



Best Practices in Glass Recycling

Recycled Glass in Art Glass Applications

Material: Recycled Glass

Issue: *Art glass, especially products produced at a studio (hot shop) scale by blowing or casting molten glass, represents one of the highest value uses for soda-lime glass. The retail value of these glass products is tremendous on a per pound basis. However, these applications are also among the most sensitive both to contaminants that might affect the clarity, and to chemistry that might affect the workability of the glass. This is a critical market barrier for the use of recycled glass. Although virgin raw material costs may appear high compared with recycled glass, in fact they are often a small fraction of the finished product prices in this application, so any risk associated with using recycled glass obviates against its use. However, in the right kinds of businesses, and if appropriate procedures are followed, hot shops can be successful in using recycled glass to create recycled content products.*

Best Practice: By carefully controlling batch formulas and melting procedures, recycled glass products can be manufactured with physical and aesthetic qualities similar to those made with virgin glass or batch materials. Obtaining a quality glass for blowing or casting from post-consumer bottle glass hinges on four processes: sourcing, cullet preparation, addition of batch chemicals, and melting.

The **sourcing** of recycled glass requires a partnership with a collection program capable of producing a reliable stream of quality sorted material. The cullet must be free of dirt, rocks, metals, ceramics, and other types of glasses like Pyrex or Visionware. A specialized collection program involving community recycling centers or local bars and restaurants can be developed to supply a clean and consistent recycled glass feedstock. The quality of glass supplied by beneficiators as “furnace ready cullet” for container plants is probably too contaminated for hot shops, because 1) container plants often tolerate a higher level of rejected products due to inclusions, and 2) the huge size of containment vessels and sophisticated fining processes in container plants help with contaminant separation.

Cullet preparation includes size reduction and contaminant removal. The amount of crushing necessary to prepare recycled glass is a function of the product being made from the remelted glass. If a glass with a long working range (time) is needed for hand blowing, it is best to crush the glass to a size that allows easy melting with the addition of batch chemicals. In that case, it is recommended that the glass be crushed to a size between 3/4 and 1/16 inches, which allows the particles to be easily coated with batch chemicals, especially if a little moisture is left on the glass particles after washing. It is best to sift the smallest powder-sized particles (called “fines”) out of the feedstock. Anything under 1/16 inch can cause problems such as increased need for chemical fining agents (usually noxious or toxic chemicals), and increased time needed to melt the new glass. Mold-blown objects and cast glass are less sensitive to workability, needing little or no fluxing, and therefore less size reduction is necessary. In all circumstances, it is a worthwhile practice to give the glass final scrutiny for contaminants before batch additions.

Batch Additions help to optimize the working characteristics of the recycled glass melt. The chemical composition of container glass used for packaged food or drinks more or less conforms to universal standards. It is formulated to set-up quickly and to hold its shape when mechanically blown into molds. However, glass for studio work, especially for hand blown objects and complicated fabricated products,

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requires a long working range. To obtain the working range required for hand blowing, soda ash can be added as a modifier to the batch. Bottle glass typically contains 13% to 16% soda ash, and it is recommended that the total soda ash content remain below 18% by weight. Up to 2% can be expected to volatilize during the melting process. Fining and fluxing agents also should be added to facilitate melting and blending of various glasses. For a more complete discussion of chemical additives and shop practices, see (1).

Since the volume of glass needed for studio products is relatively small, glass is most often **melted** in ceramic crucibles or small refractory lined day tanks (a tank holding enough melted glass for one day's work), usually near the highest temperature the equipment can endure (2350° to 2600°Fahrenheit). Cullet requires about 10% less energy to melt than straight virgin batch materials, and is less corrosive. At these temperatures, recycled glass has low enough viscosity to allow bubbles to rise readily, aiding blending of chemicals and speeding the fining process. For information about color compatibility during the melting and product formation processes, [see the *Color Modification in Remelt Applications* Best Practice](#).

Implementation: Forging partnerships with a reliable source of post-consumer recycled glass is the first critical step toward using recycled glass in hot shop operations. A good relationship with a supply source such as a community recycling center can provide the opportunity for education about the specific material needs of a glass studio. Presenting samples of ceramic stones and cords (linear strips of higher density than the rest of the glass) is an effective way to convince suppliers that even small amounts of contamination can cause big problems for the small studio glassmaker. Recognizing the differences in color-compatibility of recycled cullet is an important consideration in integrating its use with the common German colorbars. The "pull test" is a quick method of evaluating color compatibility (see best practice referenced above).

Benefits: From a cost standpoint, recycled glass may appear to be an attractive feedstock for hot shop operations. However, some glass artists believe that these savings may be small compared to the risks associated with using recycled glass because the raw material cost usually represents only a small fraction of the final price of the product. Glass art objects may sell for anywhere from \$10 to \$200 per pound of glass. By comparison, the primary supplier of premixed batch to the Northwest art glass community sells glass pellets for only \$0.35 per pound. Thus the savings in raw materials alone are insignificant in high-end applications, especially hand blown products. Recycled glass may be most promising as a substitute feedstock in production casting or pressing operations, where the material represents a larger percentage of the final price.

Application Sites: Glass-blowing studios and hot shops.

Contact: For more information about this Best Practice, contact CWC, (206) 443-7746, e-mail info@cw.org.

References:

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Courtney, Norman, Courtney Design Studios, Seattle, WA

(1) *Post-Consumer Glass Cullet Remelting Process Assessment*, Clean Washington Center, 1996.

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