticulated metal. You'll need to use more solder than usual. Because it is of uneven thickness, watch it carefully when soldering so that the thin sections do not melt. McCreight recommends burnishing the edges of the metal to reduce the solder absorption. This also evens out the thickness of the edges, making soldering a little easier.

Sanford and McCreight have found reticulated metal to be somewhat brittle. They advise against excessive bending and forming. If you want to shape a piece, repoussé the metal slightly before reticulating, says Sanford. Support the piece from underneath when heating, or it could collapse. Forming before reticulating, she warns, increases the chance of burning holes through the sheet, so you might ruin a piece you've already put labor into. In addition, you may not like the pattern of the reticulation once you're done.

However, Cooperman says he hasn't found reticulated silver unmalleably brittle. "I used to use reticulated silver to make torques. Nothing punishes metal more than anticlastic forming. Sometimes it was somewhat more brittle, but not usually." He says he annealed the piece whenever necessary, but usually it wasn't necessary. The metal worked fine.

An entire piece of jewelry can be made of reticulated metal, as with Cooperman's torques. However, most of the artists we talked to use it as an accent, contrasted with smooth or highly polished metals. "It's one of those things that works best if held in reserve," says McCreight. "It's like a hot spice: a little goes a long way." Reticulated metal contrasts well with smooth stones such as cabochons, and emphasizes the texture of rough stones such as crystals or drusy materials.

But however you use it, remember: Reticulation silver is not sterling and cannot be stamped as such. If you buy reticulation silver, mark the sheets immediately and keep all scraps separate from your sterling. When selling jewelry made with reticulation silver and sterling, be sure the customer understands that the piece is not entirely sterling.

So What's Happening Here?

Reticulation works because different alloys of the same metal (such as silver alloyed with differing proportions of copper) have different melting temperatures, each of which is different from, and lower than, the pure form of the metal. (The melt temperature of fine silver is about 1720°F; that of sterling is about 1640°F. Silver alloys with a higher copper content are down to about 1600°F or less; that of 82% / 18% reticulation silver is about 1520°F.) By creating a thin, fine silver or gold surface by depletion gilding, you create a difference in melting temperature between the surface and the interior of the sheet. When the prepared material is heated, the alloy flows before the surface "skin." The result is that the fine silver or gold surface wrinkles, something like the "skin" on hot chocolate--only more appetizing.

The wrinkling is also dependent on the difference in expansion rate between the surface and the interior alloy, explains McCreight. Expansion and contraction differs for every alloy and for pure metals. In metal prepared for reticulation, the fine silver coating has a higher

melting point and lower expansion rate than the interior alloy. Thus, the interior alloy melts sooner, expands more. "As it cools from slushy to solid," says McCreight, "it shrinks quite a bit and that has the effect of pulling the surface into ridges."

Conventional wisdom has held that the higher copper content in the reticulation silver was responsible for the improved quality of the reticulated texture. However, when, at AJM's request, Sara Sanford worked with 12 sheets of Hoover & Strong's gold, the results were not what were expected. If copper alone was the reticulation culprit, the pink or peach golds, higher in copper, should have reticulated the most dramatically and easily. However, it was Hoover & Strong's green golds, higher in silver content, that were the stars of the show.

While it may be impossible to know exactly what makes an alloy reticulate, after some head scratching, Torry Hoover was willing to make some educated guesses. One of the first things he looked at was the temperature differential between flow temperatures of fine gold and the flow temperature of the alloy. The 14k yellow flows at 1550°; 14k Royal yellow at 1600°; and 14k green gold at 1715°. Fine gold flows at 1945°. Although the green gold had the smallest temperature differential of the three golds that worked well, it worked the best. So Hoover reasoned that it couldn't be temperature differential alone that caused the improved texture.

But then Hoover realized that sterling melts at 1650°, and other silver/copper alloys melt lower. He theorizes that the copper/silver ratio inside the gold sheet drops the flow temperature below that of the pure alloy. "I think it's the copper silver ratio [in the alloy]," says Hoover. "Everybody looks at just the copper that's added to the sterling. They don't think of the silver as being part of that ratio. You just don't see it in the gold, but the silver is playing an important role."

This said, it must be noted that the success here may be due to the particular recipe that Hoover & Strong uses for its green golds. Pijanowski has reticulated 14k yellow gold. And Seppa has worked successfully with 18k. So this may not be the last word on reticulated gold.

And the Future Is?

Is reticulation a technique that could translate into mass production? Possibly, although it might be easier and cheaper to create a texture in wax and cast it. Reticulation takes a lot of skill with a torch and chances are that if you have someone that good in your shop, you'll use his or her skills to better advantage. In addition, says McCreight, "It's not a great metal to work with in terms of malleability and soldering. It takes finesse and practice and doesn't lend itself to assembly line production."

"My guess is that a manufacturer would say 'Make me a nice piece and I'll rubber mold it'," he adds. "Reticulation has no undercuts so they tend to have nice release angles. It would mold up beautifully." With a few well reticulated sheets as models, you could make a mold, cast the sheet and cut pieces out to include in earrings, necklaces, bracelets, or brooches.

Another way to do it, suggests Pijanowski, by creating a rolling mill copy. "You could dedicate one roll to the pattern and etch the pattern into the surface or impress it

mechanically." To save wear and tear on the rolls, instead of sheet metal, you could roll wax sheet through the mill, and then cast. The Japanese use a similar method to create texture for pots, says Pijanowski. "Once the pieces are cast and assembled, they look handmade."

But don't plan to shift into production tomorrow. McCreight thinks that, whether or not the patterns are reproducible on a commercial scale, "there isn't an educated taste for it. I'm not sure the world is ready for reticulation. There hasn't been a lot of call in the marketplace for a random texture like this."

So for the moment it seems that reticulation will remain in the studio jeweler's domain.

For reticulation silver, contact Hauser and Miller in St. Louis, Missouri (www.hauserandmiller.com), Hoover and Strong in Richmond, Virginia (www.hooverandstrong.com), or Reactive Metals in Clarkdale, Arizona (www.reactivemetals.com).