ENAMELING *with* PROFESSIONALS

by Lilyan Bachrach

Styles of Enameling

There are many styles of enameling and I will be addressing Champleve and Basse-taille These two techniques are very similar to each other as they both have cells normally made with gravers making defined areas to be filled with enamels but in Champleve the bottom of the cell is flat and opaque enamel is normally used. In Basse-taille the flat area is decorated with graver cuts or texturing punches to brighten the bottom of the cell and transparent enamel is used enabling the design to show through. In my work I manufacture Rings, pendants, Jewels, Wedding rings and bands.

Tools and Materials

Kiln
Torch
Support
Insulated spring tweezers
Mortar and pestle
Scoop or sable brush to load enamel
Pickle and small crock-pot
Pumice, corundum or diamond stone
Small containers to hold enamels
Powdered enamels
Powdered pumice
Hard felt lap
Gold sheet
Gravers (assorted Flat, square, round and Onglett)
Distilled water
Nitric Acid
Watchmaker's tins
Brass and glass brush

Cleaning the enamels

I purchase leaded enamel in powder form and will occasionally purchase nuggets but powder is much easier to work with. I find that leaded enamels have a deeper color and tend not to crack as much as unleaded enamels. You should prepare only just enough enamel to work with. Powdered enamels should be kept in an airtight opaque container, which will protect them from air and light. I use old glass makeup containers.

The enamels should be washed and ground with the mortar and pestle. I grind the enamels to a fine grainy consistency. Use a small stream of water and rinse the enamel. While washing the enamel the water will become a cloudy white. Wash away while using the pestle to grind the enamel until the water is clear and no white creamy water

washes off the enamel. This takes at least 8 times of washing with tap water. Pour excess water off and do a final washing with the distilled water. It is important from this time forth to only use distilled water with your cleaned enamels. Tap water has salts and minerals that can contaminate the enamel and give color changes during firing. This process gives the enamel fine grain constancy and cleans the enamel of particles and dirt ensuring an even firing with vibrant color. Place the powder in a small container for later use.

Metal preparation

I purchase standard sheet and casting grain from my metal supplier. The metal contains about 2% zinc. Most of my work is done on 10k, 14k, 18k in yellow and white along with platinum sheet. I also do trade work and many of my clients send me cast pieces to be enameled. There are many times I do not know what the alloy of the metal is that I will be working with so it is very important to clean the metal and fire guild it prior to enameling.

The metal is worked into shape by fabrication or casting, then annealed to soften the metal to ready it for engraving. Many of my finished pieces are also die struck to create the cell areas for the enamels. I lay out my emblems or cells for the enamels to lie into. The cells should not be more than .6 mm deep any deeper and the enamels with tend to crack due to different rates of cooling between the metal and enamel.

I hand engrave the outline with a sharp onglette graver about 3 tenths of a millimeter deep. Then with a flat graver the width of the gap between the onglette cuts I lower the base of the cell to the desired depth for the enamel. It is important to keep sharp crisp corners and flat bottom in the cell. If I am going to texture the bottom of the cell I will us the same flat graver and do a wiggle cut or a Florentine grave to texture the bottom of the cell. Once I am happy with the cells I have to conceder the finished piece.

At this point any soldering must be considered before proceeding. Some pieces need to be soldered at this stage with the highest melting solder such as catches, for pin backs, bails or jump rings. Some pieces are soldered at the end with the easiest solder available. Many of my pieces have at least five separate enameled section that need to be assembled to complete the finished jewel, so a some parts need to be tube set from the back and a tube must be hard soldered onto the piece being joined.

Once the cells are complete the piece must be fire gilded to remove any copper on the surface of the metal in the cells leaving a layer of fine gold on the surface on the metal. You must anneal the metal without a fire coat and let cool until all red leaves the metal, then quenched in water. The piece is then placed into the pickle for several minutes until all oxides are removed and then rinse with water. A fine brass brushed is used to clean the piece. The cleaned piece is then placed into a cool nitric acid bath for no more than 1 minute. Then placed in the ultrasonic for further cleaning. This process if repeated about

3 to 4 times to remove all copper on the surface of the metal leaving a layer of fine gold, if copper is left on the surface it can come into contact with some enamels changing the color of it. White, red and green enamels are the most susceptive to this effect.

Wet-laying the Enamel

I use a scoop to apply the enamel into the cell areas. I have taken an old file and ground a small scoop or spoon shape around 1 millimeter in diameter at the end to pick up the wet enamel and place it into the cell. A small sable brush can also be used to apply the enamels but I find the scoop much easier to use and control the amount I need. The wet enamel also tends to stay in the cells while being applied. I do not use gums in my work but sometimes I will lick the ring and them apply the enamel, which acts as a glue to keep the enamel from falling out of the cells. I do many rings and as I go around the ring if the enamel were using a dry dusting method it would fall out of the cells as the ring was turned. Unlike some of the other enameling techniques Champleve is only enameled in the cells and not counter enameled on the back due to the relatively thin layer used.

Appling the enamel I use only the colors I will be working with from start to finish from the bottom layer to the top layer. On the first layer I fill the cell to the top and using the scoop I tap the edge of the piece to pack the enamel grains tightly together. I then over pack the cell and let the piece sit to air dry. If the enamels are not dry prior to firing the water will boil and the steam will pop the enamel out of the cell. I over pack on the first firing to ensure a full fill and to protect to surface of the metal, as the enamel melts over the surface it covers the entire area around the cell keeping oxides from forming in the metal area around and in the cell.

Firing

The piece must be completely dry before being fired. If the piece is not dry the water will boil off pop the enamel out of the cells. I fire about 60% of my pieces by torch and the remaining in the kiln.

I have 2 kilns that I use one has a 3 x 3 x 4 enameling area and a larger kiln 4.5 x 4.5 x 6 inches with a pyrometer which I heat to about 1500 degrees Fahrenheit which is hot enough to melt your enamels quickly. At these temperatures you can also melt your piece, so you must monitor the time it takes the enamel melt. I use a timer and set it to 1 minute, which gives me about 5, seconds before complete melt. After melting I remove the piece on a warm charcoal block and place it under a watchmakers tin or for larger pieces I use Altoids tin with the lid removed. This ensured the piece cools at a slow rate to minimize cracking of the enamels.

On all my firings I bring the enamel to a full melt. During the cooling some of the enamel will chip off needing to be refilled. This will have to be done several times to bring the enamel flush with the surface of the metal. Each additional layer should be just enough to fill any low spots. After cooling I place the piece in the pickle for no more than a minute or two to remove and oxides and finish with a glass brush. Prior to any work ultrasonic and steam. If you leave the piece in the pickle for too long the acid will etch the enamel and will have to be remove and the process will have to be started all over from beginning. If you do not have a commercial steamer you can use a capacino maker and for a steamer.

I will then stone the enamel flush with the metal then ultrasonic and steam the piece prior to the next packing and firing. It can take from two to five application of enamel to completely fill the cell. Between each repacking the enamel must be ground down smooth with the surface of the metal this is done by using a diamond hone, pumice or corundum stone. I like using a diamond hone medium grade. The process of stoning scratches the metal and must be smoothed prior to the final-glaze. Just before the final-glaze I sand the metal and enamel with 400 corundum and 4/0 emery sandpaper, which will make polishing the metal easier at the end. I will then ultrasonic and steam the piece to ready it for the final firing, once cool I place the piece in the pickle for no more than 1 minute and ready for polishing.

Final Finishing

After all the firing the piece has been through the metal will have a thick oxide scale on it that needs to be removed which will not come off during pickling. This film will be all over the piece, in all crack and areas that are very hard to get to, but it must be removed to bring the piece up to a full polish. You cannot use a boric acid and alcohol fire coat on the piece for protecting the surface because if it can get onto the enamel during the firing and it will etch into the enamel and ruin final-glaze. To remove it I use bobbing compound on a ¾ inch boar bristly brush in my flexshaft to get into the small areas and on a 6 inch yellow muslin buff.

For the enameled surface the sanding with 4/0 emery paper should have left a smooth easy to finish surface on the metal. There are sometimes when the surface of the enamel is rough and uneven and I use a six inch round 1 inch wide hard felt wheel with a catch tray underneath it filled with pumice flower powder mixed with water in a pasty consistency. The lap is charged with the paste to smooth out any lumps and polish the surface of the metal and enamel at the same time. Rinse and finish with bobbing compound and red rough to a final luster.