THE BASICS

BY LISA VOGT

Glass fusing is simply the process of stacking two or more layers of compatible glass together to make a design. The stacked glass is placed in the super heated environment of a kiln where it melts together.

THE FUSING PROCESS

There are two basic fusing stages; heating and cooling. During the heating process the fusible glass is slowly taken from room temperature up to 1300 – 1500 degrees, depending upon the finished "look" we desire. When the glass is in this temperature range you can stop the fusing process at any time. This is when you will make the decisions that make your work unique. It's your opportunity to *be the artist*.

- At 1300 degrees the project will have slightly rounded, polished edges and a textured surface.
- At 1500 degrees the top layer of glass will sink down into the bottom layer. The project will have a smooth surface and rounded edges.

During the cooling process we control the rate at which the glass cools and slowly bring it back to room temperature. The length of time that this takes is determined by the size of the project and the number of layers being fused. The larger the project and the greater the number of layers the longer this will take. *Don't rush this step it is critical to the success of your work!* While the glass is cooling, it is going through an annealing phase, which occurs at approximately 960 degrees. I like to call it the "healing" phase. Keep in mind that you have just taken several layers of glass and forced them to become one. They need some time to adjust. Be nice to your glass!

MATERIALS / COMPATIBILITY

Glass expands when it is heated and contracts when it cools. When we fuse, we work within a family of products that have been "tested compatible" to have the same C.O.E (Coefficient of Expansion). These materials are specially formulated and pretested by the manufacturer for consistency. *Don't bother wasting your time working with the stuff you have laying around the garage.* If it isn't marked tested compatible *it isn't!* Invest in fusible glass right up front; the success of your project depends on it. *This is the best advice you will get today!*

Tips for better projects:

- **Cutting the glass:** Take the time to cut the glass accurately. Grind the project pieces where necessary to improve the fit.
- **Clean:** Wash the glass before assembling the project with a mild detergent and water. Dry the glass thoroughly.
- **Pattern Design:** Construct your projects with 2 – 2 ½ layers of glass for greater consistency in size, shape and thickness. Layer 1 is the base. Layer 2 is the design layer and the third "half" layer is the accent.
- **Glue:** Lightly tack the design layer to the base layer so you can transport the project to the kiln without its shifting. Use a tooth pick or similar tool to apply a ***pin head or smaller*** size dab of *Elmer's* white glue to the back side of the glass.
- **Firing Speed**: Slower is usually better. If you are not sure which firing program to use, err on the side of conservative and choose the slower program.

FREQUENTLY ASKED QUESTIONS

Q. Do you have to re-coat the kiln shelf with primer every time you use it?
A. If the shelf primer is in good condition it can be used more than one time. The shelf should be scraped, sanded or washed clean with clear water and re-coated when the primer shows signs of wear. It's time to re prime when the coating becomes thin (usually where a project rested) has cracks, or begins to flake off.

Q. Why does kiln wash stick to the back of a project?
A. This is usually the result of exhausted kiln wash; the shelf should have been re-primed prior to use. It may also occur when the glass has been fired to too high a temperature or kept at full fuse too long. The kiln wash can be removed with fine steel wool or a scraping tool. Stubborn patches can be soaked off with bathroom cleaning products used to remove hard chemical residue.

Q. After the project is fused, how close to room temperature do you have to be before opening the kiln lid?
A. *How badly do you want the project inside?* Room temperature is usually well below 100 degrees. If you open the lid prematurely thermal shock can occur; breakage caused by changing temperature too fast. *Just a quick **peek** in to the kiln, done too early can ruin your day. Wait, it will be worth it!*

Q. What causes tiny bubbles and how do I get rid of them?
A. Air becomes trapped between the layers of glass when it is heated. The number and size of the air bubbles can be reduced by heating the glass more slowly between the temperatures of 1000 – 1465 degrees. This gives the air more time to escape before the glass edges become sealed.

Q. How do I avoid big bubbles?
A. Large dome shaped bubbles will sometimes rise up in the middle of a medium - large (4" x 4" or bigger) projects. This is usually the result of firing too fast on a ceramic kiln shelf. The outer edges of the project become soft first and form a "seal" on the shelf. Air becomes trapped under the glass. When it expands it lifts the glass. This is less likely to happen when using shelf paper or a fiber board kiln shelf, as the air can escape through the porous materials. Best advice is to slow down the firing process.

Q. Can I stack kiln shelves?

A. Not recommended. Unlike ceramics, glass is thin and reacts to heat quickly. Stacking shelves causes uneven heating. The outer edges of the project become molten before the center has a chance to react; your firing results will be inconsistent.

Q. How does the thickness of the glass relate to my target temperature?

A. A project made with two layers of thin fusible glass will usually reach the desired "look" before a project made with two layers of 1/8" glass. When you change project sizes or materials (thin vs. 1/8") you will want to monitor the first few firings and make any necessary adjustments to your firing schedule.

Q. Can more that one project be fired in the kiln at one time?
A. Yes, as long as the projects are similar. They should be made from the same thickness glass, have the same number of layers and be close is size. *Use a firing speed for the largest project.* Small projects will not be harmed by firing slowly but a large project will suffer if rushed.

FREQUENTLY ASKED QUESTIONS

Q. What causes sharp edges on the project?
A. Dragging is usually caused by over firing a project that is resting on fiber paper. As the glass contracts and draws in on itself the paper resists, sharp edges are the result. This edge can be made safe with file a or grinder. After grinding the project can be put back in the kiln and heat until the ground edge is polished.

Q. Why is there debris between the glass layers?
A. Too much glue. Small amounts of glue will burn off leaving no trace. (See: *Glue* above for more info.) If you use an excessive amount of glue it will burn becoming sealed between the layers, leaving dark blotches. Excess glue can also cause small eruptions that will blow a hole through the glass or cause pieces to jump and move in the kiln.

Q. What are the differences between using a ceramic kiln shelf or fiber paper?
A. Ceramic Shelf:

- Fused glass will take on the texture/ pattern of whatever it is fired on. If you fire on a ceramic kiln shelf your project will have a smooth back surface. (Great for bowls, plates, fine art pieces; projects where a sleek underside is desired.)
- Ceramic shelf is used over and over again.
- A ceramic shelf is dense; it retains heat which allows the glass to pass through the critical stages slowly.
- Ceramic shelves have to be primed frequently, this can be time consuming.

Fiber Paper:

- Shelf paper comes in a variety of thickness and finishes. Generally the thinner the material the smoother the fusing surface. (Great for coasters, pins, wall art; projects where a textured back side will make it easy to glue accessories on like rubber feet, pin backs etc.)
- The thin material can be used only once. The medium material can sometimes be reused; it leaves a matt finish on the back of the project. The thick material can be used multiple times but the texture on the back of the project will be course.
- The fiber paper is porous. Air can circulate, therefore large air bubbles are less likely to form between the glass and the shelf.
- Shelf paper has to be cut to size and can be costly if you are using it every time you fire.

Q. What are the differences between ceramic molds and stainless steel forms?
A. Ceramic Molds:

- Ceramic molds come in a wide variety of sizes and shapes. They have to be primed like the ceramic kiln shelf. The primer tends to last longer on a form than on a shelf because slumping temperatures are lower than fusing temperatures. Slumping occurs at approximately 1200-1300 degrees.
- Ceramic molds are inexpensive and durable but they will break if dropped or used unprimed.
- Ceramic molds should be sanded and be re-primed if there are pits or cracks in the coating.
- Ceramic molds cool *more slowly* than the glass. Therefore most molds are shaped so the glass slumps down into the mold, allowing the glass to contract first.

Stainless Steel Forms:

- Stainless steel forms come in a variety of shapes and sizes as well. They have to be primed also. The slick surface makes priming difficult. The form can be sanded, sandblasted or heated to make the priming process easier.
- Stainless steel forms are extremely durable "forever" molds. But they tend to be several times more expensive than ceramic molds.
- Steel forms should also be sanded and re-primed if there are pits or cracks in the coating.
- Steel cools *more quickly* than the glass. The metal contracts underneath the glass which gives the room needed to slide the draped piece off the form.

A bit of advice:

Take your time in the beginning. Start with a bunch of small, 2" x 2" or 4" x 4" square, super fast (no time consuming pattern) projects. Use them to establish a relationship with your kiln and with fusing materials. Take accurate notes so you can repeat the successful projects and learn how to avoid the failures. Don't think you won't be having any fun. Some of the best work comes from loose design exercises like this. As your confidence builds so will the size and complexity of your projects.

Good Luck! Lisa Vogt

Lisa Vogt is a successful glass artist, writer, instructor, and business owner. Her artwork and glass articles have been featured in numerous national magazines. Lisa has authored several books including a beginning glass fusing book called Get Fired Up!