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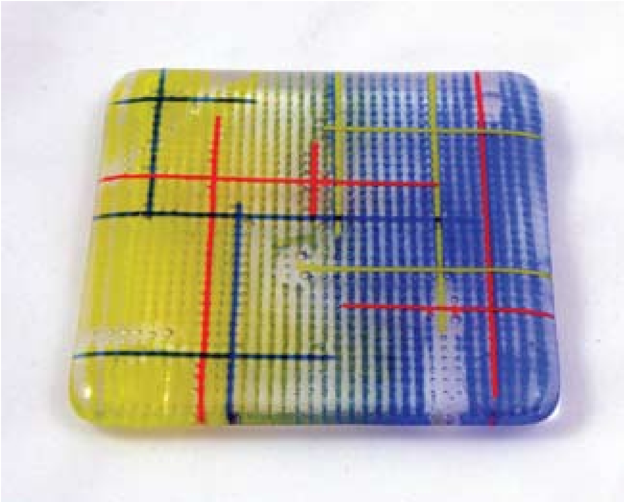
Variations

The coaster and tile designs covered so far have all been simple designs with either two layers of glass or two layers with a few small elements on top. A variety of other, more complicated techniques are illustrated on these pages. Many of these techniques are discussed in greater detail in later chapters of this book.

Reactive glasses. *A simple design such as this one gains additional impact when the two glasses react with each other to create the thin dark line between the blue and the vanilla glasses. (Photo by the author.)*

High temperature. *When larger pieces, such as those created by pot melts, combing, or other high temperature firings, are cut into coaster size pieces, each tile will be unique. (Photo and design courtesy of Brock Craig.)*

Strip construction. *One way to achieve two layer thickness without placing one layer of glass on top of another is to cut strips of glass and then arrange them on edge to form the tile or coaster. For best results, the strips should be about 5/16 to 3/8″ (7 to 9mm) wide. After cutting, arrange the strips edge to edge and then fuse fully to obtain the finished pieces shown above. (Photo by the author.)*



Air bubble inclusion with powder and stringer. *This coaster starts with a piece of Bullseye textured reed glass, placed reed side up on the kiln shelf. Powder is lightly sifted onto the reeds and stringers added to create the design. A second square of reed glass is placed reed side down criss-crossed on top of the first square. After fusing, a pattern of small bubbles is trapped with the powders and stringer between the layers of reed. (Design by Samantha Allen, photo courtesy of the artist.)*

Molds with steep rims, such as this one, are difficullt to use because the sides will draw in as the glass slumps. (Photo by the author.)

An example of a piece that was slumped on the mold to the left. The dogboned edges are curved, rather than straight. (Photo courtesy of Samantha Allen.)

Molds to avoid or use with caution

Not all molds are created equal. Some work much better for slumping than others. Some are designed for other purposes and may not work well in the kiln. And some molds are designed in ways that make slumping more difficult.

When purchasing any mold, it's a good to idea to examine it carefully to determine if it will be easy to use for slumping, or if it will be difficult to use. A few moments of reflection prior to the purchase can save hours of frustration later on.

For instance, many unglazed pottery pieces (also known as "bisque ware," or simply "bisque") make great slumping molds, but not all do. Just drilling a hole in the bottom of a piece of pottery doesn't make it a perfect mold for slumping.

Examine the mold to determine if it was made for slumping. Turn the piece over and examine the underside. Molds made for use as pottery have a finished bottom, allowing the mold to sit firmly on a flat surface. Molds made for slumping often have an unfinished underside. In addition, molds made for slumping often have sides that raise the bottom of mold slightly off the kiln shelf. This, along with one or more large ventilation holes in the mold sides, allows for good air circulation beneath the mold as it heats and cools.

Because of the higher temperature required, molds with rippled edges, such as the two illustrated below, are more difficult to slump than molds without textured rims. (Photo by the author.)

Although this mold was made for slumping, the steep sides make it much more difficult to use successfully. (Photo by the author.)

Don't eliminate a mold from consideration if it turns out to be a piece of pottery with holes drilled in the bottom. And don't automatically assume that a mold made specifically for slumping is a perfect mold. Instead, examine the way the mold is designed to get an idea of how it will perform in the kiln.

Watch out for are rims that are very narrow or steep. This makes slumping more difficult and can lead to dogboning, where the center of the sides draws in as the glass slumps. Particularly deep molds, as well as molds with steep sides, should be used with caution. These can slumped successfully, but rarely do beginners have success.

Use molds with texture with caution. Molds with wavy edges, for instance, can be slumped but are more difficult to use than molds with smoother rims. Use caution when firing any mold that has anything other than a smooth surface.

Amy Buchwald, "Falling Away." Torchworked, fused, and slumped glass on an aluminum frame. (Photo by Charles Buchwald, courtesy of the artist.)

Chapter 11

Troubleshooting

Cracked glass • Unwanted air bubbles • Dull patches and devitrification • Baked on kiln wash • Uneven fused edges • Uneven slumping • Sticking to the slump mold • Fused panel slightly bowed

Unfortunately, not all glass projects emerge from the kiln in pristine condition. Sometimes the item is cracked, sometimes there are unwanted bubbles, sometimes the edges aren't rounded properly, the surface looks hazy, or a piece slumps crooked or misshapen. Here's a discussion of possible problems and their solutions.

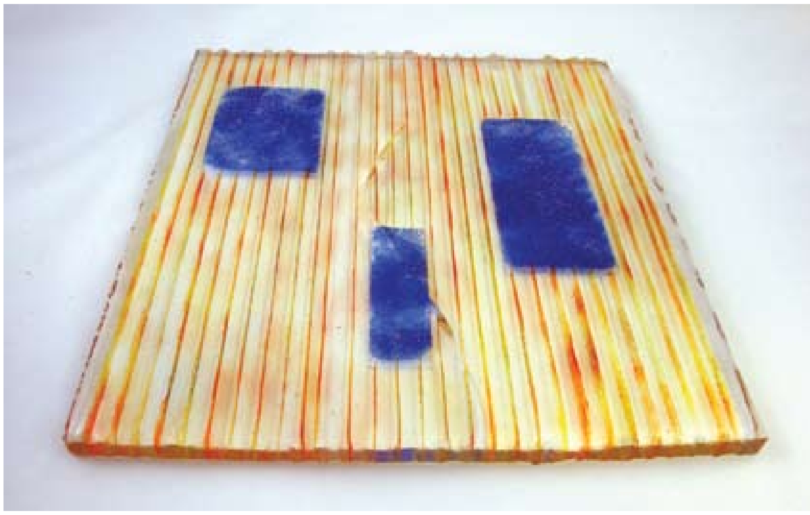
Cracked glass

There are few things more frustrating to the glass artist than opening the kiln to find that the piece you've fired has cracked. The only bright spot is in figuring out why the piece cracked so it doesn't happen again.

First, let's assume you didn't drop the piece. Let's also assume you didn't remove it while it was still warm and then "accidentally" put it on something cold or splash it with water.

Now that we've set those obvious reasons aside, let's try to figure out the less obvious reasons for glass to crack. You can learn a lot by examining the nature of the cracks. Do they go all the way across the glass? How are they shaped? Is the piece broken entirely or still intact? What's the

When thermal shock occurs, it's possible for the force of the break to shatter the glass into several pieces. This break occurred during the initial heating phase and the edges were rounded during later stages of the firing. (Photo by the author.)



Poor annealing often shows up as an S-shaped crack in the center of the piece of glass. The crack can split the piece into two or it can stop mid way through. Often it will continue to grow with time. Annealing cracks can emerge immediately after firing or they can show up many months later. Full piece above, detail to the right. (Photos by the author.)

shape of the broken pieces? By analyzing the kind of cracks you're experiencing, you can determine what caused them, then change your kiln processes to prevent their re-occurrence.

- **Cracks with rounded edges that break the glass into several pieces**

These cracks, which can occur with such force that they split the piece into two, three, or even more pieces, are caused by thermal shock. The edges of the pieces are rounded because the crack occurs early in the firing cycle (usually around 300 to 500F/150 to 260C) and the edges round during later phases of the firing. The cure for thermal shock is to fire more slowly during the initial phase of your firing (below 1100F/600C.

In most cases this kind of thermal shock splits the piece into two or three pieces. Since the edges round during the firing, it's not usually possible to fit them precisely back together and refire.

- **Curved crack across the middle of the piece**

Improper annealing causes this kind of crack. It most often shows up as a gentle curve (often S-shaped, but sometimes as straight lines) that run across the middle of the piece. Sometimes the crack will curve sharply as it nears the edge of the glass. The piece can be split in two by the crack, but often the crack only goes part of the way across the piece and it remains intact.

The cure for this problem is proper annealing. Lengthen the soak time at the annealing temperature and cool more slowly in the bottom half of the annealing range. Pieces that have already been cracked can be re-fused and then properly annealed to repair the crack, but in almost all cases the line of the repaired crack will be visible.

- **Slit marks, usually on top side of a piece**

These cracks, which look like deep knife slits on the top of a piece, are also caused by thermal shock. They are most likely to occur during slumping and are caused by being too close to a kiln's top elements, often while slumping on a bowl mold. The temperature difference between the very hot top of the piece and the cooler bottom side leads to thermal shock and causes the slits to form.

- **Cracks where two different glasses come together.**

Glass incompatibility causes these cracks. The cracks can be very small or they can cause the

A typical reaction between a blue glass containing copper and a second french vanilla glass containing sulfur. The reaction creates the dark line where the two glasses touch. (Photo by the author.)

The reaction between silver and glasses containing sulfur or selenium is particularly strong. The dark circles in this piece were punched from silver foil and fired on top of a reactive layer of glass. (Photo by the author.)

- **Glasses containing lead may react with glasses containing either selenium or sulfur**

This reaction, which tends to leave a more grayish tint, is less prevalent than some of the other reactions, but it can be used to marvellous effect when it does occur. For an example, see the Karl Herron piece on page 115.

- **Silver will react with glasses containing either selenium or sulfur**

The reaction between silver and selium/sulfur glasses is usually very strong. They can be made even stronger by using the silver on top of the reactive glass, rather than as an inclusion. If the silver used is thin (as in foil or leaf), then the metal will melt into the glass and leave a smooth finished surface.

In addition to silver wire, leaf, and foil, it's possible to create this reaction using a silver nitrate solution. Just mix a few crystals of silver nitrate with water and spray on the glass before firing. Silver nitrate can discolor the skin, so wear gloves and handle the solution with care.

The section on metal inclusions in Chapter 13 has more information about using silver in glass.

Image of a pot melt made with turquoise blue and french vanilla glass.The blue has reacted with the vanilla to create the dark brown color. (Photo by the author.)

Given enough time and heat, the reaction between two glasses will spread, as in the square on the top of this piece. (Photo by the author.)

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Photos of finished artwork indicated by **bold** page numbers.

Avery Anderson, "The Ancestors." Kiln-formed, laminated and coldworked. Cast glass and flameworked bird skulls. (Photo courtesy of the artist.)

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