



GREEN CEMENT

INNOVATION IN THE CONSTRUCTION INDUSTRY





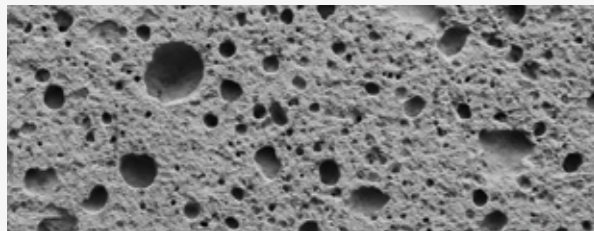
MICROTRAC
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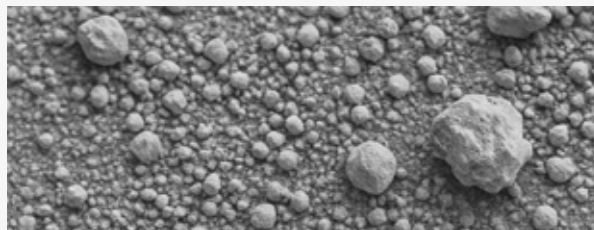
POROSITY



Mercury intrusion porosimetry (MIP) is used to evaluate **pore structure** of cement-based materials use to determine transport properties, durability, and mechanical behaviour. Pore structure affects how water and ions move through the material, influencing its **permeability and durability**. Also influence the **strength and mechanical behaviour** reducing carbon emissions and promoting sustainable construction practices.

Mercury Porosimeter - BELPORE

PARTICLE SIZE AND SHAPE



Particle Size and Shape is used for characterization of all the SCMs to determine, reactivity, hydration rate and durability.

- Particle Size from 3 up to 30 micron **enable faster hydration rates**
- Sharp angles and irregular surfaces increase surface area and reactivity
- Particle sizes and shapes impact **agglomeration porosity** and microstructure
- Particle size and Shape **influence the optimization of different SCMs** materials and can help optimize milling processes

Laser Diffraction (LD): Particle Size Analyzers

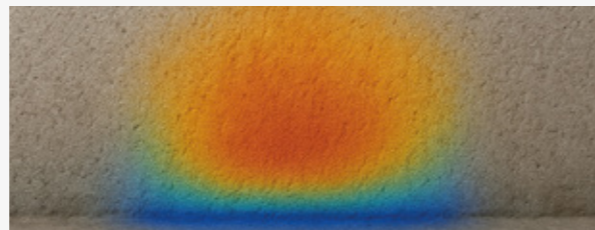
CARBON, HYDROGEN & SULFUR CONTENT



One of the first goals of green cement is **reducing the amount of clinker** needed and exploring alternative cementitious materials. One promising technique is the **carbon capture in concrete**, where CO₂ is captured and incorporated into the concrete structure. **Sulfur** content can influence carbon capture materials potential. Hydrogen is important as can influence the Calorific Value of the secondary waste material used for SCMs.

Carbon / Hydrogen / Sulfur Analyzer - CHS

THERMOGRAVIMETRIC ANALYSIS - TGA



TGA helps in determining the amount of different components in the cement, provides insights into the **thermal stability of the materials**, is used to study the **hydration and dehydration processes** of cement, can be used to monitor the carbonation process and allows study of the kinetics of phase formation and transformation in cement.

Thermogravimetric Analyzer: TGA Thermostep

MILLING & SIEVING



In Green Cement milling is a crucial part of the production. The main important systems that are used in these fields are:

SCMS MODIFICATION

With Mechanochemical activation we induce structural disorder, amorphization and increased chemical reactivity in materials through intensive grinding. Cooling or heating up the samples, processes can be modified.

Ball Mills - Suitable for every application

DRUM MILLS AND XRD-MILLS

Drum Mills are used to grind raw materials and clinker into fine particles, which is essential for producing high-quality green cement. XRD-Mills are crucial for optimizing the use of supplementary cementitious materials (SCMs)

Drum Mills - fine grinding of large volumes

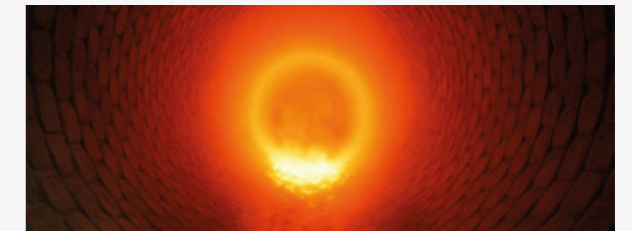
XRD - Mill McCrone - perfect for XRD analysis

JAW CRUSHERS

Used for the initial crushing of raw materials, jaw crushers break down large chunks into smaller sizes. This step is important for making the materials easier to grind and mix, facilitating the production of green cement. cement.

Jaw Crushers - high quality and reliability

HEAT TREATMENT

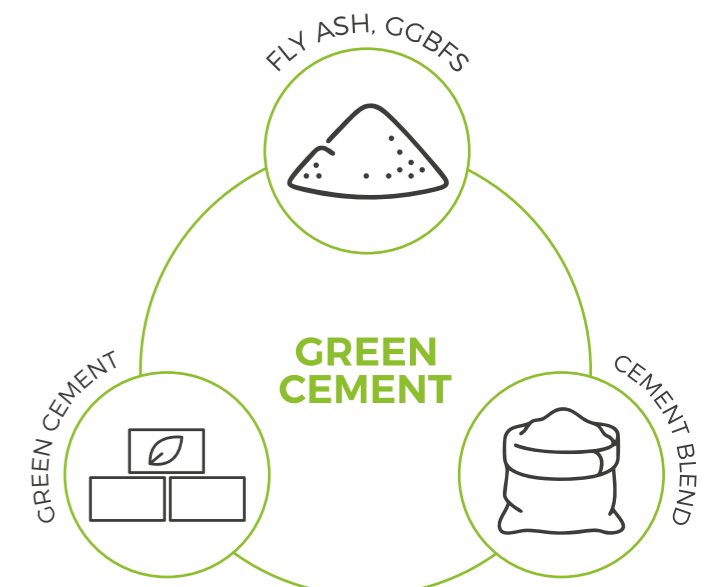


A variety of furnaces are used in the **calcination process** for clinker production, typically at temperatures up to 1450°C, to remove volatiles and create chemical compounds.

Carbolite Gero offers **batch, continuous and fully customized** furnaces.

These offer opportunities to study energy efficiency in cement production, **reducing carbon footprint** by using continuous furnaces and switching from gas to electric.

Rotary Furnace & Rotary Oven Range





ENABLING PROGRESS




1300
EMPLOYEES


300
MIO. € SALES


22
SALES OFFICES


11
MANUFACTURING SITES

VERDER

GLOBAL REACH, LOCAL EXPERTISE



**HEAT
TREATMENT**



**ELEMENTAL
ANALYSIS**



**MATERIALOGRAPHY
& HARDNESS TESTING**



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