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Austria

# Geosil – ready to use alkaline activator solutions for Geopolymers

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# 1 Motivation

- laboratories don´t focus on industrial produced waterglass
- essential for future industrial application
- qualified production processes ensure constant product quality

# 1 Introduction

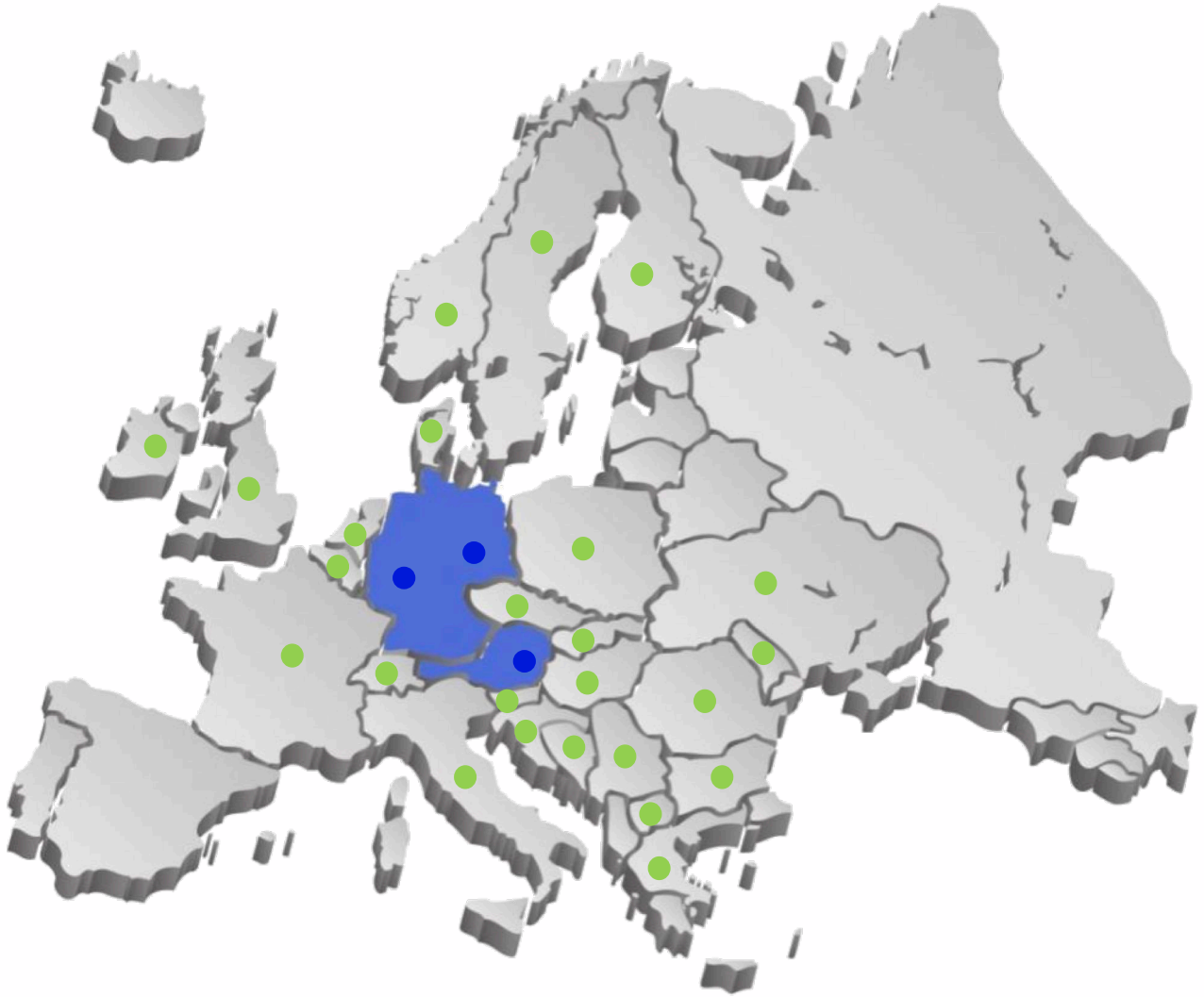
- owned by Dr. Eduard Wöllner family foundation
- 122 years of experience (founded in 1896)
- Head office in Ludwigshafen / Germany
- Main product groups:
  - industrial silicates
  - raw materials and additives for paints, plasters and construction materials
  - process chemicals for industrial water circuits
- Approx. 150 employees
- Annual turnover approx. 50M€


# 1 Production Sites & distribution network


**Ludwigshafen:**
**headquarters and production site**

**Bad Köstritz:**
**production site**

**Gratwein-Straßengel:**
**sales department and production site**



Distributor network:
Australia, New Zealand, China
Malaysia, Singapore, Thailand,
South Africa, Israel, Turkey

- production site
- Distributor

# 1 Brands of Wöllner

**Betolin®**
Specialties for Paints, Coatings and Construction

**Collosil®**
Special Adhesives

**Betol®**
Inorganic Binders

**Sikalon®**
Powder silicate

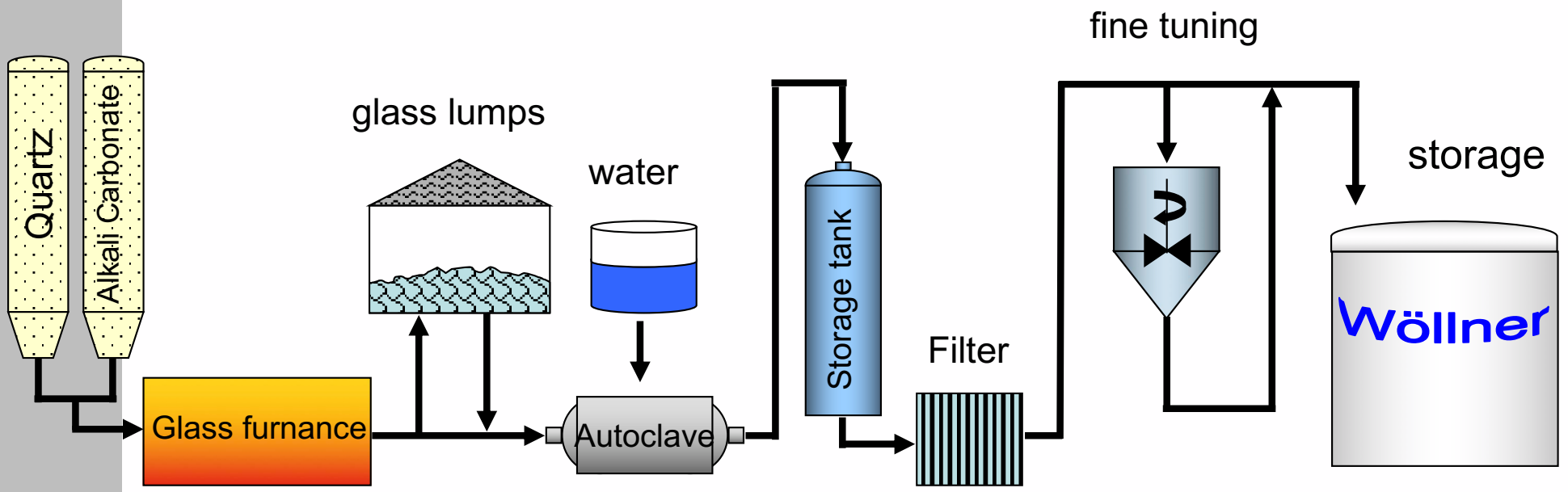
**Ligasil®**
**Stabisil ®**
Foundation engineering

**Geosil®**
liquid alkaline activator

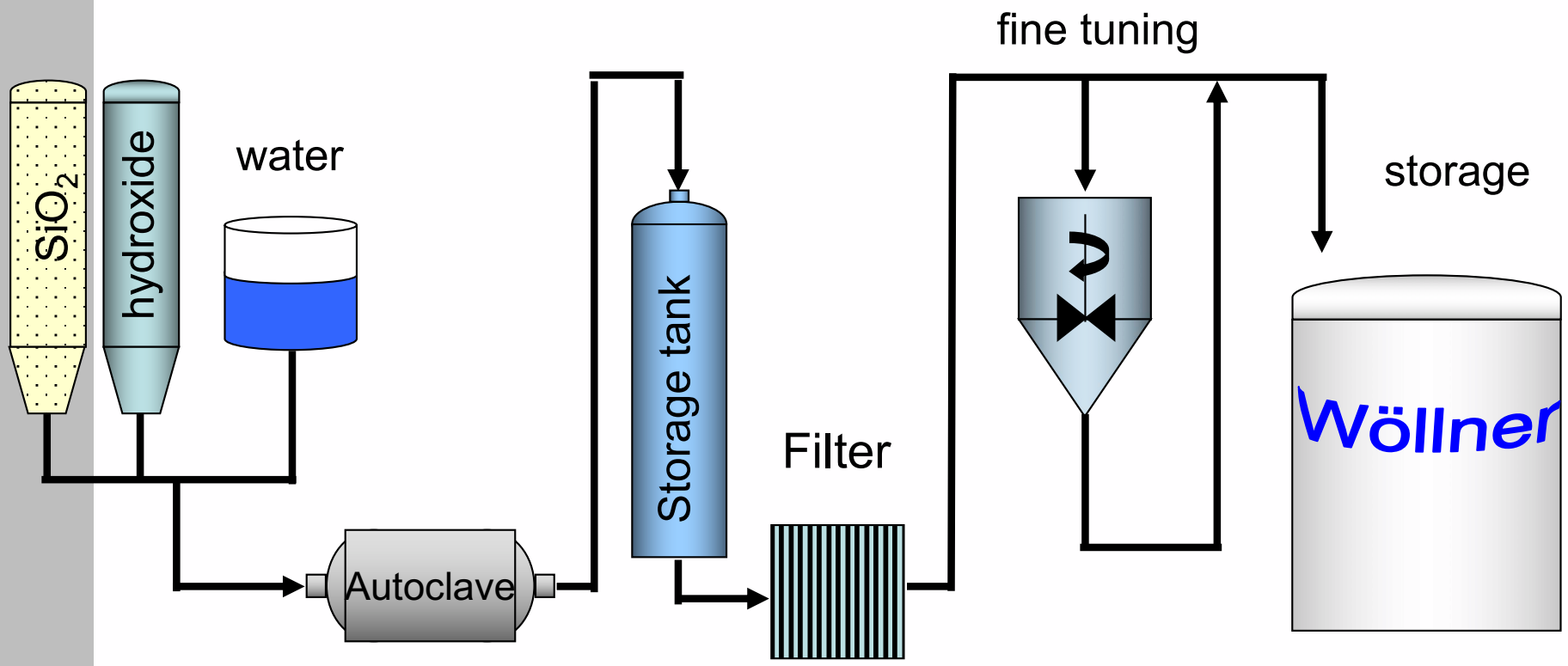
# Waterglass

- oldest anthropogenic chemical in the world
- glassy frozen melts of alkali silicates with varying composition
- not distinct stoichiometric chemical substances
- no specific chemical formula
- glasses or aqueous solutions of glasses

# Furnace route




# Hydrothermal route




$$2\ MOH + x\ SiO_2 \longrightarrow M_2O \bullet x\ SiO_2 + H_2O$$

M = Na, K, Li

# Definition molar ratio

*weight ratio:*

$$WR = \frac{\text{wt.\% } SiO_2}{\text{wt.\% } M_2O}$$

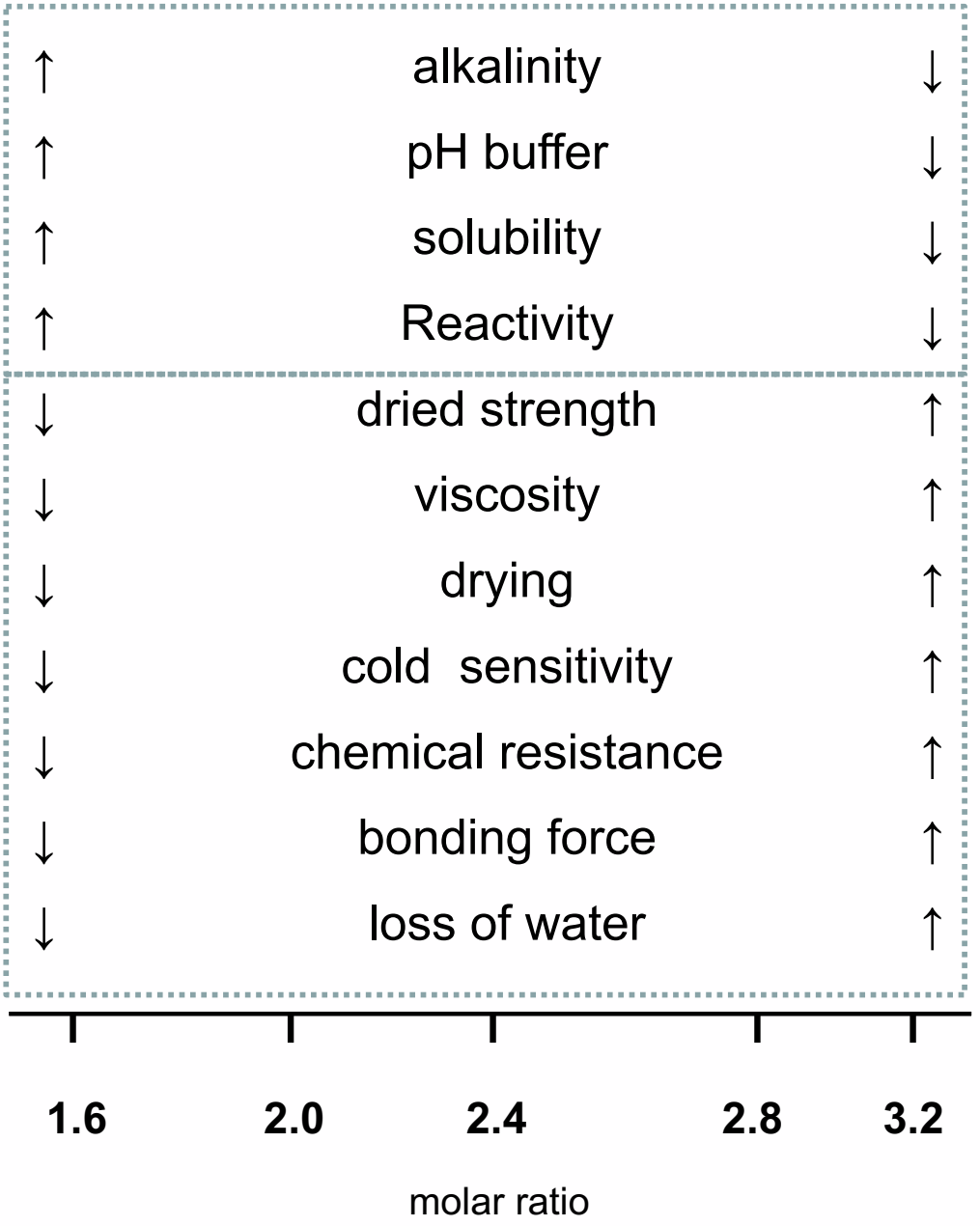
*molar ratio:*

$$MR = \frac{\text{mol } SiO_2}{\text{mol } M_2O}$$

**Molar Ratio ⇔ Weight Ratio**

sodium silicate: molar Ratio = 1,032 • weight Ratio
potassium silicate: molar Ratio = 1,566 • weight Ratio

# Properties according molar ratio



# Basics of waterglass

**technically significant liquid silicates:**

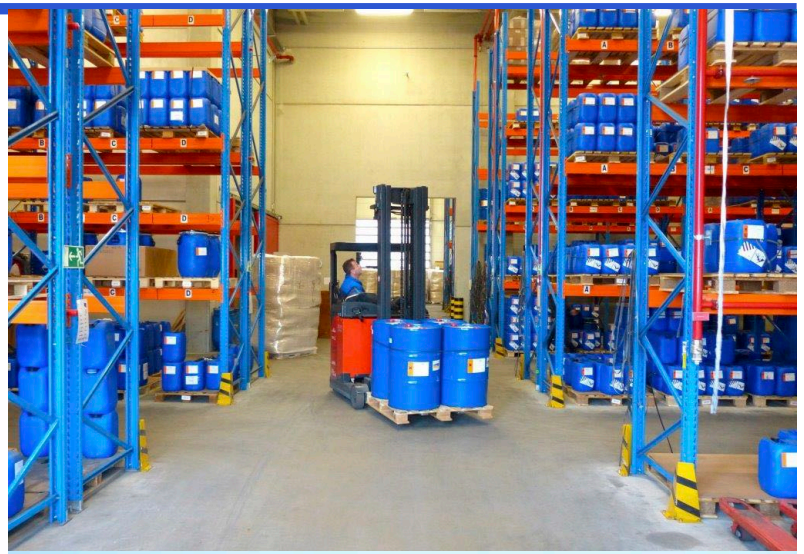
| | |
|---|---|
| Sodium silicate: | molar ratio 1.7 – 4.0 |
| Potassium silicate: | molar ratio 1.0 – 4.0 |
| Lithium silicate: | molar ratio: 2.5 – 5.0 |

# 2 Classification (soluble silicate solutions)

| Molar ratio $SiO_2 : M_2O$ | „Old“ Classification (Handling) | Dangerous Goods Classification (Transport) | CLP-Classification |
|---|---|---|---|
| **> 3,2** (conc. < 40 %) | none | none | none |
|  GHS 07 **> 3,2** (conc. > 40 %) | Xi irritant R 36/38 | none | Warning<br>Skin Irrit. 2 H315<br>Eye Irrit. 2 H319 |
|  GHS 07 **> 2,6 ≤ 3,2** | Xi irritant R36/38 | none | Warning<br>Skin Irrit. 2 H315<br>Eye Irrit. 2 H319 |
|  GHS 05 **> 1,6 ≤ 2,6** | Xi irritant R38, 41 | none | Danger<br>Skin Irrit. 2 H315<br>Eye Dam. 1 H318 |
|  GHS 05 **≤ 1,6** | C corrosive R34 | Cl. 8 / Packing Group II | Danger<br>Skin Corr. 1B H314<br>Eye Dam.1 H318<br>Met. Corr.1 H290 |

# Packaging of goods

- 30 lt. can
- 180 lt. plastic drum
- 280 lt. steel drum
- 1000 lt. IBC
- 20´ Full container load (FCL)
- 23 mt bulk in road tanker
- 24 mt Flexitank Container



# Alkaline activator solution

**hydroxide**

+ for basic trials
– soluble silica is missing
– Geopolymer binder with low physical properties

**Silica sol & hydroxide**

+ simple to use in labs
– Silica sol is made from liquid sodium silicate

**Standard waterglass & hydroxide**

+ flexible adjustment of molar ratio
+ available worldwide
– increased handling with hydroxide
– transport and storage separately
– limitation of solids content

# Geosil® liquid alkaline activator solution

- Geosil are not blends of Standard silicate with hydroxide
- new production process technology
- highest possible solids content & optimal Q-Structure distribution

Pros

- userfriendly - no hydroxide handling
- high purity of raw materials
- reproducible & controlled production process
- stable solution & long shelf life
- available in many countries
- REACH registered

Cons

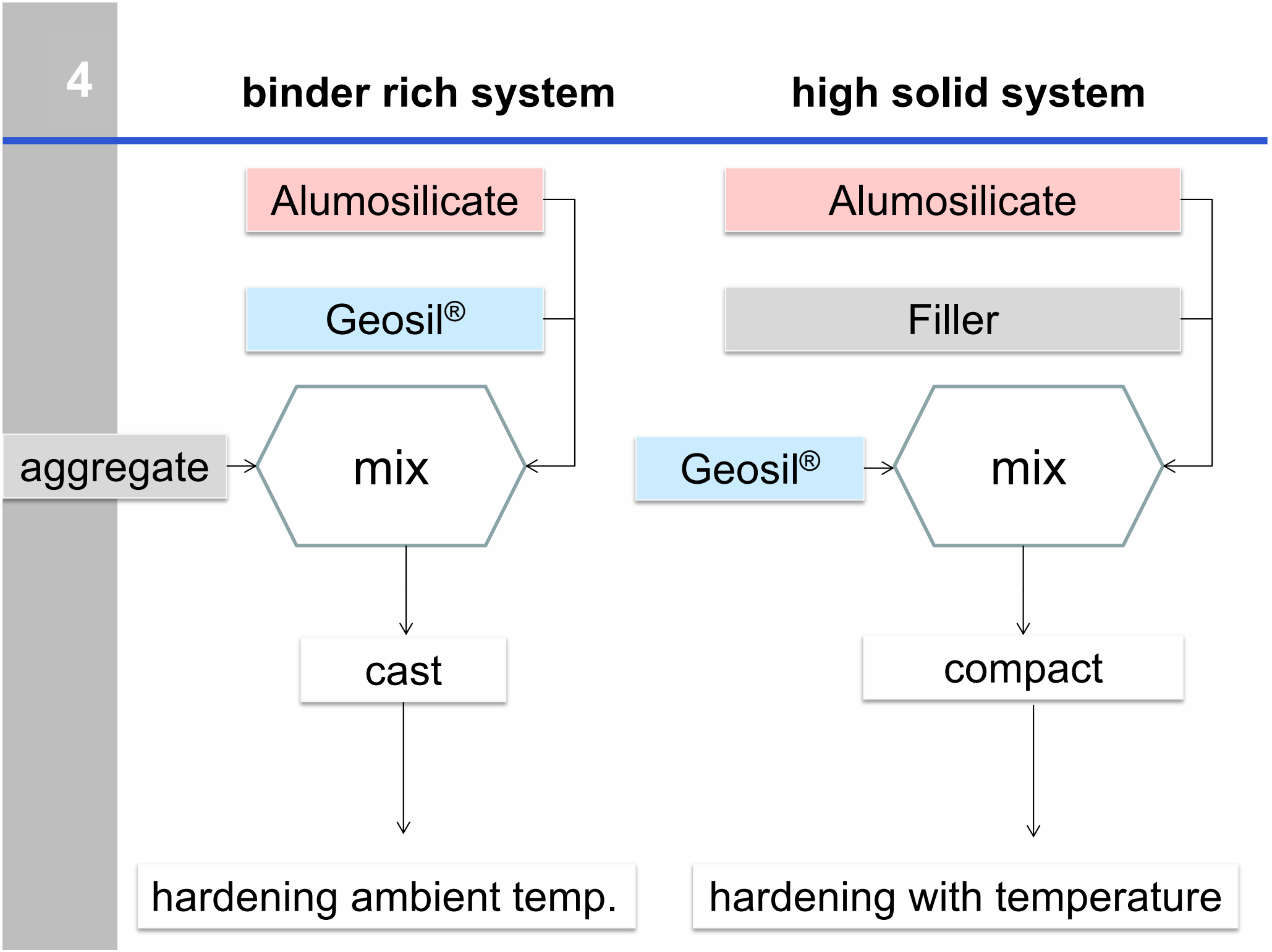
- fixed molar ratio

# GEOSIL® Products

| | Name | Type | Viscosity [20°C] | MR |
|---|---|---|---|---|
| 1 | Geosil 14515 | Potassium silicate | 20 mPas | 1,5 |
| 2 | Geosil 14517 | Potassium silicate | 20 mPas | 1,7 |
| 3 | Geosil 15517 | Potassium silicate | 130 mPas | 1,7 |
| 4 | Geosil 34417 | Sodium silicate | 450 mPas | 1,7 |

# GEOSIL® Products

| | Name | pros | cons |
|---|---|---|---|
| 1 | Geosil 14515 | high reactivity<br>high activation power<br>high mechanical properties | dangerous good |
| 2 | Geosil 14517 | good reactivity<br>good activation power<br>not dangerous good | lower reactivity &<br>mechanical properties than<br>“Geosil 14515” |
| 3 | Geosil 15517 | highest solid content<br>good activation power<br>not dangerous good | lower reactivity<br>lower mechanical properties<br>than “Geosil 14515” |
| 4 | Geosil 34417 | cheapest activator solution<br>good mechanical properties | efflorescence<br>thixotropic effect |


binder rich system
high solid system
Alumosilicate
Geosil®
aggregate
mix
cast
hardening ambient temp.
Alumosilicate
Filler
Geosil®
mix
compact
hardening with temperature

# Application with Geosil® Binder

## Binder rich

- geopolymer concrete
- geopolymer mortar
- inorganic foam A1 class
- toxic waste immobilisation
- composites
- geopolymer adhesive
- steel coating

## High solids

- acoustic panels
- thermal insulation boards
- fire protection boards
- refractory bricks
- pavement stone
- facade elements
- core binder foundry
- arts & decoration

# How Wöllner can support you

- we create customized products (blends, modified products)
- development of additives stable at high pH-values (rheological additives, water repellents)
- door-to-door logisitics solution for many countries
- individual technical support for customers

**Thank you for your attention!**