

KILNCARVING

Some Notes on a Simple Kilnforming Technique by Rudi Gritsch

"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 or 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 will give you some basic information about the materials, tools, and steps you will follow in kilncarving glass.

GLASS

While kilncarving can be done with virtually any type of glass, this TipSheet refers specifically to work done by the Bullseye Research and Education Department, using Bullseye 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. Following are some general guidelines.

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

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

Glasses with an iridescent (irid) surface: The inorganic irid surface of Bullseye glasses releases especially well 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 would.



Figure 1: Underside of kilncarved glass.

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 1/32", 1/16", and 1/8" (0.8mm, 1.6mm, and 3.2mm). 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.

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

For kilnforming purposes, the best quality paper we have found is Lytherm, manufactured by Lydall Inc., of Rochester, New Hampshire. Ceramic fiber papers are also produced by Unifrax, Thermal Ceramics, Hitco, Arnil C.F.S. Inc., Thermafiber, and Zircar Refractory Composites.

THE KILNCARVING PROCESS

To achieve the sculpted look of kilncarving, you can cut patterns from any of the various thicknesses of ceramic fiber paper. 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:



Figure 2

- 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)

Once you have cut your fiber paper pattern, you can then stack one or more layers of glass on top of it and fire the piece. (Figure 3b)

- When using only a single layer of 3mm glass, use thinner fiber papers and/or do not stack the paper more than 3mm high. A single layer of 3mm glass will stretch in the firing process and may become too thin in certain sections if your pattern is thick. Note: A single layer of 3mm glass will have a greater tendency than thicker glasses to become thin and ragged (“needlepointed”) along the edges.
- If you use two layers of 3mm 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.
- By using Bullseye 6mm sheet glass (recommended), you can avoid the pre-fusing of two 3mm layers.



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



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



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



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

HEALTH AND SAFETY NOTES: WORKING WITH CERAMIC FIBER PAPER

Ceramic fiber paper can act as an irritant to the respiratory system and should be handled with caution.

- Avoid contact with skin.
- Avoid breathing residual fiber. It is best to wear a respirator designed to filter out particulates.
- Brush the unfired paper surface or loose fibers only in a well-ventilated area or out of doors. Remove fired fiber paper under running water.
- During its first firing, the paper will give off a small amount of smoke and aroma. This is the organic binder burning out. Good ventilation in your studio area will ensure that the odor and smoke will dissipate quickly.

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.

For more information on firing in general, see Bullseye's TechNote 4, *Heat & Glass*, under the Education tab at www.bullseyeglass.com.

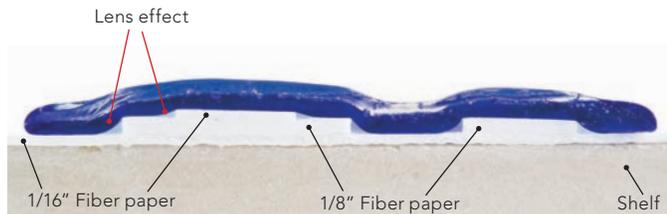


Figure 4: Cross-sectional view of kilnformed glass, fired at 1420°F (~770°C).

- 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)

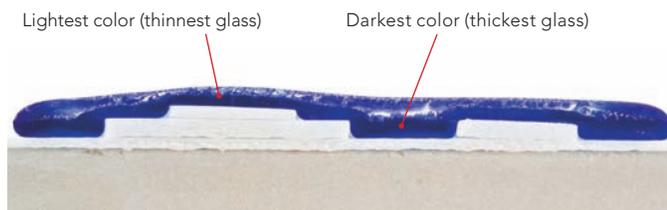


Figure 6: Cross-sectional view of kilnformed glass, fired at 1520°F (~825°C).

- 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.

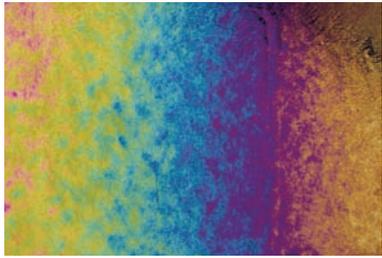
CONSIDERATIONS

- A glass with an irid or dichroic surface will release from ceramic fiber paper most easily.
- Watch out for the possibility of creating thin, ragged edges (“needlepointing”), especially if using only a single layer of 3mm glass.
- 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 that your studio is well ventilated.)
- If you need to glue parts of the fiber papers together, use GlasTac.
- Simple ceramic fiber paper designs may be reused if you follow this procedure: Spray the paper with colloidal silica (a hardener), then pre-fire it. Next, spray the hardened paper with shelf primer. (It is not necessary to pre-fire the primer; any moisture will evaporate during the initial heat-up of the final firing process.)
- If the kilncarved piece will be fired a second time (e.g., to slump it), the textured surface can 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 180°F (100°C) per hour during initial heat.
- To achieve a shiny or satin surface on the kilncarved side of the glass, first clean it well under running water, then spray with a low-temperature overglaze and refire with the kilncarved side up.
- 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 “Annealing Chart for Thick Slabs” under the Education tab at www.bullseyeglass.com.)

RECOMMENDED GLASSES FOR USE IN KILNCARVING

As was mentioned earlier in this TipSheet, some of the best glasses for use with ceramic fiber paper are Bullseye sheets with iridescent or dichroic surfaces. Both types of glass have surfaces that release easily from the fiber paper and are enhanced by the slight texture created in firing.

IRIDESCENTS



Rainbow (-0031, -0051)



001101 000100 000113

Rainbow iridescent is available on Clear, Black, and White glasses and on all of the transparent colors shown below, in two thicknesses:

3 mm (-0031-F) This is the glass thickness most often used for kilncarving.
2 mm (-0051-F) Colors in 2mm styles will usually appear lighter than the samples shown here.



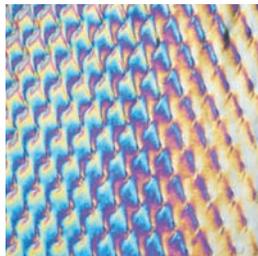
*These styles strike or mature to target color on firing. **The hues of "shift" colors change, depending on the thickness and/or lighting of the piece.



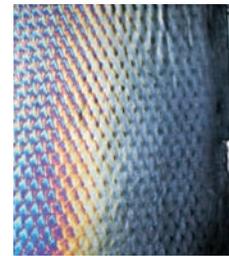
Silver (-0037, -0057)



Gold (-0038, -0058)



Patterned (-0032)



Iridescent coatings may vary in appearance from edge to edge and from sheet to sheet.



001101 000100

Silver, gold, and patterned iridescents are available on Clear and Black. Other colors may be special ordered. Minimum quantities may apply.

For more information and more color images of Bullseye glasses, see our full-color catalog, available by calling toll free: 888.220.3002; visiting our website: www.bullseyeglass.com; or sending an email to catalog@bullseyeglass.com.

DICHROICS

Many styles of Bullseye glass are treated with dichroic coatings and are available through distributors and retailers nationwide. They are also available directly from most coaters.

The dichroic coating company that consistently receives high marks for quality and service from our users is:

CBS

Coatings by Sandberg
 856 N. Commerce Street
 Orange, CA 92867
 Tel: 714.538.0888

Fax: 714.538.2767
info@cbs-dichroic.com
www.cbs-dichroic.com



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