

Cembinder

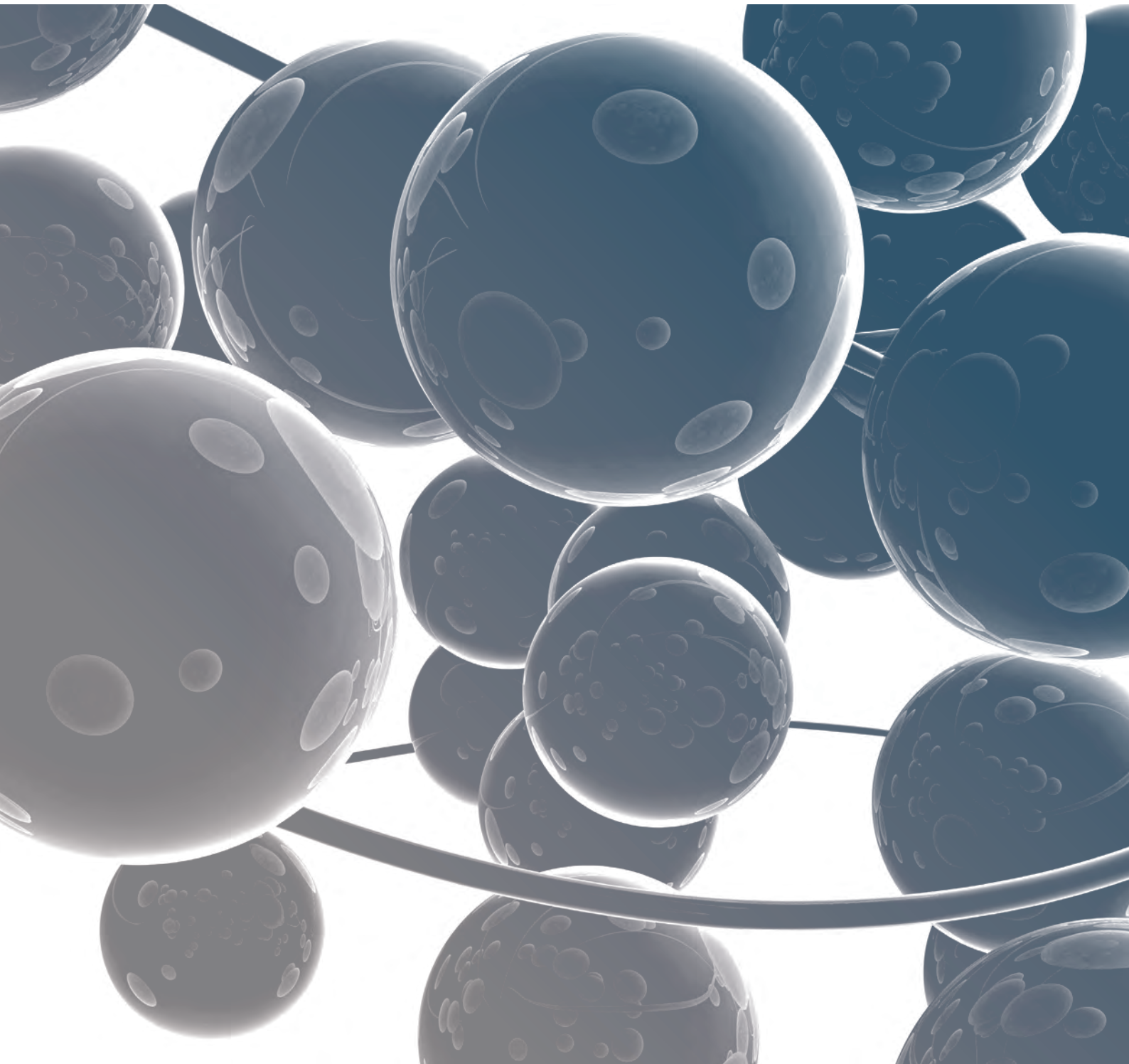
for the construction industry

Colloidal silica dispersions – uses and benefits



AkzoNobel

Tomorrow's Answers Today



Cembinder technology

creation of calcium silicate binders

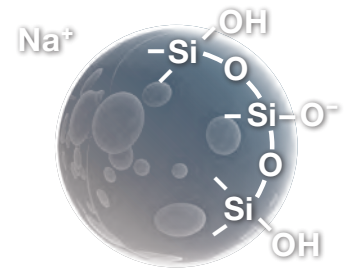
Cembinder colloidal silica

Cembinder performs exceptionally well as e.g. a stabilizer, a durability enhancer, an accelerator and a strength developer.

- Stabilizer – bleed and segregation control.
- Durability enhancer – chloride penetration reduction.
- Accelerator – set accelerator.
- Strength developer – early strength enhancement.

Cembinder particle

- Sodium stabilized
- Dispersed in water
- pH 9–11



Cembinder reaction

Calcium silicate binders are created during hydration of cement, when silica and calcium hydroxide is dissolved.

Hydration of cement (OPC)

During hydration of cement, both silica and calcium hydroxide (CH) are dissolved and become available for further reaction.



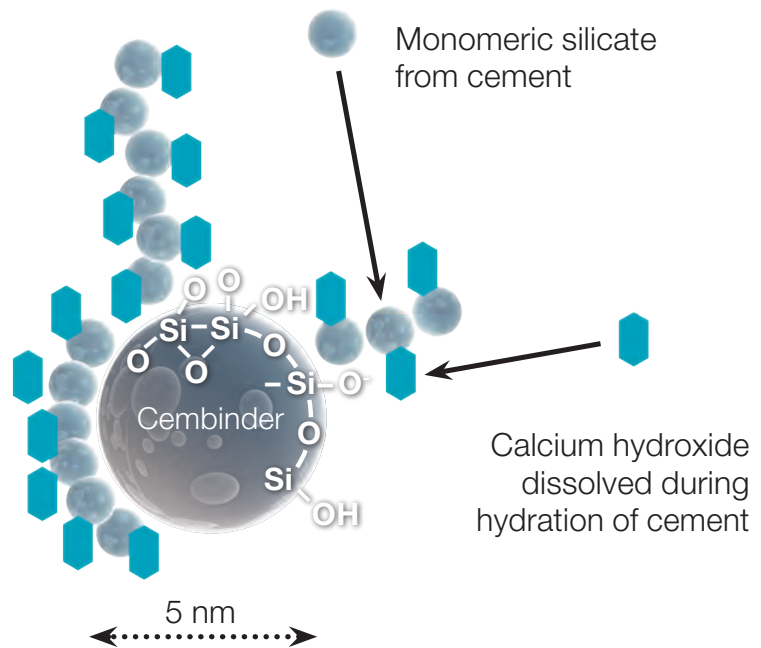
CSH gel creation

The Cembinder silica particles attract the dissolved silica and calcium hydroxide. Additional CSH binder is created.



Densification of cement

The new CSH binder enhances the cement paste density, reinforcing the structure between cement grains.

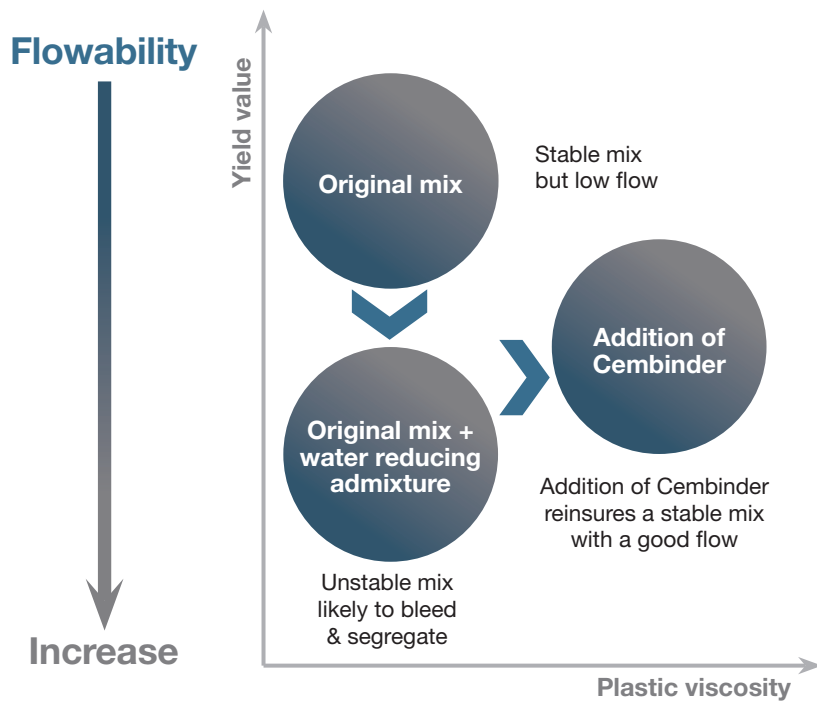


Cembinder the product line for construction industry

Specific parameter	Unit measure	Cembinder grades			
		8	45	50	75
Density	g/cm ³	1.4	1.1	1.1	1.1
SiO ₂	wt%	50	15	15	15
pH	---	9.5	9.5	10.0	10.5
Viscosity	mPas	<10	<10	<10	<10

Cembinder for superior stability and pumpability

Cembinder for segregation control



Bleeding without Cembinder



No bleeding with addition of 0.8% Cembinder 50 bwoc

Cembinder controls the segregation of aggregates. It also eliminates free water and prevents bleeding. The creation of a cohesive binder phase means improved workability and enhanced pumpability.

Product recommendations

Cembinder 8

High solid product, excellent for bleed & segregation control of mix designs with low to medium water content – **W/C ratio < 0.5**

Cembinder 45 and Cembinder 50

Products for excellent bleed & segregation control of mix designs with low to high water content – **W/C ratio 0.35 – 0.8**

Cembinder 45 is surface modified for enhanced compatibility with chemical admixtures.

Mix design of a self-consolidating concrete

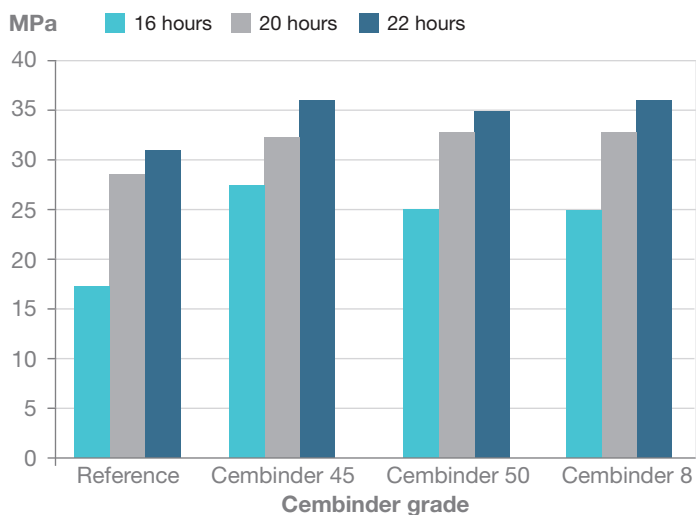
Material	kg/cbm
CEM II/LASR	400
Filler (LSP)	130
Fine aggr. 1 (0–4 mm)	191
Fine aggr. 2 (0–8 mm)	725
Coarse aggr. 1 (8–11 mm)	206
Coarse aggr. 2 (11–16 mm).....	404
Water	200
Superplasticizer (PC)	3 kg.....
Air-entraining agent.....	1.6 kg
Cembinder 45 or 50	2–4 kg

Cembinder for higher performance and early strength

Cembinder in prefabricated concrete

Early compressive strength enhancement at 23 °C

- 50–70% strength increase after 16 hours with addition of Cembinder

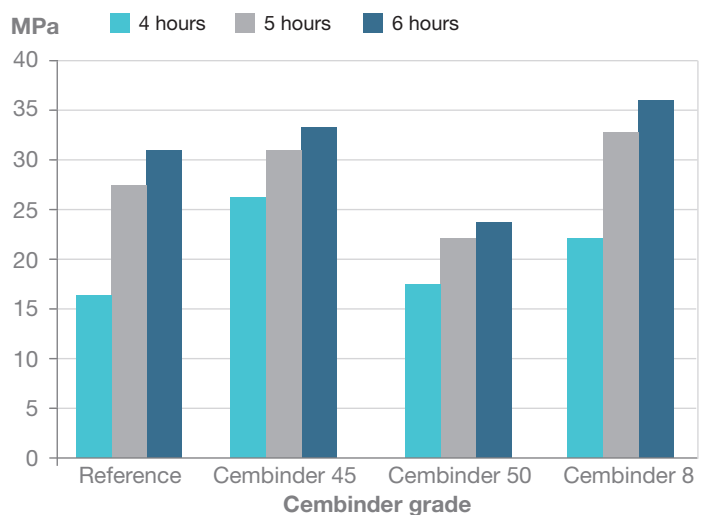


Mortar mix design

- W/C = 0.45
- S/C = 1.5
- Cem I 52,5R COUVROT, France
- Norm sand (DIN EN 196-1)
- DI water
- SP, Glenium Ace 30: 0.6% bwoc
- Cembinder: 3% bwoc

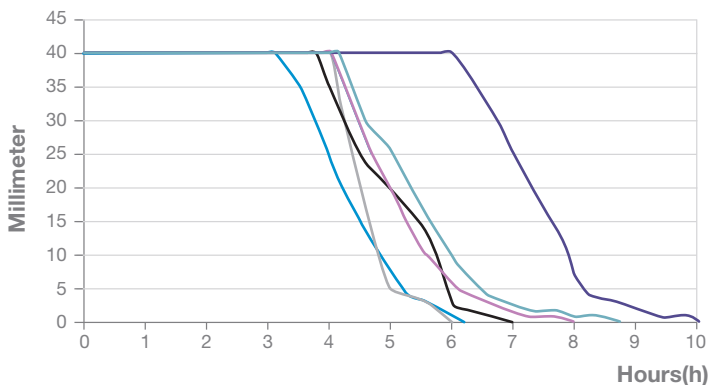
Early compressive strength enhancement at 60 °C

- 50% increase after 4 hours with addition of Cembinder



Construction: Set accelerator – cement paste

- Significantly faster setting with Cembinder addition
- Comparable setting time with commercial accelerator



- Reference
- Cembinder 75
- Commercial accelerator
- Cembinder 45
- Cembinder 50
- Cembinder 8

Mortar mix design

- W/C = 0.323
- S/C = 1.5
- Cem I N MH/LA/SR
- Norm sand (DIN EN 196-1)
- DI water
- SP: 0.37% bwoc
- Cembinder: 1% bwoc

Product recommendations

Cembinder 8

High solid content product with low surface area for prefabricated concrete applications with low to medium water content – **W/C ratio 0.3-0.5**

Cembinder 45, Cembinder 50 and Cembinder 75

Low solid content product with high surface area for prefabricated concrete applications with low water content – **W/C ratio < 0.5**

Cembinder for higher performance and durability

Cembinder in high durability concrete

Cembinder 8 with OPC

Addition of Cembinder 8 in Portland cement is effective at a very low water to cement ratio. In the example shown, with a water to cement ratio of 0.28 and a 5% addition of Cembinder 8, the RCP is reduced with 60% down to a RCP value of 395.

At water/cement ratio 0.30–0.34, the dosage of Cembinder was 2.5% of the cement, giving a RCP reduction of 35–40%.

The cement used in the concrete was OPC from Arabian Gulf Cement CO.

Cembinder 8 combined with OPC/FA or GGBFS

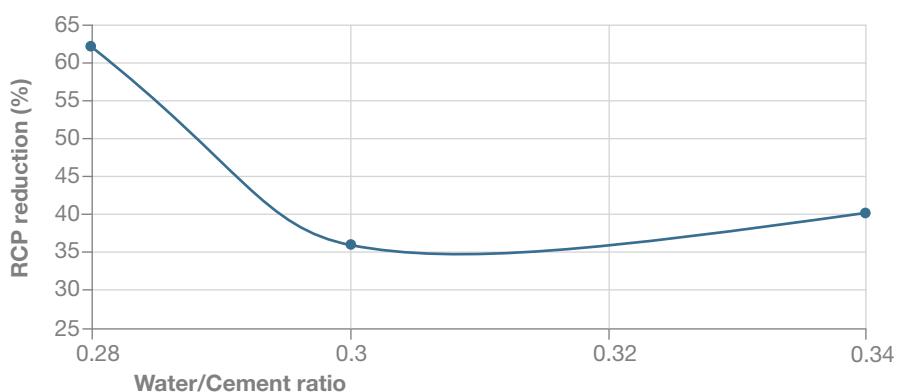
Combining Cembinder 8 with OPC/FA increases the particle packing of the binder system, thus reducing the permeability.

Cembinder 8 chemically interacts with the free lime, creating a new CSH-binder phase between the fly ash and the cement grain. Example 1 has an OPC to fly ash ratio of 85:15 and a water to binder ratio of 0.40.

Example 2 has an OPC to GGBFS ratio of 80:20 and a water to binder ratio of 0.35.

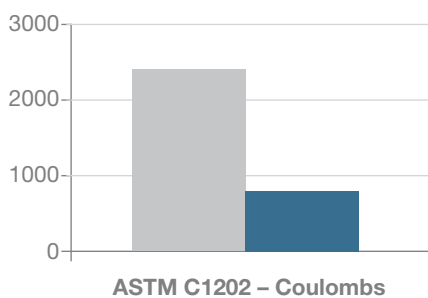
The Cembinder 8 dosage was 5% by weight of the binder, giving a RCP reduction with more than 100%. A higher content of fly ash and lower water to binder ratios can reduce the permeability further.

Rapid chloride penetration – a function of water to cement ratio



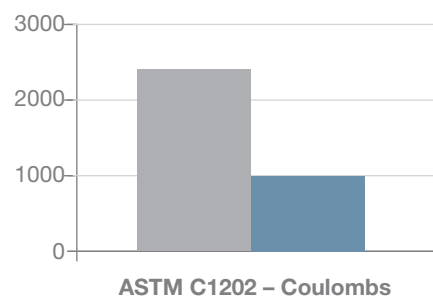
1. Rapid chloride penetration with Cembinder and OPC/FA (fly ash)

■ Control OPC/FA
■ OPC/FA Cembinder 8 5% addition bwob



2. Rapid chloride penetration with Cembinder and OPC/GGBFS (slag)

■ Control OPC/GGBFS
■ OPC/GGBFS Cembinder 8 5% addition bwob



Product recommendations

Cembinder 8

- High cement containing concrete
- Durability enhancement of concrete
- High strength concrete

Typical dosages: 1–5 wt%
Cembinder product on cement



Further information

For more detailed product information, please refer to our product guide. For samples, technical service and further information, please contact your nearest office, visit our website at www.colloidal silica.com, or send an e-mail to colloidal silica@akzonobel.com

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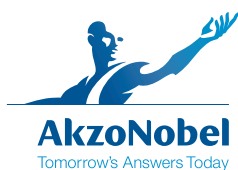
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