

Product Data Sheet

microash™

ULTRAFINE FLY ASH

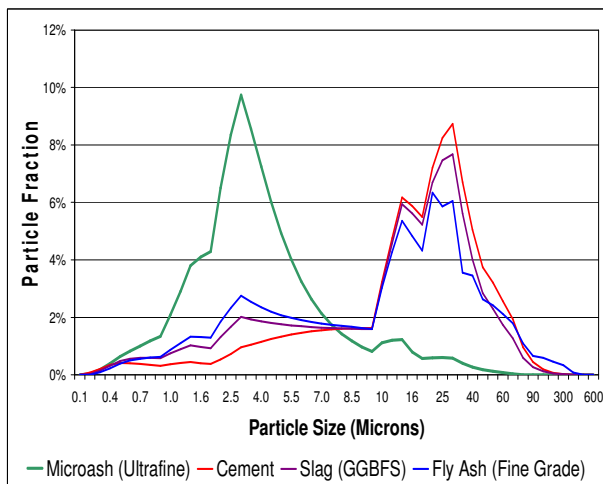
THE PRODUCT

microash™ is a highly reactive aluminosilicate pozzolan¹ designed to increase strength, reduce permeability and increase the durability of concrete. Its effectiveness in concrete is derived from three main characteristics:

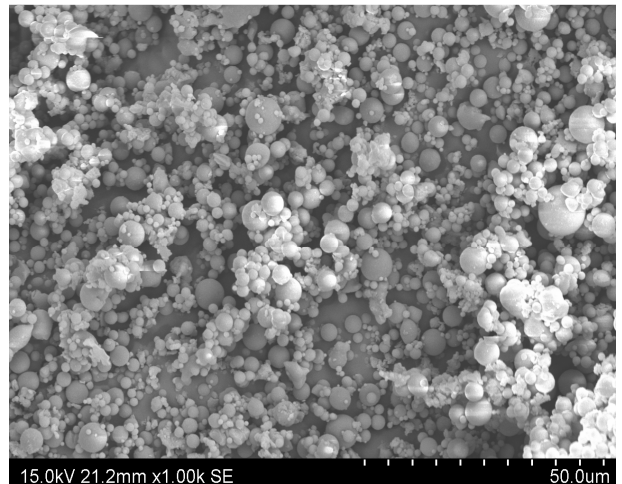
- spherical shape
- particle size distribution
- chemical composition

microash™

- is 100% ultrafine fly ash
- conforms to the requirements of AS 3582.1 (Special Grade Fly Ash)



Particle Size Distribution



Scanning Electron Micrograph

Element	microash™
SiO ₂	70.70%
Al ₂ O ₃	20.70%
Fe ₂ O ₃	3.90%
CaO	1.13%
K ₂ O	1.09%
TiO ₂	0.92%
MgO	0.77%
Na ₂ O	0.26%
P ₂ O ₅	0.15%
MnO	0.05%

Typical Properties AS3582.1-1998	microash™
LOI	0.7%
Fineness	99%
Moisture Content	0.01%
Sulfuric anhydride content	0.2%
Available Alkali	0.2%
Relative Density	2.35
Relative Water	95%
Relative Strength	110%
Chloride ion content	0.001%

APPLICATIONS

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microash™ is Ideal for High Performance Concrete

- Decreases water demand
 - Lowers concrete permeability
 - Achieves higher strengths
 - Continues developing strength at late age
 - Improves durability
 - Improves resistance to alkali silica reactivity
 - Improves resistance to sulfate attack
 - Reduces chloride ingress
 - Enhances pumpability, workability, finishability
- Typical High Performance Concrete Applications
- High Strength Concrete
 - Water Retaining Structures
 - Marine Environments
 - Self Compacting Concretes
 - Precast Concrete

microash™ is Ideal for Shotcrete Applications

- Improves mix cohesion
- Improves shotcrete adhesion
- Reduces shotcrete rebound

Typical Shotcrete Applications

- Pools
- Mine Walls & Roofs
- Tunnelling
- Road Cuttings
- Retaining Walls

microash™ is Ideal for High Performance Mortars and Grouts

Typical Applications

- Flowable Fills
- Self-Levelling Grouts
- Repair Grouts

microash™ is an Ideal Filler for Non-Cementitious Applications

- Where a controlled particle size range is required

Typical Applications

- Extruded plastics and rubber compounds
- Adhesives

PERFORMANCE IN CONCRETE

microash™ performance in concrete is derived from three main characteristics:

- **Spherical Shape**

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Microash™ consists predominantly of very fine spherical particles which act as a lubricant in a concrete mix – the “ball bearing effect”. The spherical particles assist in reducing the water demand and in the reduction of drying shrinkage in concrete.

- **Particle Size Distribution**

Microash™ has a “bell-shaped” particle size distribution with a nominal median particle size of 3.5 microns. This compares with a typical median particle diameter of cement of 12 microns.

Microash™ efficiently fills the voids between cement grains and other fine particles in concrete to improve particle packing. The dense paste matrix resulting from the use of Microash™ actively decreases permeability and improves strength gain characteristics.

- **Chemical Composition**

Microash™ is a highly reactive aluminosilicate pozzolan¹. Its reactivity is enhanced by its high surface area.

Microash™ combines with calcium hydroxide, formed by the hydration of Portland cement, to form additional calcium silicate hydrate gel to fill pore spaces and create a denser concrete paste mix.

Hydration reactions:



The ability of Microash™ to react with lime ensures more efficient cement hydration and increased strength development over time.

The combination of shape, size and chemistry provides the basis for improved workability, water reduction and increased strength and durability.

Compatibility

microash™ is compatible with other cementitious materials and a wide range of admixtures.

Microash™ is suitable for use with all types of Portland cement and supplementary cementitious materials:

- Fly ash
- Ground granulated blast furnace slag (GGBFS)
- Silica fume

Microash™ is also compatible with a wide range of admixtures, working particularly well in high performance concretes when used in conjunction with high range water reducers.

Typical Performance Properties – Plastic Concrete

Workability

Workability is one of the most critical characteristics of fresh concrete. Workability refers to the ease of handling, placing and finishing of fresh concrete. The spherical shape and ultra-fine particle size of Microash™ significantly improves the rheology of the mix, resulting in:

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- Highly workable concrete
- Reduced segregation potential
- Enhanced pumpability

Shotcrete Applications

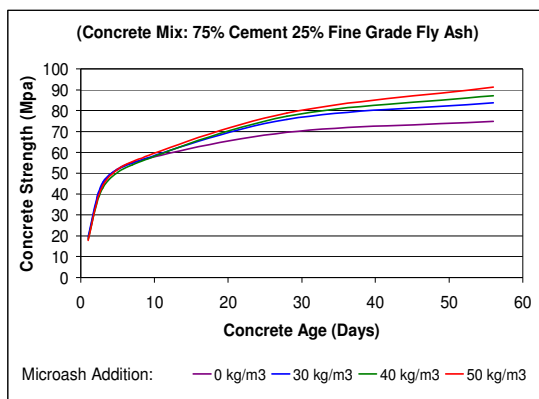
The addition of Microash™ in shotcrete improves mix cohesion and shotcrete adhesion, allowing increased shotcrete thickness, and also reduces shotcrete rebound. Microash™ can further improve shotcrete mixes where the fine aggregates used are deficient in fines or have poor particle shape.

Typical Performance Properties – Hardened Concrete

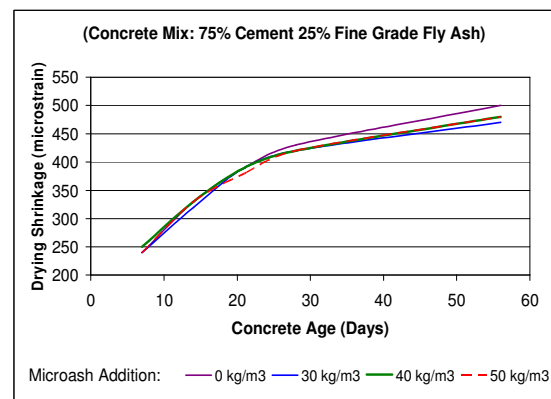
Strength Development

Strength development of concrete containing Microash™ continues well past 28-days due to the pozzolanic properties of Microash™.

The chart below shows the comparative strength development of concrete made with a 75:25 blend cement:ash blend (the control) and similar concrete dosed with increasing levels of Microash™.



Concrete Strength Development



Concrete Drying Shrinkage

Drying Shrinkage Potential

One of the largest contributors to concrete drying shrinkage is water content. The spherical shape of Microash™ particles through their lubricating and particle packing actions assists in the reduction of water content and thereby the reduction of drying shrinkage of concrete.

Concrete Durability

The dense concrete matrix, achieved using Microash™, results in a decrease in concrete permeability and consequential improvement in concrete durability. This is evidenced by typical test results for sorptivity and chloride diffusivity tests.

Sorptivity

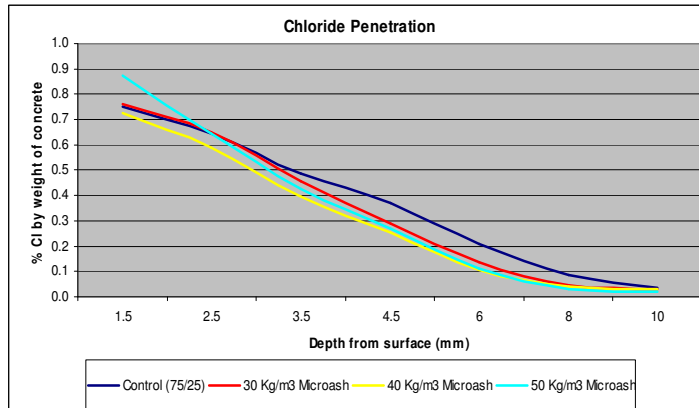
The use of Microash™ reduces the degree of interconnectivity of capillary pores in concrete leading to reduced sorptivity and increased concrete gel matrix density due to the ongoing hydration of silica-alumina hydrates.

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Chloride Ingress

The use of Microash™ as a partial replacement of cement reduces permeability thereby reducing both the diffusion and penetration of chloride ions into concrete. Microash™ contributes to the binding of the chlorides due to the additional calcium aluminate hydrates that are formed in the hydration reactions.



Chloride Ion Diffusion Rate Nord Test NT443 - 1995	
Microash Addition	E-12m ² /sec
0 kg/m ³	3.28
30 Kg/m ³	2.61
40 Kg/m ³	2.09
50 Kg/m ³	1.90

Chloride Ion Diffusion

Sulfate Resistance

Microash™ addition improves sulfate resistance by decreasing the ability of sulfate ions to penetrate the concrete matrix. Microash™ chemically binds with free lime thereby decreasing the ability of sulfates to form ettringite and other expansive compounds.

Alkali-silica Reaction

Reactions of alkalis with Microash™ result in a reduction of the available alkalis, therefore resulting in less alkalis being available for reaction with the silica in the aggregate.

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Addition Rates

Typical addition rates of Microash™ in concrete range between 3% and 12% by weight of the cementitious content of the mix. It is recommended that concrete trials are conducted to assess the appropriate addition rates for particular applications.

Good Concrete Practice

To achieve the optimum benefits of Microash™, proper curing in line with “good concrete practice” should always be followed.

A useful publication is the “Guide to Concrete Construction” available from the Cement Concrete and Aggregate Association at www.ccaa.com.au

Availability

Microash™ is available in:

- Bulk Tanker loads
- 10kg Dispersible Bags (designed to disintegrate in a transit mixer)

Storage

Microash™, like cement, must be protected from contamination and moisture. Bulk product should be stored in a clean, dry storage silo with adequate dry-air aeration. Bagged product should be stored off the ground in a clean, dry environment. There may be some agglomeration of particles when stored.

Health and Safety

Refer to the Microash™ Material Safety Data Sheet available at www.flyashaustralia.com.au

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COMPANY DETAILS



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¹ Pozzolan A siliceous or alumino-siliceous material, which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties.