



Glass Problems Conference, October 2011

Calcium and Magnesium Batch Compounds

The Lhoist Group

Largest manufacturer of Carbonates and Oxides of Ca/Mg

Company is over 100 years old.

World's most extensive Ca/Mg R&D staff and facilities

Major supplier of Ca/Mg for glass for approximately 50 years

Understands demands for high quality and consistency

Willingness to work with the Glass industry as demands for Ca/Mg batch minerals/chemicals evolve



Batch Carbonates

Limestone (CaCO_3)	95%+ 55%	CaCO_3 Total CaO
Dolomite ($\text{CaMg}(\text{CO}_3)_2$)	55% 44% 31% 21%	CaCO_3 MgCO_3 Total CaO Total MgO
Approximate weigh	~95	lbs cubic foot
CO ₂	~45%	Limestone & Dolomite (900lbs/ton of Carbonate)
Fe is Ferrous		
Minor source of organic Carbon		
Decrepitation is ore body and physical size specific		



Carbonate Ore Processing

Extraction: Open pit or underground mine

Processing: Crushed, dried, screened, classified, pulverized

Glass sizing: Granular: 16X120m, Pulverized: 85% -200m

Granular: Float, Container, Insulation Fiber

Pulverized: Composite Fiberglass





Carbonate Logistics & Handling

Rail: Standard covered hopper car, ~100 tons

Truck: Granular: Bottom drop and Pneumatic tanker
Pulverized: Pneumatic tanker
~25 tons

Additives: Not required

Safety: No special considerations

Handling: No special considerations



Carbonate Decrepitation

As carbonates release CO₂, the crystalline structure “snaps” releasing energy that carries fine particles of Carbonates/Oxides & other batch minerals into the exhaust system. Ca and Mg tend to stick to refractory reducing melt temp of the brick as well as “clogging” checkers restricting air flow.



Decrepitation is ore body and size dependent

Dolomite may have higher decrepitation tendencies due to the larger crystallite size as compared to Limestone.

Batch Oxides

Quicklime (CaO) 95% Total CaO

Dolomite (Ca/MgO) 58% Total CaO
 39% Total MgO

Approximate weight ~57 CaO lbs cubic foot
 ~65 CaO/MgO lbs cubic foot



Calcination Process

Standard preheater rotary Lime kiln (US)

Carbonate kiln feed size: 2" X 1/2"

Ton/Carbonate, 5mmbtu energy yields Oxide + 900 lbs CO₂

Fuel: Coal/Coke, sometimes natural gas

Organic Carbon is removed during calcining process

Decrepitation is removed during calcining process

Fe converts to Ferric

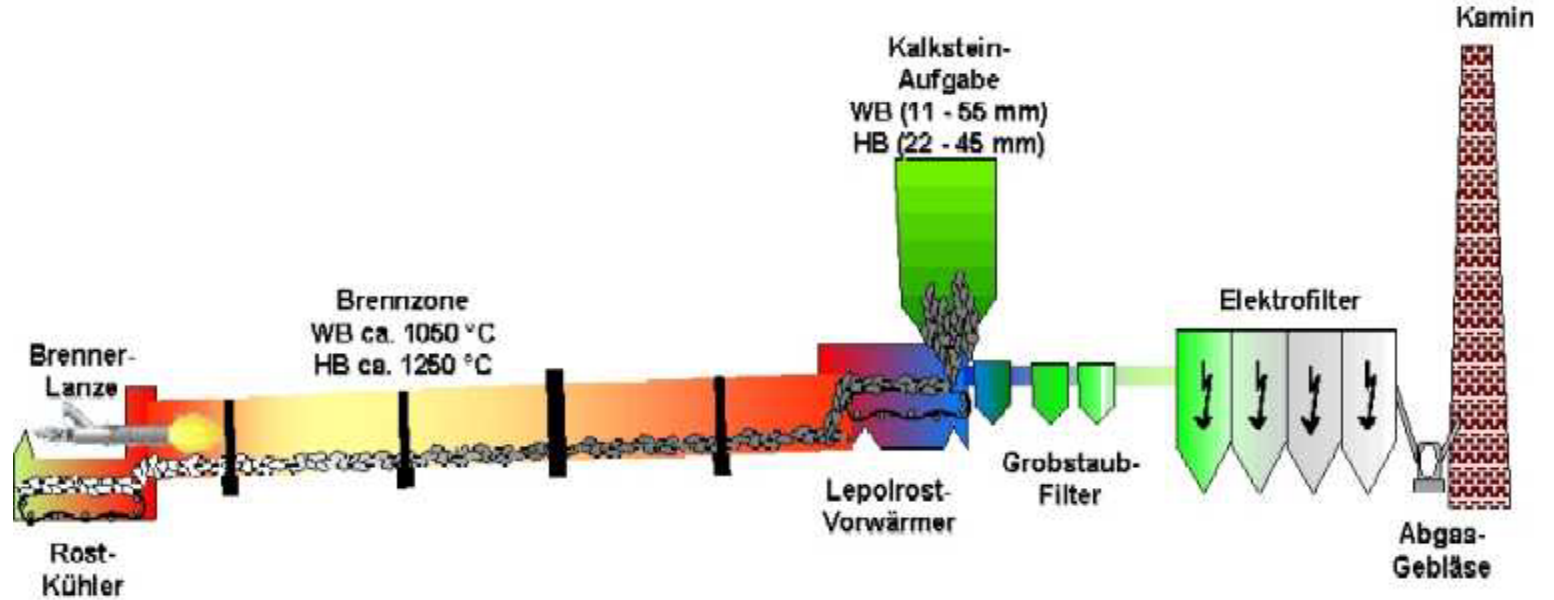
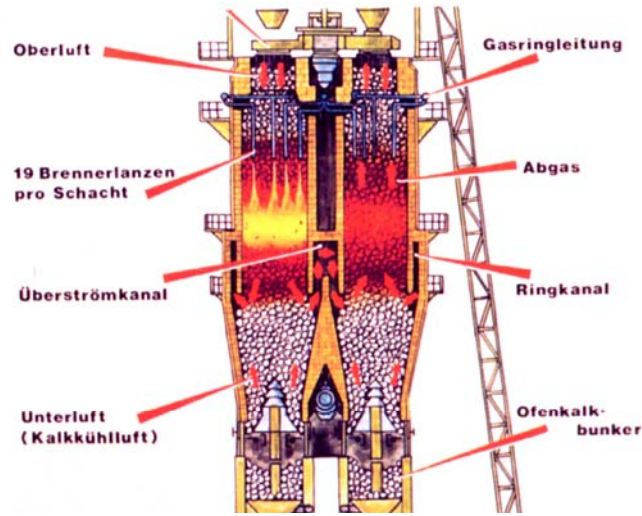
CaO is highly reactive with H₂O, exothermic

Crushed, screened, pulverized, Hydrated

Granular: 16X120m Insulation Fiberglass

Pulverized: 85% -200m Composite Fiberglass





Hydrated Lime

CaO is pulverized, water added to convert to Ca(OH)₂

Size: ~90% -325m (44 micron, high porosity, Specialty sizes

Total CaO: ~73%

Decrepitation: Removed during calcination

Organics: Removed during calcination

Weight: ~25-35 lbs cubic foot

Reactivity: Not exothermic

Safety: Some considerations



Oxide/Hydrated Lime Logistics and Handling

Rail: Oxides: Jumbo Covered Hopper, PD car (Pulverized)
Hydrate: PD car

Truck: Oxides: Pneumatic tanker
Hydrate: Pneumatic tanker

Additives: Pulverized CaO only

Safety: CaO is exothermic (~58% of Burnt Dolomite is CaO)
Safety considerations apply

Handling: Large sizes of Oxides may degrade physically
Normally not an issue



Lime as a Binder

Hydrated Lime (CaOH_2) has binder characteristics
1-5% by weight

Water added to batch will convert CaO in either high Calcium Quicklime or in Burnt Dolomite to Hydrated Lime (CaOH_2)



Batch briquetting trial using water and Burnt Dolomite at Glenshaw Glass in PA during the 1980's. Trial was reportedly successful.

LNA willing and interested to actively participate in development of CaOH_2 as a batch binder for dry pelletized batch.

Carbonate/Oxide Comparison

	Carbonates	Oxides
Total Oxides	~55%	95%
Weight cubic ft	95 lbs	57 lbs
Product Cost	X	~5X
Logistics Cost	X	-40%
CO2	900 lbs/ton Carbonate	none
Organics	minor source	none
Decrepitation	ore dependent	none
Iron	ferrous	ferric
Safety considerations	none	exothermic
Melt Energy	100%	92.5%



Conclusion

Regulations, cost of energy, logistics, with production efficiency efforts may result in an evolution in batch minerals and handling systems.

Lhoist stands prepared to partner with the glass industry in developing innovative products and approaches.

Electronic copy of this presentation is available by request

Lhoist has products and approaches for other industry applications such as flue gas and waste water treatment

