

Technology Brief

Recycled Glass as a Ceramics Raw Material

Container glass is a vitreous silicate, the primary ingredients of which are silica sand (SiO_2), calcium carbonate (CaCO_3), and soda ash (Na_2O). Although silica has a melting point of over 3000°F, in the presence of the other fluxing and fining agents, the sand forms a glass at temperatures below 2500°F. With proper cooling, the silicate remains a glass at room temperatures. Most clays are silicates, as well.

The Clean Washington Center (CWC) has performed research on a number of ways in which the properties and techniques of traditional ceramics can be combined to help create markets for glass and to enhance the properties of ceramics.

Several businesses in the state of Washington have been created based on these techniques. They represent an opportunity to perform small business development manufacturing unique products from recycled commodities using readily available raw materials and appropriate technologies.

Current Projects

The CWC is currently managing a research project by a ceramics raw material supplier to test the use of glass in conventional clay bodies. Glass can be readily substituted for other fluxing silicates such as feldspars and talc. Moreover, the vitreous nature of soda-lime glass appears to induce vitrification in clay bodies at substantially lower temperatures than typically required, saving energy and extending the life of refractories.

Key Words

Materials:	Recycled Glass.
Technologies:	Kiln techniques using recycled glass.
Applications:	Fused glass, clay body fluxes, and powder processes.
Market Goals:	Small-scale manufacturing.
Abstract:	Description of workshop on using glass as ceramics raw material.

The study is examining the use of glass in clay bodies, looking in particular at three aspects:

- Energy savings
- Workability
- Total manufacturing cost

The CWC is also sponsoring work on more unconventional uses of glass in kiln-fired products, some of which are described below.

Workshops

The CWC has developed a hands-on workshop to demonstrate ways in which glass can be used in ceramics processes. The target audience for the workshops is the ceramics community that exists throughout most of the world.

Some of the applications demonstrated in the workshop use skills, like moldmaking, that are already familiar to ceramics craftspeople. Other applications, like clay body flux, use glass as an alternative raw material in the same processes ceramicists use every day.



“Starter kits” of raw materials can be shipped to the workshop from Seattle to make it easy for local craftspeople to begin with proven materials. Among the applications covered are the following:

Glass Fusing

At temperatures considerably below melting, particles of glass begin to bond through a process called sintering. Sintering of soda-lime glass begins at about 1250°F. Sintering can be used to create solid glass objects by heating glass particles to above the sintering point and holding at that temperature until a dense body forms.

Because there are no binders, fusing must be done in molds. A number of commercial “castable” moldmaking products are available, which mix and pour and set up like cement, but can withstand repeated firings to over 1500°F. The CWC has also developed formulas for making inexpensive molds from local materials.

Glass fusing can be used to make tiles, plaques, simulated stones, bricks, and pavers.

Clay Body Flux

Ceramicists have used vitreous silicates to enhance the properties of clay bodies for generations. In the 1970’s, following the energy crisis, the United States Bureau of Mines became interested in the possibility for energy savings from incorporating recycled glass into clay bodies for making bricks. Today, some brick plants make finely ground glass a regular constituent of their batch materials.

In clay bodies, finely ground glass acts as a flux, causing the creation of a denser, fully fired clay product at kiln temperatures up to 400°F cooler than normally used. In addition, the glass can help create a

denser, more freeze-resistant clay body.

At lower firing temperatures, ceramicists should expect different mature clay body colors. The color changes, however, can be offset by the addition of oxide colorants. The fluxing effect of glass fines can be used to enhance the properties of any clay body.

Powder Processes

High-tech ceramics manufacturers have used powder processes for many decades to make precision parts from finely ground ceramic and metal powders. Some powder techniques have been proven for use with recycled glass.

With powder processes, well-defined gradations of finely-ground raw materials are combined with water and binders to form products at room temperatures. The binders cause the products to get hard, or “set-up,” at room temperatures.

After the products have set up, they can be fired in kilns without molds. During the firing, the binders burn out and the glass particles fuse. The advantages of these processes include not needing a high temperature mold and the ability to make three-dimensional products like bowls.

Summary

The CWC has developed hands-on workshops to demonstrate some new techniques for using recycled glass as an alternative ceramics raw material. For more information on the workshops, call CWC at (206) 464-7040.

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For More Information

For a copy of the report, *Recycled Glass as a Ceramics Raw Material* use the CWC Publication Order Form or call (206) 443-7746. For more information call CWC at (206) 443-7746, email info@cw.org, or visit the CWC Internet Website at www.cwc.org.

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