THE SCIENCE OF PMC

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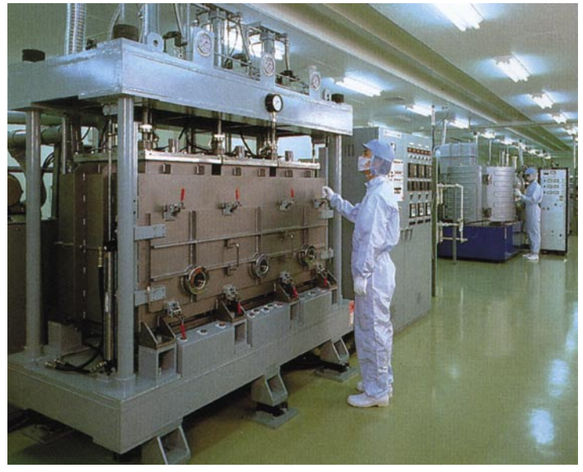
What is PMC?

In concept, Precious Metal Clay is an elegant and simple material. In fact, it is a highly technical product. The idea was the brainchild of a scientist named Dr. Morikawa, employee of Mitsubishi Materials Corporation in Japan. His goal was to develop a form of metal that had the feel and working properties of pottery clay. He reasoned that such a material would allow artists to create objects from silver or gold just like a potter makes ceramic items. In fact, the first PMC pieces were Japanese style tea ceremony cups formed on a potter's wheel.

PMC is made from pure silver or gold (or gold-silver alloys). Gold and silver are noble metals, a term which indicates that they react chemically much less than most common metals. One result is that they react much less against skin. People who have an allergic response to sterling silver may be able to tolerate fine silver, and that is why fine silver is used in medical implants and dental fillings. Another result is that noble metals are less likely to develop an oxide skin when heated. In PMC, this is what allows the particles to fuse together. This also explains why there is no such thing as a brass or bronze metal clay—those alloys would oxidize far too much to permit the particles to bind.

How is PMC Made?

The patented formula for PMC appears simple: pure water + binder + very pure silver (or gold) powder. In practice, however, several years of development went into getting the details right. The choice of binder was important. The scientists at Mitsubishi Materials chose a material often used as a food additive to assure that there would be no health risk. PMC has been tested and found to be 100% safe to handle and use.



To control shrinkage and achieve ideal workability, the amount of binder is kept to a minimum. This makes the mixing process critical to ensure that the components are distributed uniformly. The silver powder used in metal clay is very fine, finer than the finest cake flour. Further, the particle size and shape are closely controlled. The process used to make the silver powder is highly technical and a company secret. It is also an expensive process.

The silver, binder, and water are added together to make a homogeneous mixture, much as you would make cake batter. Process control is critical to ensure that there are no lumps. There are many tests along the way to be certain that each batch meets high standards, and that each batch is the same.

There are different forms of PMC: clay, paste, slip. The basic recipe is the same, but proportions are adjusted and in some cases, additional materials are added to modify the handling characteristics. These changes have adapted PMC to formulations that allow it to be molded, rolled, squeezed out, or painted.

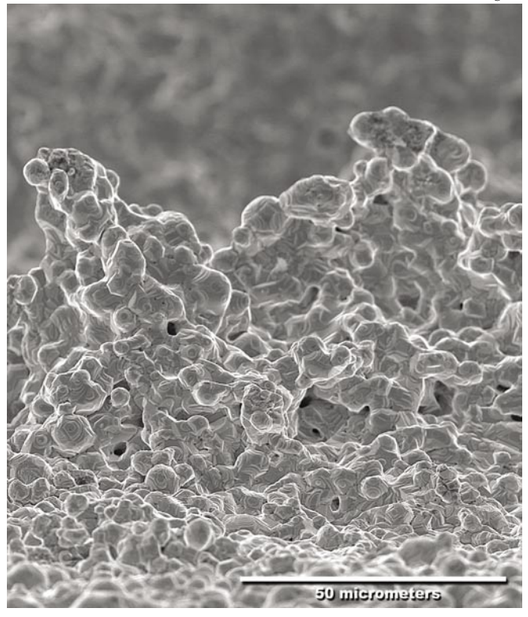
How Does PMC Work?

The series of steps involved in completing a metal clay object can be described as a person walking up a staircase. First, the PMC object is formed by any of a hundred different processes, including rolling, layering, imposing texture, etc. It is then set aside to dry, and we'll call this the first step. At this point, some of the water content of the PMC leaves through natural evaporation. This will happen passively, but artists sometimes accelerate the process by using warmers or dehydrators. At this point, the PMC is tough enough to withstand sanding, carving, and light polishing.

The work is then put in a furnace, where remaining moisture is driven off—step two. The third step occurs when the temperature rises to the flash point of the binder, around 500° F (260° C). This creates a bit of smoke, but no more (and nothing more dangerous) than burning a pan of biscuits. At this point, the PMC is fragile because the binder that was holding the form together has been removed. There is no reason to stop the process here, so in normal uses, the work moves along to the next step.

By now the temperature has risen high enough to "sinter" the silver particles together. Sintering is a scientific term that might not be familiar, but the concept is easily understood. Think of M&M candies. The hard coating keeps them from melting in your hand, just like their ads say. That is what the binder does in the early stages of PMC. When it burns away in the furnace, the result is analogous to a handful of chocolate chips. They don't melt and run. Instead, they fuse together into a big lump, and this is what happens to PMC. If you do it right, you can get a big lump, with no holes and no change

Photo by Tina Carvalho, MicroAngela



This image was taken by a scanning electron microscope, and shows properly sintered PMC at a magnification of 1000 times actual size. The individual silver particles have fused together to form solid metal.