

Glass International

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Abrasion-resistant machinery is mixing it up

Mixing raw materials for glass production can cause abrasion within the mixer, which in turn can lead to defects on the final glass product. This article explains the mixing process and how mixer abrasion and contamination between batches can be avoided.

Kopp Glass is one of the leading producers of moulded borosilicate glass, a tough material that can withstand harsh industrial environments and is resistant to degradation from sunlight and weathering.

Applications

The glass is used worldwide in applications such as airport and aircraft lighting, chemical process equipment, medical device illumination, light filters of all types (including military night vision equipment), electrical transformers, architectural and theatrical lighting, railroad and traffic signals.

It can also be found at the South Pole, where scientists have installed a computerised network of thousands of 35.5cm diameter glass globes, approximately one mile below the surface of the ice. The globes contain sensors, with the goal of capturing sub-atomic particles, called neutrinos.

Mixing

The company produces its glass in small batches, typically in the range of 100 - 1000 pieces. The powdered ingredients are mixed, melted in a pot furnace and then moulded by hand.

The mixer is a vital part of the operation. "A batch may contain anywhere from five to 15 ingredients that must be mixed thoroughly in order to guarantee product quality," says



◆ Kopp Glass replaced a rotary pan mixer with a Munson Machinery rotary batch mixer - a horizontal, rotating drum powered by a 3.7KW motor. Mixing flights, or baffles, tumble the batch in a multi-directional manner.

David Pungratz, Mix and Melt Manager at Kopp Glass.

The rotary mixer, manufactured by Munson Machinery, USA, is a horizontal, rotating drum that is supported on either end by trunnion rings and driven by rollers, powered by a 3.7 kilowatt (KW) motor. It has a stationary inlet at one end and a stationary outlet, with a discharge gate, at the other. Mixing flights, or baffles, tumble the batch in a multi-directional manner.

Ingredients

While many ingredients are used, sand accounts for 60 - 75% of a formulation, so sand is delivered to a silo in tanker trucks of 18,144 kilogram (kg) capacity. The rest of the ingredients, including borax, metal oxides and various other minerals, arrive in bags, drums or barrels.

The ingredients for a batch are loaded into a large rectangular hopper that is set on load cells. Sand from the silo is fed to the hopper by means of a screw conveyor and a chute. When the amount of sand reaches the pre-set weight, an operator manually shuts off the conveyor. Other major ingredients



▲ The flange of a discharge valve at the hopper's outlet is positioned atop the inlet of the mixer using an overhead hoist and trolley, due to ceiling height restrictions.

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▲ The batch is rapidly discharged from the mixer into a cart that transports it to the furnace.

are added manually, one by one. Finally, the minor ingredients, which are pre-weighed, are introduced into the batch.

When the batch is complete, the hopper is raised into position above the mixer's inlet by an overhead hoist and trolley. The flange of a discharge valve at the bottom of the hopper rests on a rubber seal affixed to the mixer's inlet, after which the valve is opened and material flows into the machine, aided by two vibrators located on the exterior of the hopper.

Abrasion-resistant

The mixer (model GB10 glass batcher) has a capacity of 2.8m³, or 680kg for

glass. However, the operation is limited to 317kg by the size of the hopper. Larger hoppers cannot be used because of the limited clearance above the mixer.

The liner and other contact surfaces in the glass batcher are made of abrasion-resistant steel, designed to withstand the abrasive mixture of ingredients, particularly sand, in the formulations. Mixing times are approximately five minutes, less than half the time required by the pan mixer.

Nevertheless, the machine's slow tumbling action, aided by the baffles, achieves a homogeneous mix. "We aim to make hand-pressed glass with minimal defects," says Mr Pungratz.

Once a batch has been mixed, it is discharged into a wheeled cart or wagon and taken to a furnace. The company has two furnaces, one of which can accommodate 16 melting pots and the other 12 pots. Most of the pots have a glass capacity of 1134kg. The furnace operates at 1427°C, but the temperature of each pot can be individually controlled and ranges from 1093 - 1370°C, depending on the composition of the glass.

Process

When a batch of glass is ready for use, the pot is opened and cooled to a working temperature and then the glass is cast in moulds of stainless steel or cast iron. Two skilled craftsmen, known as the glass gatherer and presser, carry out this operation.

Each piece is made individually: The gatherer accumulates the appropriate

amount of glass needed for the piece by using a punty, which is a steel rod with a clay ball on one end. The punty is placed into the mouth of the pot until it touches the molten glass, then the punty is turned in a way that gathers glass on the clay ball. The glass is carried to and released into the mould and the presser shears off the flow, then pulls a lever to bring the plunger into the mould. Large products are made by layering three molten gobs of glass.

Contamination

Meanwhile, the mixer provides a continual supply of mixed glass ingredients to the furnaces. As soon as one batch has been discharged, the machine is cleaned and readied for the next batch. The machine processes 10 to 20 batches per day, typically of several different colours, so it is important to avoid residue from one batch that might contaminate the next one.

To prevent contamination, all material is rapidly discharged, leaving minimal residue and cleaning takes approximately 10 minutes using a dedicated vacuum. A door on the side of the machine provides full access to the interior.

A second vacuum system removes any airborne dust that results from the cleaning operation. ■

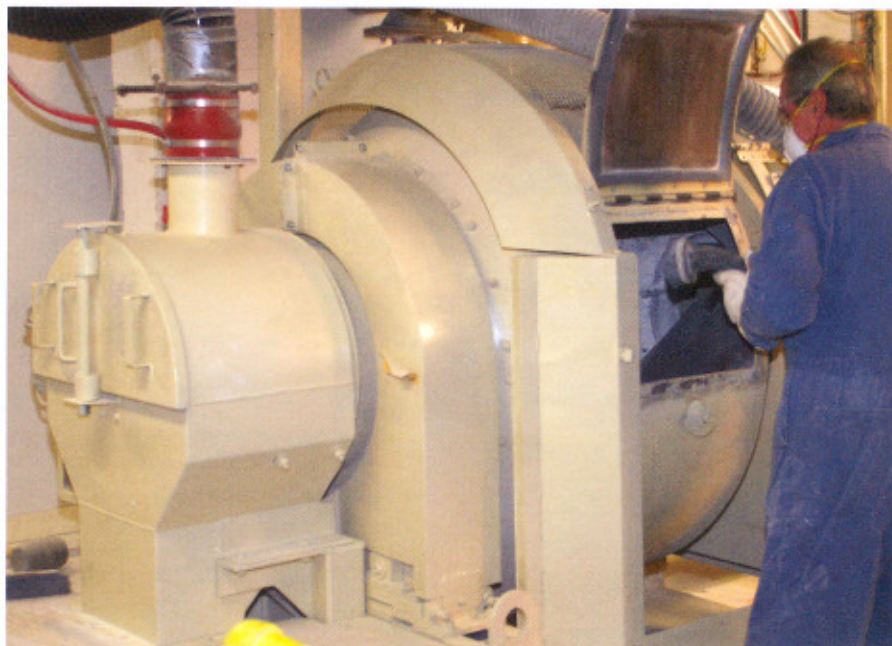
Munson Machinery, USA.

Website:

www.munsonmachinery.com

Kopp Glass, USA.

Website: www.koppglass.com



▲ Access doors facilitate interior inspection, cleaning and maintenance.



▲ The gatherer uses a punty, which is continually turned, to accumulate molten glass from the pot, and transfer it to a mould.