Concrete the column size can be reduced, resulting in lower concrete volume as well as reduced formwork. At the same time, the amount of vertical steel reinforcement can be reduced. Through optimization of column size, amount of reinforcement and concrete strength, the least expensive column is achieved. In addition to reduction in initial cost, smaller columns result in increased rentable floor space.

In bridge construction high-strength microsilica concrete is used to increase span length, increase girder spacing and/or produce shallower sections.

High strength microsilica concrete will also provide high early strengths for fast track construction projects and precast applications.

**Chloride and Sulphate Protection**

**General**

Reinforcement in concrete is normally protected against corrosion. A high alkalinity gives the pore water a pH if 12.5-14, and this causes the formation of protective passive oxide layer on the steel surface.

Active passive film is broken or over larger areas. This can happen as a result of chloride ingress or carbonation. Chlorides are a common cause of the breakdown of the passive layer. If a sufficiently high concentration of chloride ions is established on the steel surface, the passive layer will be disrupted locally. Because the flaw will be the small anode to the larger cathode of passive steel intense corrosion can then take place (pitting).

Sulphates are common in soil, ground water, sea water and effluent discharges from industry. Damage caused by sulfates has been observed particularly in foundations, sewage systems and marine structures.

**Summary**

The use of Expansilica is very favorable in concrete which is subject to chloride attack (road salt, sea salt). The addition of Expansilica will strongly reduce the penetration of chlorides into the concrete and therefore delay the onset of corrosion. Furthermore, the use of Expansilica in concrete will reduce the rate of corrosion after initiation. Similarly, it will make concrete at least as resistant to sulphate attack as concrete produced with sulfate resistant element. In addition Expansiclia will give concrete with increased strength and reduced permeability.

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**Densified and Undensified Microsilica for concrete**

**Introduction**

Microsilica is a pozzolana – a term derived from the ancient Italian town of Pozzuoli, where volcanic ash was mixed with burnt lime to make cement. This means that it will react with the calcium hydroxide given off by the cement hydration and form more of the calcium silicate hydrate crystal structure that binds concrete together. Because the microsilica is typically over 90% SiO₂, the reactive component, it is very powerfull pozzolana.

**What is Microsilica?**

Microsilica is a mineral composed of ultrafine amorphous spheres of silicon dioxide (SiO₂), produced during the manufacture of silicon or ferrosilicon. This tightly controlled electro-metallurgical process involves the reduction of high purity quartz in electric arc furnaces at temperatures of over 2000°C. The microsilica is formed when SiO gas, given off as the quartz reduces, mixes with oxygen in the upper parts of the furnace.

Here the SiO is oxidized to SiO₂ condensing into the pure spherical particles of microsilica forming the major part of the smoke or fume from the furnace. Hence the alternative names for the material – condensed silica fume or silica fume.

The average particle is 0.15 micron in diameter, meaning that each microsphere is 100 times finer than a cement grain. In a typical mix, with a 10% dosage of microsilica, there will be between 50,000 and 100,000 microsilica particles per grain of cement.

**Advantages of Microsilica**

**High Strength Concrete**

The addition of Microsilica allows production of high- and ultra-high strength concrete.

Cast-in-place as well as precast concrete with compressive strength reaching more than 100 MPA can be produced on industrial scale.

Architects and design engineers are given greater design flexibility, and owners enjoy extended service life since concrete durability is greatly improved with high strength microsilica concrete.

The most well known application area for high strength concrete is high-rise buildings. High strength concrete provides the most cost efficient way to carry vertical loads to the building foundation. By utilizing high strength concrete the column size can be reduced, resulting in lower concrete volume as well as reduced formwork. At the same time, the amount of vertical steel reinforcement can be reduced. Through optimization of column size, amount of reinforcement and concrete strength, the least expensive column is achieved. In addition to reduction in initial cost, smaller columns result in increased rentable floor space.

In bridge construction high-strength microsilica concrete is used to increase span length, increase girder spacing and/or produce shallower sections.

High strength microsilica concrete will also provide high early strengths for fast track construction projects and precast applications.

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PACKING

The product is supplied in a range of packaging:

- 25 kg paper bags.
- Big bags in a variety of designs and sizes depending on product.

Special packaging can be supplied on request

Product Form

The product is available in two main forms.

- Undensified
  With a typical bulk density of 200 – 350 kg/m³
- Densified
  With a typical bulk density of 500 – 700 kg/m³

DOSAGE

The optimum dosage of Expansilica to meet specific requirements should always be determined by trials using the materials and conditions that will be experienced in use. The normal dosage range is 5 – 15% by weight of cement.

Properties

<table>
<thead>
<tr>
<th>Chemical and physical requirements</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>SiO₂ (%)</td>
<td>&gt; 85</td>
</tr>
<tr>
<td>SO₃ (%)</td>
<td>&lt; 2.0</td>
</tr>
<tr>
<td>Cl (%)</td>
<td>&lt; 0.20</td>
</tr>
<tr>
<td>Free Si (%)</td>
<td>&lt; 0.2</td>
</tr>
<tr>
<td>Loss on Ignition, LOI (%)</td>
<td>&lt; 3.0</td>
</tr>
<tr>
<td>Specific Surface (BET – m²/gram)</td>
<td>18-25</td>
</tr>
<tr>
<td>Pozz. Activity Index (%)</td>
<td></td>
</tr>
<tr>
<td>7 days normal curing</td>
<td>&gt; 90</td>
</tr>
<tr>
<td>28 days normal curing</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>Retained on 200 micron sieve (%)</td>
<td>&lt; 3.0</td>
</tr>
<tr>
<td>Retained on 45 micron sieve (%)</td>
<td>&lt;10</td>
</tr>
</tbody>
</table>

Making of Silica Fume Concrete in The Labarotray

1. Place 75 % of water in mixer
2. Add coarse aggregate
3. Add silica fume slowly into the revolving mixer and Mix for 1.5 minutes
4. Add cement and fly ash or slag cement, if being used, slowly in to the revolving mixer and Mix for 1.5 minutes
5. Add fine aggregate
6. Add remaining 25% of water with admixture and mix for 3 minutes.
7. Rest 3 minutes
8. Mix 5 minutes
Important note

Expanchem Fospak products are guaranteed against defective materials and manufacture and are sold subject to its standard terms and conditions of sale, copies of which may be obtained on request. Whilst Expanchem Fospak endeavours to ensure that the technical information on this data sheet is correct at the time of printing, it is the customer’s responsibility to satisfy himself, by checking with the company that this information is still current at the time of use, that the product is suitable for the intended application, and that the actual conditions of use are in accordance with those recommended. Because Expanchem Fospak has no control over the conditions of use of its products, all recommendations or suggestions regarding the use of these products are made without guarantee.

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