Mesh Size, Particle Size, and Transparent Clarity

Mesh Size*

Mesh size is an indicator of glass particle size. The mesh number indicates the number of openings in a linear inch in a standard wire mesh screen. 80 Mesh would be 80 openings per linear inch.
6 Mesh would be six openings per linear inch.
A double mesh number such as 80/200 describes the glass particle sizes which pass through an 80 mesh screen, but stay on top of a 200 mesh screen.

80 Mesh enamel is the standard mesh size that Thompson sells. It is the mesh size used for most enameling procedures. It is glass that has been ground to a particle size slightly finer than "granular sugar".

6/20 Mesh enamels are particles that have an average diameter of about 1/16" to 1/8".
This particle size is ideal for bead making on copper tubing, fired with a torch.

100 Mesh is particles that will pass through a standard 100 mesh wire screen (100 openings per linear inch).
This mesh size is slightly finer than 80 mesh.

150 Mesh is particles that will pass through a standard 150 mesh wire screen (150 openings per linear inch).
This mesh size is finer than 100 mesh.

200 Mesh is particles that will pass through a standard 200 mesh wire screen (200 openings per linear inch).
This mesh size is finer than 150 mesh.

325 Mesh is particles that will pass through a standard 325 mesh wire screen (325 openings per linear inch).
This mesh size is finer than 200 mesh and resembles "flour" in particle size.

Clarity and Mesh Size

The larger the grain (smaller the mesh size) the clearer the enamel
Wet enamel: rinse out the finer grains
Dry enamel: sift out the finer grains

The thinner the layer of enamel the clearer it will be.

Sifting and Mesh Size
Sifting finer mesh sizes (smaller grains) will give you crisper edges both with stencils and when using scrafitto (scratching through one layer to get to expose the previous layer) techniques

*from www.thompsonenamel.com

Grains of Glass/Panes of Glass Principles
(Understanding Enamel Layers)

Principle 1:
Each grain of enamel creates a "pane of glass" which has Depth

Depth: How thick and high the grain of enamel is.
The larger the grain the deeper in value it will be because it is a thicker Pane of Glass.

Principle 2:
Each grain of enamel has an "edge".

Width: Each grain has an edge where it meets the neighboring grains. The closer in value and hue these edges are the more they will blend together. Larger grains of different enamels will have more noticeable edges where they meet. The edges of smaller grains will not be as noticeable as the edges of larger grains.

Principle 3:
A group of grains creates a layer, which is also a pane of glass

An enamel layer also has depth and will have edges if it doesn't cover the entire surface.
Depth: A thicker layer will have have a deeper value than a thin layer of the same transparent enamel.
An uneven layer of a transparent enamel will have highs and lows which creates thicker and thinner areas of glass. This will create differences in value (light and dark).

Edges: Where a layer ends (any amount not covering the entire surface), there will be an edge created.
This edge will be in contrast to the layer of enamel underneath it. The closer in color/hue and value the two layers are, the less pronounced the edge will be.

Principle 4:
Enamel can be opaque, transparent, or opalescent

Mixing enamel on the same layer:
You can mix different types of enamel together within a layer to create a variety of effects (opacity, color/hue, grain size)
The above principles (depth and edge) are factors which determine how the layer will look.

Mixing enamel on the different layers:
You can layer any combination of enamels over one another. An opaque will cover up what is underneath it. Transparent and opalescent will let different amounts of light through, depending on the colors below, and the value of the upper enamel layer.

Principle 5:
You can remove all or part of a layer after it has been fired

Use a diamond burr and water to drill through enamel layers, exposing bottom layers. You can remove a whole layer or just portions of the layer.

Creating a Transparent Gradation

Transparent enamel gradations are created two ways:
1) How one color looks next to another
2) How one color looks when fired over another.

Try to think of each grain of enamel as a "color layer",or a single pane of transparent glass.
Each grain has an edge; this is the perimeter of the grain. Where edges of grains meet when they are the same color, there is no line created. The closer in hue and value two different grains are, the less you are able to notice a "line" where they meet. Unlike paints the individual grains will not melt into one another. Each grain will melt where it lies, and create a "salt & pepper"effect. The closer in hue/value the grains, the less pronounced the salt & pepper" effect.
When you fire one layer over another, you will be looking down through one pane of colored glass to another. A lighter color over a darker color will not be very noticeable. A darker color over a lighter color will tint /change the color on the bottom.

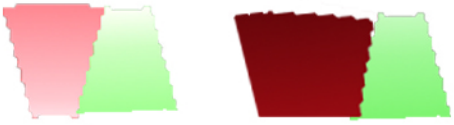
Blending Considerations: Creating gradations without Lines

1. Hue: what color is the enamel? Where on the color wheel is it?

The closer the hue, the easier the enamels will blend seamlessly; without a line being visible.
This means that the closer they are together on a color wheel the better they will blend together
Blending red into orange into yellow will be much easier than blending purple into yellow.

2. Value: how dark or light the enamel color is, regardless of opacity

Similar to Hue, the closer two enamels are in value the easier the gradation.
A dark green will blend into a dark red easier than a dark red into a light green.
Two light value colors will blend more smoothly than two darker value colors.
It is easiest to blend light values, as you can even blend complementary colors (opposites on the color wheel) if they are light enough. You can create lighter values of colors by using thinner layers or finer grains of enamel.



3. Opacity/Transparency

Transparent colors will blend better into each other than opaques and opalescent enamels since the edge created by individual grains or partial layers is less pronounced with a transparent enamel.

4. Particle Size: How small or large are the enamel grains you are using?

The smaller the particle size (grain of enamel), the lighter in value it will be.
The smaller the size the less of a "mark" it will make on the surface, more easily blending into the background color.

Transparent Color Gradations Part 2

5. Thickness of a transparent Enamel Layer:

The thinner the layer of enamel the lighter in value it will be, which will make it easier to blend into either another layer next to it orunderneath it. You can angle a layer from thick to thin to create a gradual transition of the same color as long as you don't make it so thick that you lose clarity due to excess air bubbles..

6. Placement of Enamel Grains

You can use your brush or other tool to mix the grains where two colors are meeting, creating a "salt and pepper" effect. The smaller the particle size and the more close in value and hue the enamel particles are, the more smooth the gradation. You could also mix a separate third color by grinding together equal amounts of two different colors and using this enamel to connect the two original colors.

7. Placement of Enamel Layers

When firing a second transparent layer of transparent over a similar transparent layer, start with the darkest enamel color and bring the edge of the top layer past the edge of the first layer.

8. Direction of Enamel Layers

Curve the gradation of colors along the line which you want the eye to move.

Preparing Your Fine Silver Shape Part 1

What? How? Why?

Action Step 1: Anneal and Dome your shape

Method/How

Soften your piece of fine silver by annealing it in either the kiln or with a torch. Gently push the shape into a slightly domed dapping block, being sure to create an even dome. If it is a shape other than a circle, gently push the edges down so that it creates a "pillow" form

Principle/Why: "Principle of Doming"

a) Doming your shape will help it to hold it's form throughout the firing steps and not become warped.
b) A domed piece will reflect light better than a flat piece

Action Step 2: "Flash" the surface to create a Highly Reflective surface

Method/How:

Heat and melt the surface slightly so that it has a mirror like finish.
I use either a hot plate kiln or ceramic honeycomb block/charcoal block
a) Preheat the silver shape:
Place your silver form on either a hot plate kiln (pre-heated) or a honeycomb/charcoal block)
If using a hot plate kin, let the piece heat up until the silver shape has a slight orange glow.
If using "block", heat the piece with a torch until it begins to have a slight orange glow.

b. Flash the surface
When the piece looks like it is about to melt, pull the flame back so that the tip is slightly heating the metal surface.
Keep the flame moving in a circular motion over the piece, until you begin to see the metal "flash". It will look very shiny.
If you are too close with the flame you may melt the piece, and if too far away it will not "flash".

Principle/Why: "Principle of Reflectivity"

Porosity. Why fine silver is annealed, the metal crystals "relax", which creates a porous surface.
Even if your piece is polished, when it goes into the kiln with enamel over it, the metal will anneal again, which causes it to look slightly matt, taking away from the reflective quality of the metal.
Flashing the surface helps seal the surface so that it does turn matt anymore when heated.

Action Step 3: Prepare Flux Enamel/Remove fine particles

Method/How

I use Ninomaya N3 Flux as my base layer. N3 is the same enamel as N1, only most of the fine particles have already been removed. If using lump enamel as your flux the grains must be ground similar in size to 80 mesh enamel; otherwise, your layer may be too thick and begin to crack since you have not counter enameled the piece yet.
a) Use a dry,clean spoon to scoop some N3 flux into a small plastic cup.

b) Pour some water into the cup and swirl the grains of enamel for a few seconds. Pour off any fine particles floating in the water into a container so that the fine particles don't go down the drain. Repeat until water is clear.

Principle/Why: "Principle of Transparency #1"

The larger the grain size, the more transparent the enamel will appear. This is because tiny air bubbles get trapped in between the grains, and the smaller the grains within a layer, the more air bubbles there will be. The less air bubbles the clearer your layer.

Action Step 4: Paint a Thin, Level Layer of N3 flux on the front

Method/How

a) Layout: This means getting the surface covered with enamel.
Make sure that your surface is free of grease. If you have touched it with your fingers you need to de-grease it or the water and enamel will not flow smoothly, as oil and water do not mix well. I use spit to de grease the surface if I have accidently touched it.
Using a watercolor brush, size 0 -1, pick up some grains of the N3 Flux and place them on the front of your piece.
Don't place them too close to the edge or the water in the grains may begin to fall off the edge. Resting your hand on your work area, hold the brush at an angle 15 to 45 degrees so that the SIDE of the brush is touching the top of the enamel grains. Using the tip will poke holes into the layer. Try to find the right amount of water necessary (Principle of Irrigation) so that the enamel grains will flow easily with just the slightest touch of the brush. Too little water and the grains will require you to push them, and too much water and they will move away out of control, leaving low areas wherever you touch them. Use small pieces of toilet paper rolled up to wick out the water if there is too much, or use your brush tip to add a little bit of water if it is too dry.

b) Editing: This refers to making sure that the layer is even (not too thick or too thin).
Too thick: The enamel looks white and slightly opaque. You cannot see what is underneath it
Too thin: You can see bare areas of silver showing through
Just right: Approximate 2-3 grains thick. No white areas, and no bare silver showing, but you can see the light from the silver bouncing through the thin layer.
If too thick, use your brush to remove a bit, then add a small drop of water with your brush and flow the high areas into the low areas.

If too thin, add a small amount and a drop of water and flow this new enamel into the surrounding enamel to level it out.
C. Remove most of the water. I use toilet paper to gently wick out the water, being careful to touch gently so that no grains of enamel get moved. I do this from several places until I see the water has stopped flowing into the paper wick. YOUR PIECE DOES NOT HAVE TO BE COMPLETELY DRY BEFORE YOU FIRE IT! I prefer it slightly damp so that enamel doesn't fall off the edges.

Principle/Why: "Principle of Irrigation", "Principle of Transparency #2"

a) "Principle of Irrigation": Use your brush to flow the water where you want the enamel to go. Use just enough water so that you barely touch the enamel grains. Find Your Water! Pay attention so you know if it is too wet or too dry. This makes a huge difference in helping you move the enamel grains where you want and creating a level surface.

b) "Principle of Transparency #2" : The thinner the layer , the more transparent it will be. This is based on the same principle of AIR BUBBLES from #1. The more air bubbles the less clear, so the thicker the layer, the more air bubbles there will be.

Action Step 5: "Fire your piece to Glossy"

Method/How:

Fire until the surface is smooth and you can see through the clear N3 flux.
I like to fire my pieces on Firing Cloth. Place a piece of firing cloth onto a lightweight firing screen. Kiln temperature should be approximately 1500 degrees Fahrenheit. Use a masonry trowel to gently place your screen/cloth/enamel into the kiln. Be careful to gently close the door so that you don't knock the grains . Fire until smooth. This should take about 1 to 2 minutes. Open the door to check, or pull the piece out in order to see if it is smooth and clear. Place it on a fireproof surface (I use large ceramic tiles) and let it cool

Principle/Why: "Principle of Time and Temperature"

A combination of time and heat will make the enamel begin to melt and reach whatever stage you desire. The hotter the kiln, the shorter time this will take. The cooler the kiln, the longer it will take. Enamels have different melting points, and firing time will vary depending on many variables, including how long the door has been opened, how large the piece is, how recently someone else has used the kiln, etc.

Preparing Your Fine Silver Shape Part 3

What? How? Why?

Action Step 6: Counter Enamel your piece

Method/How

a) Apply enamel on the backside. This can be done wet using the "wet application" technique from Step 5, or sifted dry. Sifting is much quicker if your are doing many pieces, though if you are using leaded enamel as your counter enamel you need to be more safety conscious as fine particles will go into the air and ventilation or a dust mask is necessary.

b) Apply the first layer of counter enamel. This can be thicker than the front (perhaps twice as thick) since there is already one layer of enamel on the other side. If you get it too thick it will want to pull away from the sides, leaving a thicker rim around the edge next to a bare edge of metal.

c. Fire the enamel upside down in a three point trivet (use whatever style trivet works best for your shape). Place the trivet on the firing screen. You don't need to use a firing cloth with this. Gently place the screen/trivet/enamel into the kiln and fire until it reaches the ORANGE PEEL STAGE. You should be able to see a texture on the surface of the enamel. Pull it out to check if necessary. If the piece is over-fired at this stage, the front may get overheated and begin to stick to the trivet. Let cool. If using wet application do not touch counter enamel side with your fingers to avoid grease.

d. Repeat this process at least one more time, using a thicker layer of enamel on the second firing. Since the second layer is not touching the metal, it can be thicker as it will not want to pull inwards as on the previous firing when it was directly on the metal surface.

Principle/Why: "Principle of Counter Enamel", "Principle of Firing Stages"

a) "Principle of Counter Enamel": When you place a piece of metal with enamel on it into a kiln, the metal expands with the heat. As the enamel melts it spreads slightly with the expansion of the metal. When the piece is pulled out of the kiln and cools, the metal want to contract. The enamel doesn't want to. This creates a stress between the metal and the enamel, and the enamel being more fragile, has to move. This causes cracking, or even enamel flaking off the metal surface if it is too thick. Too BALANCE THE STRESS the fine silver must have enamel on the back. This is called "counter enamel". You can use any type of enamel on the back; in fact you can do a double sided piece with the back looking as good as the front. The back and the front must be close in thickness, though if the metal is domed the front can be thicker than the back.

b) "Principle of Firing Stages": When the enamel is fired, it goes through several visible firing stages. The first noticeable change is called "Sugar". The enamel grains have begun to melt and pull upon themselves, not joining with the surrounding grains. The surface resembles a "sugar cookie". The next stage is "Orange Peel". The grains have begin to melt into the surrounding grains to create a single layer, but it is still very uneven. This resembles the surface of an "orange". Finally it will reach the stage of "Glossy", in which the surface is perfectly smooth. The surface will remain glossy eve when over-fired. OVER FIRED refers to a piece which is fired longer than you need to achieve a specific result.

Action Step 7: "Seal the Counter Enamel"

Method/How:

I like to coat the back of the piece (counter enamel) with Scalex. This will fire into the enamel surface and helps to keep it from sticking onto the firing cloth. Paint a very thin layer of Scalex onto the back, let air dry,and flip it over and place on the firing clothe SCALEX SIDE DOWN! Fire the piece and when the enamel melts, the scalex will be fired onto the surface creating a matte , white colored surface.

Principle/Why: "Principle of Scalex"

The Scalex is used merely as an aid to make firing easier. If the back of the enamel is to be seen when the piece is finished, you would not want to use the scalex, and would either fire using a trivet or firing cloth, though the firing cloth would create a texture on the counter enamel. I bezel set my enamels so that the counter enamel is not seen, so the Scalex is a good solution.