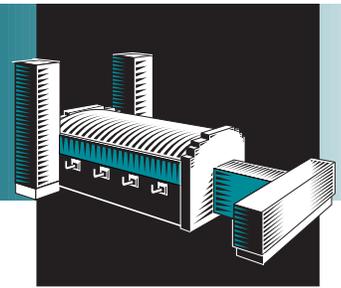


GLASS

Project Fact Sheet



ENERGY SAVING METHOD OF MANUFACTURING CERAMIC PRODUCTS FROM WASTE GLASS

BENEFITS

- Sintered recycled glass process reduces energy consumption during firing processes by 37 percent compared to clay-based tiles and 50 percent compared to glass melt-based tiles
- Uses up to 100 percent waste glass as raw material
- Does not require water or clay for production
- Eliminates the need for expensive, energy-intensive spray drying step needed to produce powder for dry pressing of tile
- Requires only one firing step due to the rapid sintering behavior of glass powder
- Eliminates product molds used in some waste-glass production processes

APPLICATIONS

This new processing method will have immediate applications in the ceramic tile industry, where raw material and fuel costs are significant. Because ceramic tile is used in both residential and commercial floor and wall coverings, the technology will likely have mass-market appeal due to its less energy-intensive, recycled nature.

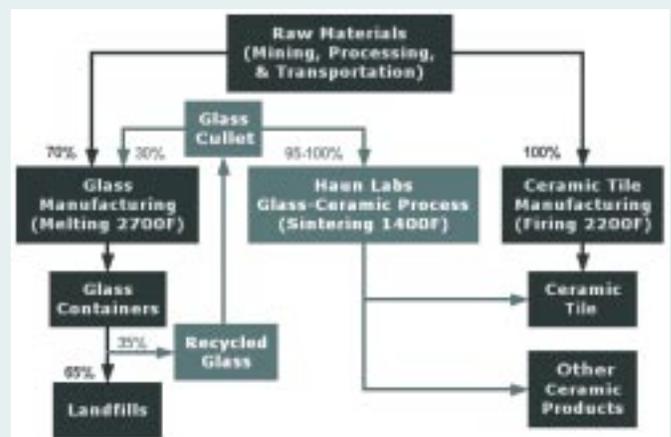
NEW MANUFACTURING METHOD REDUCES ENERGY USE DURING THE PRODUCTION OF CERAMIC TILE FROM WASTE GLASS

Traditionally, ceramic products have been created using raw materials that require high firing temperatures and intensive processing steps. The manufacture of clay-based tiles, for example, requires firing temperatures of approximately 2200°F. Ceramic products can also be produced using glass-melting methods, which require temperatures of 2700°F or more.

A new technology being developed by Haun Labs has the potential to lower energy costs related to the conventional method of manufacturing ceramic products by substituting raw materials with sintered recycled glass. Research has demonstrated that products created using the new processing method are less sensitive to contaminants in the glass and can be made from either green or mixed-color waste glass, which are difficult to recycle. With 100 percent substitution, firing temperatures for this new process can be reduced by as much as 37 percent (clay-based), resulting in significant reduction in energy costs and a significant increase in recycling rate. In addition, this new process resolves inherent chemical and processing incompatibilities previously encountered with the use of traditional ceramic raw materials and manufacturing methods.

CERAMIC TILES MADE FROM 95-100 PERCENT RECYCLED GLASS

PIX#09576 Photo courtesy of Haun Labs



Ceramic tiles produced from recycled glass offer the same quality as traditionally manufactured tiles, but require substantially less energy to produce.



Project Description

Goal: Develop a low-cost, energy-efficient process to manufacture ceramic tile from large quantities of waste glass.

The production of ceramic-tile is energy and cost intensive due to the firing and glass-melting steps required in the manufacturing process. Products typically need to be fired at approximately 2200°F. Raw materials, which have to be mined and processed, increase the cost of production.

Haun Labs' new technology saves production energy by reducing processing temperatures and eliminating mining and other energy-intensive processing steps. In comparison to the glass-melting method of tile production, the new process eliminates the annealing step that was traditionally required to relieve internal stress after sintering glass powder. The temperature required to melt glass in the production of ceramics is about 2700°F, but the new process *sinters* glass powder into a dense product at approximately 1400°F. Unlike clay-based tile manufacturing, the new technology does not require spray drying of the raw material mixture and still reduces firing temperatures by 800°F.

Haun Labs is developing this new technology with the help of a grant funded by the Inventions and Innovation Program in the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- A patent application has been filed for the technology.
- The new processing method creates high quality tile on a laboratory scale, but additional development is needed to demonstrate that products can be commercially produced.
- The technical hurdles to optimize each of the processing steps and scale up the process to a pilot plant have been completed. Later, the process will be optimized for the manufacturing scale.
- Marketing and commercialization strategies for the process are being explored.

Economics and Commercial Potential

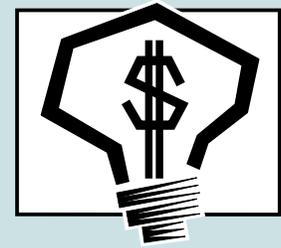
U.S. ceramic market consumption was estimated at \$1.8 billion for 2.1 billion square feet of product in 1999, a solid increase over 1.9 billion square feet in 1998. This increase was due to increased construction, declining prices, and higher preference for ceramic tile. Traditionally, the high cost of quality ceramic tile has made it difficult for the tile industry to compete with other flooring options. However, the superior quality and lower price of the tiles created with this new processing method should allow it to compete effectively in the floor covering industry, especially in the ceramic-tile segment.

Due to its use of a lower-cost raw material that requires less energy to manufacture, the new manufacturing method will likely be competitive in the ceramic-tile industry. Ceramic tiles created using this new method should have wide acceptance, especially if they can be shown to meet customer demands on appearance, size, durability, price, and slip resistance, as well as quality and safety perceptions affected by weight and break resistance of conventional glass.

INDUSTRY OF THE FUTURE—GLASS

*In April 1996, several organizations representing the glass industry signed a compact with the Department of Energy (DOE) in an effort to encourage technological innovations that will reduce energy consumption, pollution, and production costs in the industry. The glass industry published a report entitled **Glass: A Clear Vision for a Bright Future**, which articulated the industry's vision of its future, including increasing recycling rates to 100 percent. This compact set the foundation for collaborative efforts between the industry and the Federal government. Signed by both key industry players and Department of Energy officials, it was a formal commitment to align DOE'S limited resources to meet the challenges identified in the vision.*

OIT Glass Industry Team Leader: Elliott Levine (202) 586-1476.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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