



# Fosroc Solutions for Admixtures

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*constructive solutions*



*constructive solutions*

The FOSROC brand stands synonymous with

■ innovation

■ quality

■ reliability

## Introduction

Fosroc is an international supplier of high performance chemicals for the construction industry. It operates primarily in Europe, the Middle East and Asia Pacific through a network of operating companies and distributors.

Fosroc's product portfolio is made up as follows:

- Additives for the cement and readymix / precast concrete industries
- Formulated cement based products for grouting, concrete repair and flooring markets
- Formulated polymer based products for waterproofing, sealing and protection of structures



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Fosroc's strategy is to continue to grow in its selected markets and differentiate itself from competitors through a combination of innovative technological development and excellent local customer support.

New technology development is carried out at regionally based laboratories throughout the world, under the direction of the company's Group Development function.

Customer support is delivered through locally based operating companies equipped with manufacturing and local technical development facilities.

Seventy years of experience in solving problems have gained FOSROC the acknowledgement as "market leaders" in quality production and supply of the most comprehensive range of high performance constructive solutions.

## Quality, Standards and Specifications

- FOSROC is an ISO 9001:2000 and ISO 14001 certified company which ensures that the quality of all FOSROC products and services and the level of customer satisfaction are on par with the highest standards in the concrete industry.
- As a clear indication of continual improvement in safety, quality and environmental standards, FOSROC was awarded the OHSAS 18001 certification.



# Admixtures

## Definition

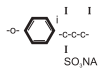
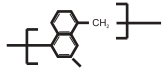
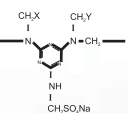
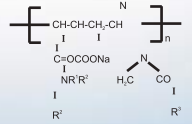
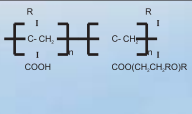
BS EN 934-2 defines ADMIXTURES as “materials added during the mixing process of concrete, in a quantity not more than 5% by mass of cement content of the concrete, to modify the properties of the mix in the fresh and/or hardened state”.

Admixtures play a vital role in production of quality concrete and mortars in all segments of the industry - Readymix, Precast and Site-batch. Admixtures add value and contribute to successful production of concrete for specialised applications, environmental considerations and long-term durability.

## History

### History of admixtures dates back to 7000 BC.

- **300 BC - 476 AD** Animal fat, milk and blood were used as admixtures to increase the properties of pozzolanic cement. These structures still exist today.
- **1930** Drum mixer trucks were introduced - similar to today's concrete mixers.
- **1960's** Superplasticisers were originally developed in Japan and Germany.
- **Mid 1970's** Superplasticisers introduced in the US.
- **1980** ASTM C 494 was modified to include high-range water-reducing admixtures
- **1985** Silica fume was introduced as a pozzolanic additive.
- **1990's** Introduction of the PCE technology for self compacting concrete.

Year	Type	Chemical structure
1930	MLS (Modified Lignin-sulphonate)	
1970	NS (Naphthalene sulphonate)	
1980	MS (Melamine sulphonate)	
1990	VC (Poly Vinyl copolymer)	
2000	PCE (Poly Carboxylic copolymer)	

### FOSROC's comprehensive and much acclaimed range of products include:

- Plasticisers/water reducing agents [WRAs]
- Superplasticisers
- Air-entrainers
- Retarders
- Accelerators
- Pumping aids
- Specialty admixtures

### Conventional Admixtures and their limitations

Conventional admixtures perform on the principal of reduction in surface tension and/or electrostatic repulsion between cement particles, thus releasing the entrapped water and changing the rheology of concrete.

### Limitations of conventional admixtures:

- Difficult placement in highly congested reinforced sections
- High dosage + excessive retardation at very low water : cement ratios

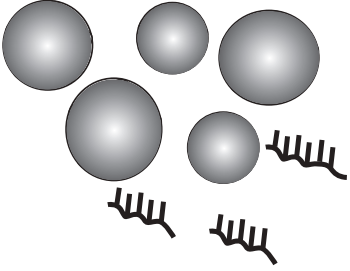
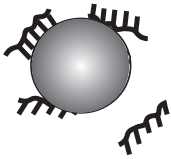
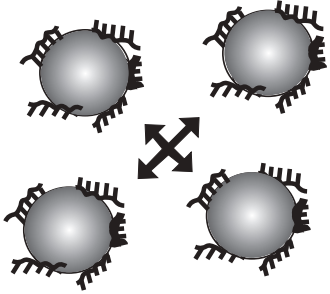


# FOSROC'S PCE technology - *Welcome to the future!*

FOSROC's latest contribution to the ever changing needs and requirements of the construction industry is the new generation of hyperplasticiser based on Polycarboxylate Ether (PCE) technology.

This superior PCE Technology is steadily establishing a strong track record throughout the world with progress being made in the Middle East.

Polycarboxylate Ether based products showcase water dispersible comb-polymers with a more complex molecular structure than conventional superplasticizers. The two most important mechanisms attributed to dispersion in polycarboxylate systems are linked to polymer adsorption and steric hindrance caused by the thickness of the adsorbed polymer layer onto the cement particle and electrostatic repulsion through induced electrical charge.

Step	Mixing	Adsorption	Dispersion
Function	<ul style="list-style-type: none"> <li>■ Mechanical blending</li> </ul>	<ul style="list-style-type: none"> <li>■ Physical adsorption</li> <li>■ Chemical adsorption</li> </ul>	<ul style="list-style-type: none"> <li>■ Electrostatic repulsion</li> <li>■ Steric hindrance</li> </ul>
Scheme			

The end result is greater performance at lower dosages.

## Presenting FOSROC'S innovative "STRUCTURO" technology

"STRUCTURO", based on Polycarboxylate Ethers (PCE), can produce concrete which flows silently and with less friction (S C C) and can be placed within the most intricate formwork and / or heavily congested reinforcement without the aid of any vibration or compaction.....with no bleed or segregation.

***"STRUCTURO PCE technology has been developed after years of R & D".***

This has been specially formulated by altering the molecular structure, grafting other polymers onto the basic trunk polymer & blending with other additional polymers. These are required to match specific performance viz, adjustments to properties such as setting times, high slump retention and high water reduction.

With such potential of performance, **STRUCTURO** PCE technology lends itself for use in high performance concrete which include:

- High strength concrete
- Self-compacting concrete

***"Fosroc's formulations are carefully designed for specific customer use".***





## STRUCTURO technology offers the following advantages

- The possibility to create "zero defect" concrete
- The ability to maintain high slumpflow values for two hours and more
- Self compacting concrete can significantly reduce manpower for placing
- Good compaction and low voids improves steel protection against corrosion

## STRUCTURO PCE technology packs the following as cost benefits to concrete specifiers, producers and users:

- Faster placement in adverse conditions
- Non segregated flow within the most congested reinforcement
- Reduced vibration and finishing
- Reduced labour
- Improved durability and high early strengths
- Highly effective with cement replacements
- Reduction of noise in the environment and hence improved health and safety conditions....

## With Structuro PCE Technology you can:

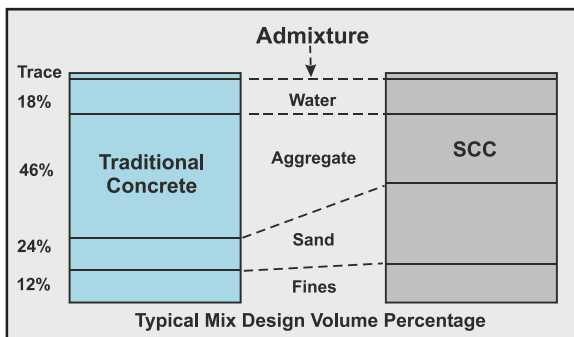
- Design **Self Compacting Concrete (S C C)**
- High workability and workability retention

## STRUCTURO..... the answer to SELF COMPACTING CONCRETE

### Definition

- As per EFNARC specification and guidelines, " Self Compacting Concrete" is defined as "concrete that is able to flow under its own weight & completely fill the form-work even in the presence of dense reinforcement without the need of any vibration whilst maintaining homogeneity."

<b>Coarse Aggregates</b>	Should be around 28 - 35% by volume of the mix. Limited volume to facilitate flowability by reducing interparticle friction and prevent blocking.	
<b>Fine Aggregates</b>	Usually $\geq 50\%$ of total aggregate content.	
<b>Typical aggregate distribution</b>	0 - 5 mm = 50 % 5 - 10 mm = 20 - 25 %	
<b>Cementitious additions and fines content</b>	Fines $\leq 0.125$ mm (i.e from cement, sand and other pozzolans): For 10 mm MSA - 550 to 650 kg/m <sup>3</sup> For 20 mm MSA - 475	Binder (i.e cement and pozzolans): For 10 mm MSA - 450 to 500 kg/m <sup>3</sup> MSA - 450 to 500 kg/m <sup>3</sup>
<b>Water</b>	Free Water in high strength S C C around $\leq 160$ litres/m <sup>3</sup> . In other cases, water binder should be practically 0.38 - 0.4	
<b>Admixture</b>	Dosage of the PC to be established by trials	



### Design of Self Compacting Concrete (S C C)

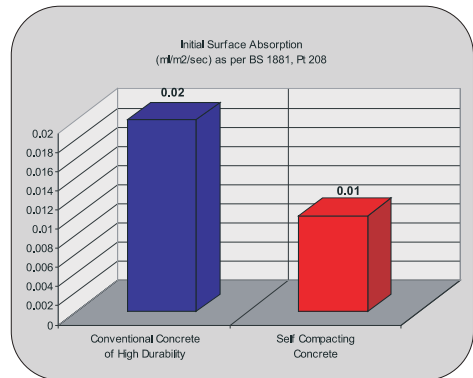
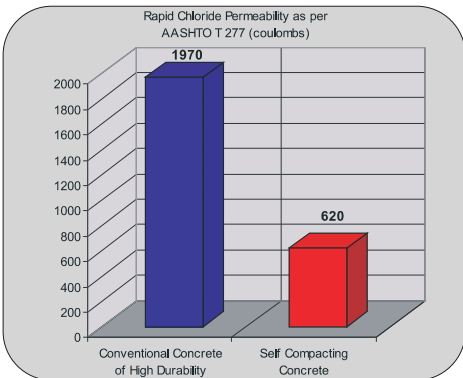
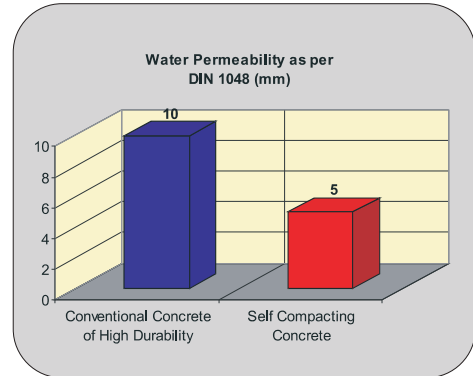
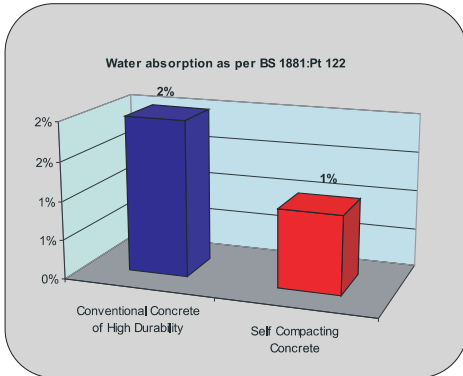
- Using a very low water/cementitious materials ratio in S C C mix designs (even with triple blends like combinations of OPC, GGBFS and silica fume); there is excellent cohesion between particles internally. This makes the concrete mix ultra cohesive in spite of very high flowability;

**S C C fulfills three pre-requisites:**

- **Filling ability**
- **Passing ability**
- **Segregation resistance**

S C C is easily produced from a quality ready-mix plant and can be either pumped or poured by a skip to provide concrete which is highly durable with low values of:

- **Rapid chloride permeability**
- **Permeability co-efficients**
- **Water absorption**
- **Carbonation**

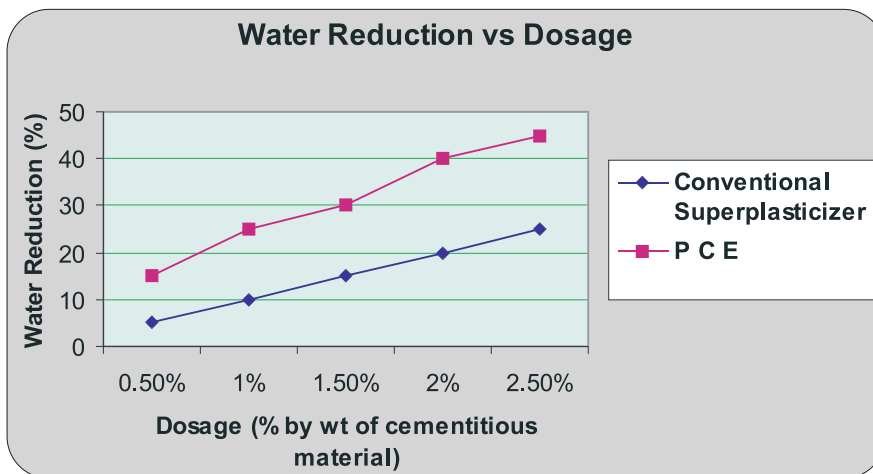


In certain cases of concrete with harsh aggregates, such as manufactured sands, there is a tendency of the mix to be harsh. In such cases, STRUCTURO is used in conjunction with a Viscosity Modifier (VM).

**STRUCTURO..... also for ultra high strength concrete**

For a very high water reduction/hyperplasticizing effect, STRUCTURO action is two-fold:

1. Greater control of the dispersing effect because of chemically designed molecules;
2. Effective steric hindrance of the cement grains by a 3-D molecule.



## The advantages of using STRUCTURO PCE technology as a hyperplasticizer:

### Fresh State:


- a. Extremely high flowability and/or workability.
- b. Uniform homogeneity and stable concrete.
- c. Excellent surface finish for "fair faced concrete".

### Hardened State:

- a. Reduced voids, hence highest density.
- b. Very low permeability leading to high durability.
- c. Reduction of porosity leads to reduced carbonation attack and / or chloride and /or sulphate ion ingress.
- d. High water reduction ensures very low shrinkage values.
- e. High density ensured through high water reductions.

## A List of few Projects where PCE Technology has been used:

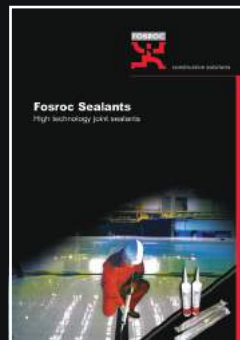
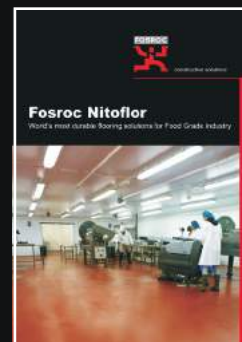
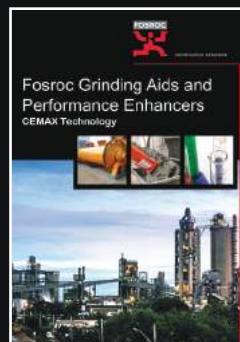
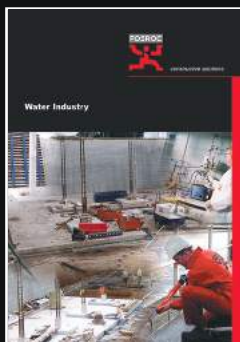
- Shangri- La Hotel, Dubai
- Beirut Tunnel, Dubai
- Water Tanks for residential & commercial complex in Sharjah
- Third Bridge crossing, Abu Dhabi
- Al Zoor Gas Turbine power station, Kuwait



Shangri - La Hotel DUBAI

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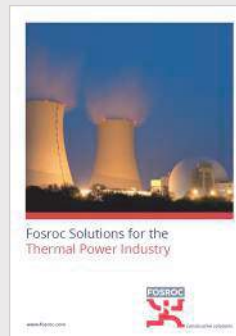
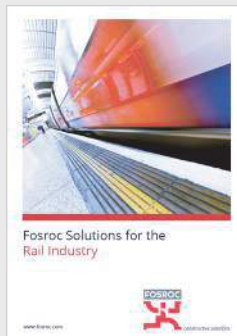
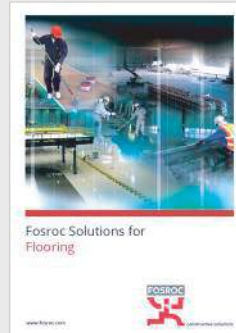
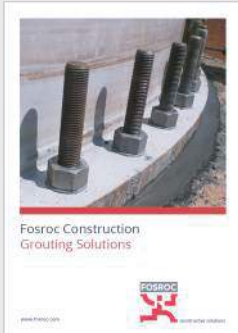
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