

SuperPozz[®]

Product information sheet

A highly reactive aluminosilicate pozzolan. As a constituent of a concrete mix, the product's pozzolanic activity increases strength and durability. Its unique particle size distribution and spherical shape make it the preferred material where improved workability and/or water reduction is required.



AshResources
Fly ash products

A SUBSIDIARY OF AFRIMAT

AFRIMAT[®]



Typical characteristics

Physical

The mean particle diameter of SuperPozz® typically ranges between 3,9 and 5,0 microns, with over 90% of the material having a particle diameter of less than 11 microns. The bi-modal distribution of SuperPozz® effectively fills the void spaces between the fine aggregates and the cementitious component, creating an ideal 'fine filler' effect. This feature is particularly beneficial in high consistence and self-compacting concretes.

Chemical

SuperPozz® contains the same oxides as Portland cement, being made up of the same basic components but in different proportions and mineralogy. Portland cement is rich in lime (CaO) while SuperPozz® has a lower lime content. SuperPozz® can be used in conjunction with other cement extenders in concrete mixes. Technical evaluations have shown that concrete performance is further enhanced by using SuperPozz® in ternary blend combinations with either other grades of fly ash or ground-granulated blast furnace slag (GGBS).

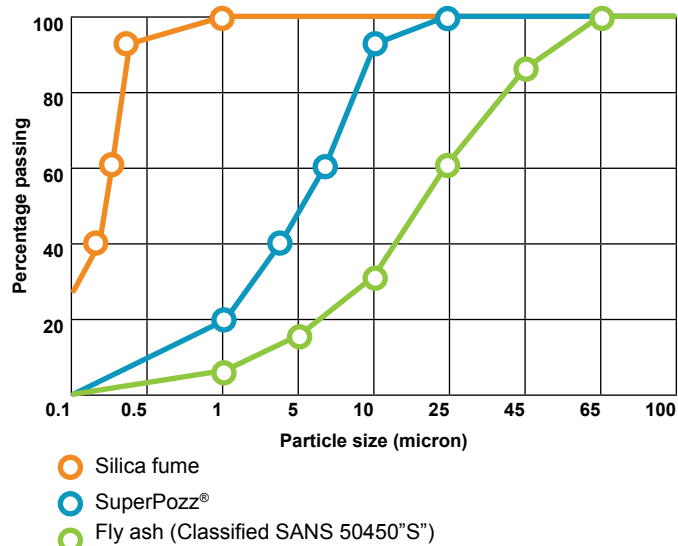
Hydration reaction

Cement + H₂O = Calcium silicate hydrate (CSH) + Ca(OH)₂
 Ca(OH)₂ + SuperPozz® = CSH (additional, durable cement gel)

Technical support

Ash Resources provides a technical advisory service for on-site assistance and advice on mix design, evaluation trials and handling of their products. Technical data and guidance can be provided for all products used in concrete and mortars.

Typical particle size distribution



Typical product characteristics

Relative density	2,0 - 2,4
Theoretical surface area (cm ² /g)	13 000
pH in water	11 - 12
Moisture content % (At point of dispatch)	< 0,5
Colour	Light grey
LOI % (Loss on Ignition)	< 1,5
Carbon content (%)	< 1,0





Typical chemical compounds

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO
SuperPozz®	53.5	34.3	3.6	4.4
Cement	22.6	4.3	2.4	64.0

Quality assurance

Ash Resources' products are manufactured under a Quality Management System which conforms to the requirements of ISO 9001. The Quality Management System is registered and audited by SANS.

Typical performance properties

Water reduction

Values obtained for concrete with equal binder content (400 kg/m³, equal HRWR dosage and constant workability).

Improved workability

Values obtained for concrete with equal binder content (400 kg/m³) Equal w/c ratio and constant superplasticiser dosage.

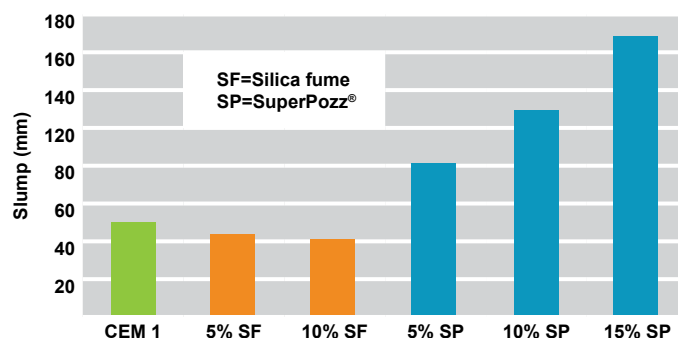
	Control (CEM I)	SuperPozz (10%)
CEM I	400	360
SuperPozz®	-	40
Water content	163 litres	141 litres
Water reduction	0	22 litres
w/b ratio	0,41	0,35
Slump (mm) initial	125mm	125mm

Compressive strength (MPa)

24 hours	15,5	20,5
7 days	52,0	58,5
28 days	70,5	82,0
90 days	74,0	91,0

Workability

Though never specified, workability is one of the most critical characteristics for fresh concrete. Workability refers to the ease of handling, placing and finishing of the fresh concrete. Approximately 30 litres of water are theoretically required to hydrate 100kg of cement. A normal concrete mix will generally need up to twice this amount of water, the additional water being required to facilitate handling and placing. This "water of convenience" not only increases the water/cement ratio, requiring more cementitious binder to achieve the design strength, but also increases the possibility of segregation. SuperPozz® addition actively reduces the water demand of a concrete mix, producing higher strengths and superior cohesion at higher workability levels, without the requirement for additional water.



Packaging

SuperPozz® is available in Bulk (pressurised bulk powder tanker by road), 1,25 ton FIBC's, jumbo bags with plastic inner liner, and 25kg plastic lined, repulable paper sacks - all packaging can be arranged in consultation with Ash Resources. Sample product can be obtained from Ash Resources and will be provided in 20kg buckets.

Applications

Concretes containing SuperPozz® can be used in virtually any application where Portland Cement concretes are used. With its unique properties, it is particularly suited for high performance applications including the manufacture of proprietary pre-bagged repairs, precision grouts and flowable screeds. In marine environment concretes, and in any other application where durability is a fundamental requirement, SuperPozz® is the preferred addition to the mix.

Recommended uses of SuperPozz® concretes

Excellent

- High performance readymix and precast concrete
- Marine environment concretes
- Pumped concrete
- Wet-sprayed concrete
- Proprietary pre-bagged formulations
- Self-Compacting Concrete (SCC)

Good

- Mass concrete sections
- Concrete tiles
- Industrial floors
- Fibre cement products

Compatibility

With other cementitious materials and admixtures, SuperPozz® is suitable for use with all types of Portland cement and cement replacement materials, e.g. GGBS, fly ash, silica fume and metakaolin. SuperPozz® is compatible with a wide range of admixtures working particularly well in high performance concretes when used in conjunction with superplasticisers.



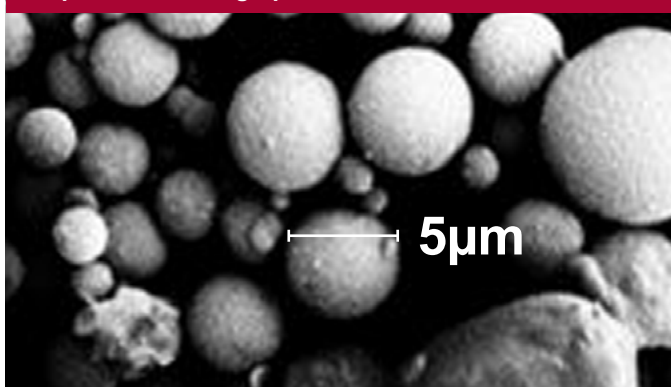
Mix design

When using SuperPozz® in concrete, normal mix design procedures and guidelines can be used taking into account the unique benefits and properties contributed by its addition.

Features

- High-performance concrete with a low w/c ratio, high early and later-age strength and superior durability is made possible with the inclusion of SuperPozz® in the mix
- SuperPozz® can be used in the production of Self-Compacting Concrete (SCC)
- Low w/c ratio SuperPozz® concrete exhibits decreased permeability, reduced Sulphate Attack and reduced Alkali Silica Reactivity (ASR)
- The lubricating action of SuperPozz® reduces water content and drying shrinkage

SuperPozz® micrograph



Fresh Concrete Properties

Performance

SuperPozz® imparts physical as well as chemical benefits when used in concrete. In fresh or plastic concrete, the spherical shape and ultra-fine particle size of SuperPozz® significantly improves the rheology of the mix. Consequently:

- The water content of the concrete can be reduced. As a guide, the mix water should be reduced by a minimum of 10%
- The workability of the concrete is improved at the same water content without bleeding or segregation of the mix normally associated with highly workable concrete
- Pumpability is greatly increased by the use of SuperPozz® and it is often possible to pump mixes without altering the fine aggregate content. In more conventional concretes, the coarse aggregate content can be increased e.g. at a SuperPozz® addition of 15%, an increase in stone content of $\pm 5\%$ can be achieved
- SuperPozz® addition can lead to more cost-effective dosage levels of dispersing admixtures such as superplasticisers and new generation PCE's

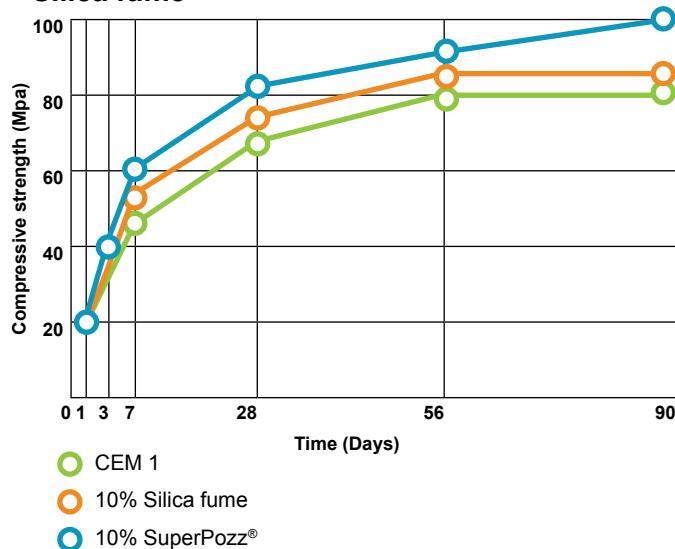
Hardened concrete properties

Strength development

As can be seen from the following graph, the mix containing SuperPozz® has comparable strength to silica fume concrete at all ages. It also illustrates the continued strength gain up to 90 days due to the pozzolanic properties of SuperPozz®.

The typical strength development of concrete containing SuperPozz® is illustrated below:

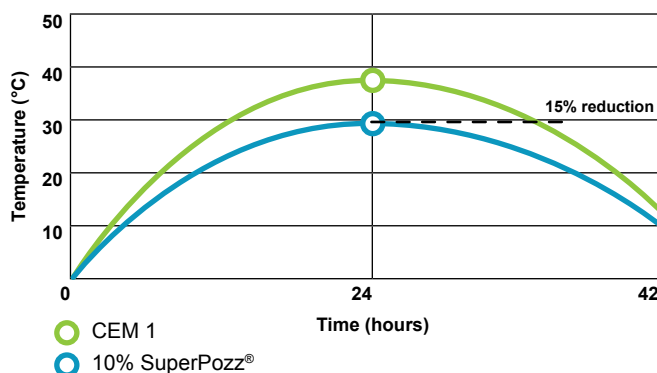
Strength development over time vs. CEM I and Silica fume



Heat of hydration

By reducing the water content with a subsequent reduction in the cement content, SuperPozz® is very effective in the control of the heat of hydration. At SuperPozz® addition levels of between 10 - 15%, reduction in the maximum temperature generated can be in the order of 15%.

Heat rise of SuperPozz® concrete mixture, Grade 45





Storage

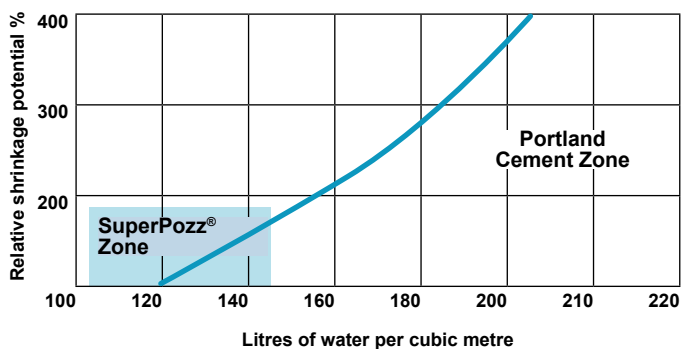
SuperPozz[®], when stored correctly, has an indefinite shelf life. Like cement, SuperPozz[®] must be protected from contamination and moisture. The product can be stored in bulk in a clean, dry storage silo. Advice on aeration, which may be required due to the product's extreme fineness and rounded shape, is available from Ash Resources on request.

Benefits

Relative shrinkage potential

The largest contributor to shrinkage is water content. SuperPozz[®] concrete demands less water, potentially reducing shrinkage by up to 75%.

Shrinkage potential of SuperPozz[®] concrete mixtures compared to Portland Cement



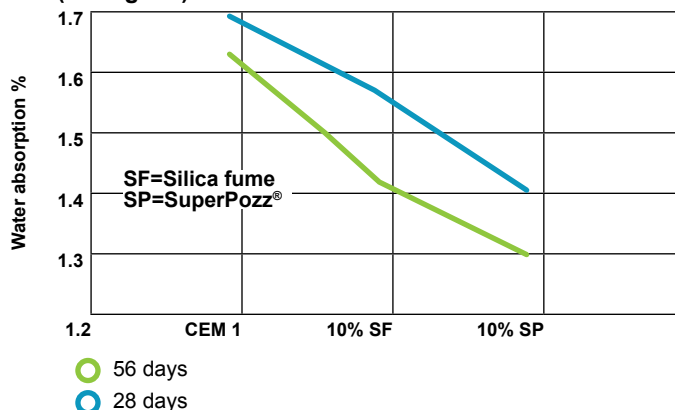
Source: Framework for durable concrete

Water absorption

The pozzolanic reaction of SuperPozz[®] in concrete produces additional calcium silicate hydrate gel which fills pore spaces. This results in a dense paste matrix. The decrease in water absorption from 28 to 56 days reflects an increase in density as a result of the refinement of the pore structure.

Water absorption

Values obtained for concrete with equal binder content (400 kg/m³)



Durability

SuperPozz[®] protects concrete in a number of ways. Hardened SuperPozz[®] concrete is less permeable because SuperPozz[®], unlike other high reactivity pozzolans, reduces the amount of water needed to produce a given slump. Coupled with its high pozzolanic reactivity, creating more durable calcium silicate hydrate (CSH) gel, SuperPozz[®] reduces the rate of ingress of harmful chlorides and other corrosive salts.

Chloride ingress

The use of SuperPozz[®] as a partial replacement of cement improves impermeability, significantly reducing both the diffusion and penetration of chlorides into concrete. In addition, research has shown that chemical binding of chlorides is improved by aluminosilicate pozzolans. The alumina content of SuperPozz[®] exceeds 30%.

Sulphate resistance

SuperPozz[®] addition is an ideal means of providing Sulphate resistance. SuperPozz[®] decreases the available sulphate, preventing the formation of ettringite, which could otherwise form expansive compounds.

Alkali-silica reaction

Where aggregates are classified as alkali-reactive, SuperPozz[®] has the ability to react with alkali hydroxides in Portland cement paste, making them unavailable for reaction with these aggregates, and combating this expansive reaction.

CO₂

Reduces the carbon footprint of concrete.

Health and Safety

No known significant health risks are associated with SuperPozz[®] but high concentrations of dust may cause irritation. It is recommended that suitable protective clothing, gloves and eye/face protection is worn. In case of contact with eyes, rinse immediately with plenty of clean water and seek medical advice. For further details please consult the Material Safety Data Sheet (MSDS) for SuperPozz[®].

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