

CIMCOOL[®]

Technical Report

Milacron Marketing Co. | Consumable Products Division | Cincinnati, Ohio 45209

Fluids for Glass Processes

What is Glass?

Glass, one of the oldest man-made materials known, dates back to 3500 BC in the region of Egypt and Mesopotamia. Natural forms of glass are traceable back to the beginning of time.

Manufactured or man-made glass is typically formed using a basic recipe, of sand, soda, and lime. Many variations of this centuries old mixture exist, for instance the addition of potash and lead will improve glass quality, and introducing cobalt, sulphur, or other minerals to the mixture produces color to the glass. Glass is a homogeneous material with a random, non-crystalline molecular structure that is dissimilar to the majority of materials we produce since it does not form crystals as it cools from a heated state. Glass becomes a "super-cooled liquid," resisting any change in the arrangement of its molecules. This allows hot glass to be manipulated to form the shape desired, retaining that shape as it cools without changing structurally.

Glass Processes

Grinding

The removal of glass with abrasives or abrasive (grinding) wheels in order to shape, polish or otherwise finish both flat and hollow glass. These processes include edging and surface type grinding.

Edging

The shaping or finishing of the edges of a glass surface, usually by grinding with an abrasive wheel.

Polishing

Smoothing the surface of an object when it is cold by holding it against a rotating wheel fed with a fine abrasive. Glass may also be polished with hand-held tools.

Beveling

The production, by abrasion, of a sloping edge on a glass sheet. Commonly used on mirror glass.

Shearing

Process employed in a gob feeder for an individual section machine. The gob feeder is equipped with a set of shear blades which cuts /shears the molten glass into individual gobs of molten glass that are then fed to molds where jars and bottles are formed. The shear blades require lubrication and cooling from a glass processing fluid for maximum service life.

Abrasive Machining

These processes include, milling, drilling, sawing, and cutting glass.

Products Manufactured With Glass Processing Fluids

- Mirrors
- Windows
- Windshields
- Light bulbs
- Optical glass
- Bottles, jars
- Gemstones
- Glass plate

Fluid Requirements for Glass Processes

A glass processing fluid should provide the following:

1. Optimum settling of glass fines.
If settling is too rapid, fines will plug the lines.
If it is too slow, re-circulation may cause a rapid increase in the alkalinity of the mix, resulting in etching of polished faces. In addition, fluids with optimum settling characteristics, keep the glass fines from hard packing in the filtration system.
2. Adequate lubrication.
Lubrication is required for various operations, tool life, shear blade life and to improve diamond wheel life. If a product provides too much lubrication it will cause the glass to slip in the machine.
3. Good washing action.
A grinding fluid with good washing action removes fines from polished faces of the plate and any oil left on the glass from previous processing.
4. Corrosion protection for the machine
The wet environment of glass processing has the potential to cause corrosion to the machine & it's tools. Glass processing fluids are formulated with materials that provide protection for the tools and machine.
5. Foam Control
Low foaming products are important since the presence of foam may impede the grinding process causing quality issues such as chipped edges

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Difficulties Linked to Glass Processes

There are several unusual problems that must be dealt with when working with glass processes. The problems are interrelated so correcting one problem often prevents another from taking place.

1. Small fines

Extremely fine particles are generated in glass processes, specifically grinding. The particle size and nature of the glass fines makes positive filtration uneconomical so they must be settled out, rather than filtered from the fluid. These fines settle on machines, in central system trenches, and in the bottom of the system reservoir. The fines tend to coagulate and form a deposit of cement-like hardness. Deposits of glass fines can interfere with the operation of the machine; slideways may seize and the settling tank dragout chain may break.

2. Etching

The ground and polished surfaces of plate glass are prone to etching when using water-based fluids. Water leaches silicates from the glass and glass fines. The leached silicates are alkaline, causing a rapid rise in mix pH. As the pH of the fluid increases, the possibility of etching the glass also increases. To prevent etching, boric acid is commonly used to lower mix pH.

3. Variations in settling characteristics.

The settling rate of glass fines can be affected by:

- a. Changes in wheel grade, producing larger or smaller fines.
- b. Changes in water hardness, affecting both the "wetness" and stability of the mix.
- c. A change in the composition of the mix, a significant variation in the concentration or unusual chemical contamination.

4. Burning

The ground edges of glass may burn as a result of fluid depletion or improper fluid application. The term burning refers to a small cluster of fire and white-hot molten glass fines that may occur in the glass grinding process. High temperature is generated, partially melting the powdery glass fines, forming a plastic material that sticks to the ground glass surface.

In addition, lumps of partially fused glass shoots from the interface of the wheel and part, building up ahead of the grinding wheel, causing interference in the grinding process. This re-deposits on the ground surface leaving rough white streaks on the finished surface.

Severe burns may have minute cracks called "checks" which extend into the clear unground glass. Checked glass must be scrapped.

5. Foam

Foam is often the result of the mix being too rich but also may be caused by excessive agitation. The presence of foam may interfere with grinding performance resulting in chipped edges.

6. Fluid Depletion

Since there are great numbers of extremely fine glass particles generated during glass grinding and abrasive machining, fluid depletion can occur. Formulations for glass processing fluids often utilize cationic materials to enhance the settling properties of the fluid. Diminished levels of these components will cause various issues. It is important to conduct frequent concentration checks, replenishing lost components with adequate fluid makeup and /or additives, as needed, to maintain the fluid system.

Fluids for Glass Processes

Semisynthetic and synthetic fluids have both been used for glass processes. In the industry today, the product type of choice when working with glass typically is a synthetic water based fluid for the following reasons:

- Clear product providing excellent visibility
- Clean
- Improved settling of glass fines
- Low foaming

Table 1 provides a list of CIMCOOL[®] Fluids recommended for use in glass grinding and abrasive machining.

Additives for Glass Processing Fluids

Additives may be required as makeup to extend the life and performance of the fluid used in the glass processing system.

Examples of additives that may be required are:

- Settling Aids
- Corrosion Inhibitors
- Antifoams

Consult with your regional CIMCOOL[®] Technical Service Engineer for specific recommendations, or contact CIMCOOL[®] Technical Services at:

1-513-458-8199

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Table 1.

| CIMCOOL Fluids for Glass Applications | | | | | |
|----------------------------------------------|---------------------|---------------------------------------------------|-------------------------------------------|-------------------------------|-----------------------------|
| Product Name | Product Type | Application | Recommended Use Dilution Range (%) | Advantages | Special Tests Passed |
| CIMTECH[®] GL 2015 | Synthetic | Glass grinding / lens polishing | 2 - 5% | Excellent settling properties | |
| CX-427 | Synthetic | Glass / mirror grinding, beveling, lens polishing | 2 - 5% | Excellent settling properties | |
| CIMTECH[®] GL2030 | Synthetic | Glass / mirror grinding | 2 - 5% | Excellent settling properties | Copper corrosion |
| CIMTECH[®] 100 | Synthetic | Glass grinding | 2 - 5% | Excellent settling properties | |
| CIMSTAR[®] 40 | Semisynthetic | Glass grinding, shearing | 2 - 5% | Low cost | |
| CIMSTAR[®] S2 | Semisynthetic | Glass grinding, shearing | 2 - 5% | Low cost | |