TIPSHEET 1

Published by Bullseye Glass Co.

Kilncarving

A Simple Kilnforming Technique Developed by Rudi Gritsch

Figure 1: Underside of kilncarved glass.

"Kilncarving" is a term coined at Bullseye to describe a simple kilnforming process that achieves a bas relief, textured, or sculpted look in glass. The process involves cutting a pattern or design in ceramic fiber paper, then stacking glass on top of the pattern and firing the piece in a kiln. During firing, the underside of the glass conforms to the ceramic fiber paper pattern, assuming its contours and textures. (Figure 1)

Kilncarving is a good beginning technique. In trying it, you can learn how glass reacts with heat at various temperatures, and you can achieve some beautiful shapes and patterns with only minimal glass cutting and fusing.

The two primary materials used in this process are glass and ceramic fiber paper. The primary tool—besides a kiln—is an X-Acto knife. In this TipSheet, we provide some basic information about the materials, tools, and steps involved in kilncarving glass.

GLASS

Different types of glasses react differently when fired in contact with ceramic fiber paper. Some glasses are easier to use for kilncarving than others. Either billets or sheet glass can be used.

Clear and transparent colored glasses: Release more easily from ceramic fiber papers than do opalescent glasses.

Opal glasses: Tend to stick to ceramic fiber papers more than other glasses.

Glasses with an iridescent (irid) surface: The metallic irid surface of Bullseye glasses provides the best release from ceramic fiber paper and creates a very clean fired surface.

Glasses with a dichroic surface: Like the irid surface, the dichroic surface has a thin film that provides excellent separation from ceramic fiber papers.

Pre-fired glass: If a piece of glass has already been fired once, the surface that was previously in contact with the kiln shelf or a ceramic fiber paper will release from the fiber paper pattern more easily than an unfired glass surface.

CERAMIC FIBER PAPER

Ceramic fiber paper is composed of vitreous aluminosilicate fibers and an organic binder. The paper is available in a variety of thicknesses, including 1/16" and 1/8" (1.6 mm and 3.2 mm). The quality of the fiber paper is affected by a number of variables. These include:

Chemical composition: The higher the alumina (Al_2O_3) content of the paper, the less the paper will stick to the glass.

Fiber quality: Tiny glass balls embedded in ceramic fiber paper are a by-product of the manufacturing process. Higher-quality papers contain fewer of these tiny balls, which tend to melt into the surface of fused glass and cause small cracks, due to differences in expansion between the paper and the fused glass.

Surface quality: Surface quality varies, depending on the manufacturer. All ceramic fiber papers have more-or-less textured surfaces. Texture may differ between the front and back sides.

Weave quality: The tighter the weave, the more durable the fiber paper.

Bullseye recommends and carries Lytherm®, the best quality fiber paper we have found for kilnforming.

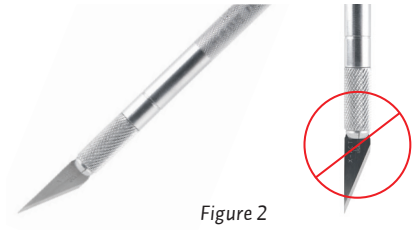

Figure 2

Figure 3a: Positive and negative ceramic fiber paper designs.

Figure 3b: Fiber paper designs stacked with 6 mm pre-fused glass, before kilncarving firing.

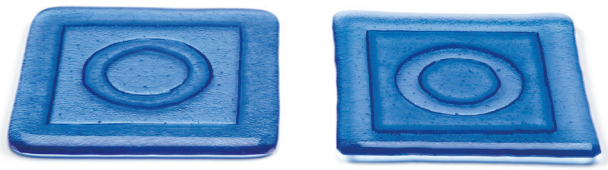

Figure 3c: Glass after firing, kilncarved side down.

Figure 3d: Glass after firing, kilncarved side up.

THE KILNCARVING PROCESS

Preparing the fiber paper

To achieve the sculpted look of kilncarving, you can cut and stack patterns from any of the various thicknesses of ceramic fiber paper. When using only a single layer of 3 mm glass, use thinner fiber papers and/or do not stack the paper more than 3 mm high. A single layer of 3 mm glass will stretch in the firing process and may become too thin in certain sections if your pattern is thick.

First, draw your design directly onto your fiber paper—or transfer the design onto the fiber paper using carbon paper.

Cutting ceramic fiber paper will dull the blade of your X-Acto knife rapidly. Two things will help to minimize this:

- Hold the knife at an angle to the cutting surface. Do not hold it straight up and down. (Figure 2)
- Cut only on a penetrable working surface like linoleum, cardboard, or plastic tile. Do not cut on an impenetrable surface like metal or ceramic tile.

If you cut precisely, a single piece of ceramic fiber paper will yield two patterns: a positive and a negative. (Figure 3a)

If you need to glue parts of the fiber papers together, use GlasTac.

To improve the surface of fiber paper and remove tiny glass balls before firing, brush the paper lightly by hand, wearing latex or vinyl gloves, in a well-ventilated space or out of doors.

Consider pre-firing the fiber paper at 1290˚F (700˚C) before placing the glass on top of it. This will prevent the hazing that sometimes results as the binder burns out. (Be sure your studio is well ventilated.)

Preparing the piece

Once you have prepared your fiber paper pattern, you can then stack one or more layers of sheet glass or a billet on top of it. (Figure 3b)

If you use two layers of 3 mm glass, it is best to fuse the two layers together before kilncarving. You can fuse and kilncarve in the same firing if you take the glass to a full fuse temperature, but you'll risk trapping air bubbles between the glass layers.

Remember that a single layer of 3 mm glass will have a greater tendency than thicker glasses to become thin and ragged ("needlepointed") along the edges.

Firing

The temperature to which the glass is fired will determine the look of the finished piece. The temperatures below work well in our studio kilns and should be useful guides in helping you determine appropriate temperatures for use in your own kiln.

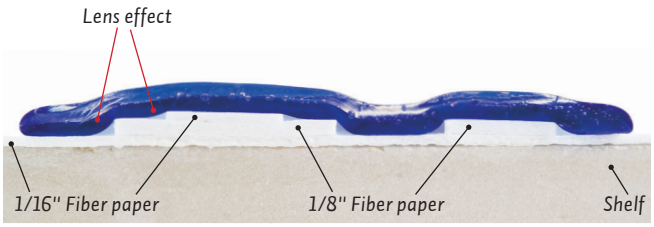

Figure 4: Cross-sectional view of kilnformed glass, fired at 1420˚F (~770˚C).

At 1420˚F (~770˚C), the glass will not contact or conform to the sharp edges in the paper pattern, but will gently slope over those edges, creating what we call a "lens effect." (Figure 4)

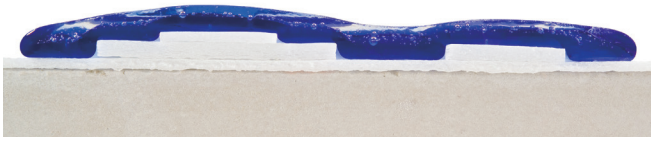

Figure 5: Cross-sectional view of kilnformed glass, fired at 1490˚F (~810˚C).

At 1490˚F (~810˚C)—with a soak of about 5-10 minutes—the glass will pick up the exact texture of the fiber material and will conform more closely to the paper pattern's sharp edges. At this temperature, the upper side of the glass will follow the contour of the fiber paper stencil slightly. The intensity of the color (or color saturation) of a transparent glass will be fairly uniform because the glass thickness will be fairly uniform. (Figure 5)

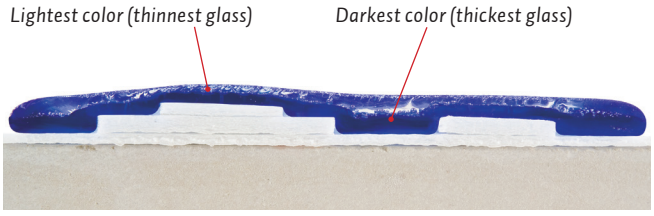

Figure 6: Cross-sectional view of kilnformed glass, fired at 1520˚F (~825˚C).

At 1520˚F (~825˚C)—with a soak of about 30 minutes—the glass will conform very closely to the pattern's sharp edges. The upper surface of the glass will begin to level out and different areas of the project will transmit different intensities of color because the glass thickness will vary. (Figures 3c, 6) The soak time and the amount of glass used will depend on how many layers of paper are used.

- Select an annealing cycle that is designed for twice the thickness of the thickest area of the piece. (For more information on annealing cycles, see the *Annealing Chart for Thick Slabs* at bullseyeglass.com.)

For more information on firing in general, see *TechNotes 4: Heat & Glass* at bullseyeglass.com.

Refiring or Slumping

- If the kilncarved piece will be fired a second time (e.g., to slump it), the textured surface can first be altered by sandblasting. If an irid surface was fired against the fiber paper on the first firing, further decoration can be achieved by sandblasting a design onto this surface.

- In refiring or slumping a kilncarved piece with sections of varying thickness, it is important to fire very slowly through the initial heating phase—typically not faster than 200˚F (93˚C) per hour during initial heat.

WORKING SAFELY WITH CERAMIC FIBER PAPER

When fired, fiber paper will give off a small amount of smoke and aroma from the organic binders. Good ventilation in your studio will ensure that these dissipate quickly.

Ceramic fiber paper can act as an irritant to the skin and respiratory system, particularly after it has been fired and the binders are burned out.

Handle fired fiber paper with care to avoid breathing residual fibers. Be sure to wear proper respiratory protection when removing paper from the glass or sweeping the work area.