



**Innovative
solutions for
fibre reinforced
concrete**

Chryso Fibre reinforced concrete



The concept of using fibres as reinforcement is not new.

Fibres have been used as reinforcement since ancient times. Historically, horsehair was used on mortar and straw in mud huts and the Egyptians used mud mixed with straw to bind dried bricks when building the pyramids. In the early 1900's, asbestos fibres were used in concrete, and in the early 1950's the concept of composite materials came into being and fibre reinforced concrete was one of the topics of interest. There was a need to find a replacement for asbestos used in concrete and other building materials once the health risks associated with the substance was discovered. By the 1960's steel, glass and synthetic fibres such as polypropylene fibres were used and research into fibre reinforced concrete continues today.

A pioneer in the field, Chryso has a range of macro and micro polypropylene fibres that are suited to a large variety of different concrete applications:

- ✓ Flooring
- ✓ Tunnels
- ✓ Plaster
- ✓ Extruded concrete
- ✓ Marine concrete
- ✓ Shotcrete
- ✓ Roads
- ✓ Runways
- ✓ Piling and geotechnical
- ✓ Soil stabilisation
- ✓ Bridges
- ✓ Water retaining structures
- ✓ Foundations
- ✓ Precast concrete
- ✓ Decks
- ✓ Slabs
- ✓ Spun concrete pipes
- ✓ Concrete overlays
- ✓ Foundaries
- ✓ Self-compacting concrete
- ✓ General building works



Marlboro Gautrain
Shotcrete Lining



Chryso® Fibres provide the following benefits to concrete:

Crack width control

Plastic shrinkage and plastic settlement cracking can on occasion penetrate the full depth of the slab, causing huge expenses with regard to remedial measures or an even greater cost should the slab have to be replaced.

Fortunately, **Chryso®Micro Fibres** provide effective crack control in concrete during the pre-hardening phase while **Chryso®Macro Fibres** provide effective post crack control in concrete once it has hardened.

Post crack control

Chryso®Micro Fibres not only improve post cracking behavior, but also reduce the further propagation of macro cracks. The **Chryso®Micro Fibres** that cross the crack and are anchored in concrete on both sides of the crack effectively 'sew' its two sides together and prevent it from widening. **Chryso®Micro Fibres** therefore increase the ductility and the load bearing capacity of concrete.

Plastic settlement cracking

Plastic settlement cracks can occur where concrete segregates and there is excessive bleeding that is outside the design parameters. Changes in the depth of the concrete can increase the intensity of these cracks.

Chryso®Micro Fibres improve the rheology of the concrete mix and therefore prevent the segregation of fine cement and sand particles (that increase bleeding). By helping to reduce bleed, there is more water available to assist in the hydration process and improves bonding within the cement matrix. This assists in reduced curling (in screeds), increasing the ductility of concrete, creating more durable concrete and reducing concrete cracks.





Increases the durability of concrete

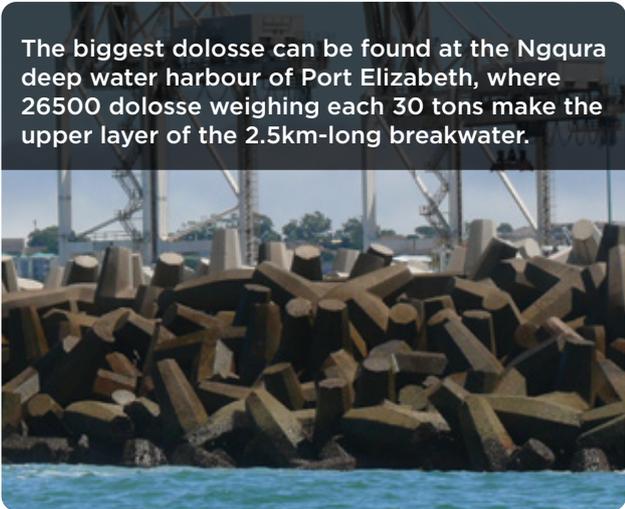
Corrosion resistant

Chryso®Fibres reduce the permeability of concrete. This prevents water and harmful chemicals from penetrating the concrete, making it corrosion resistant.

Abrasion resistant

Abrasion resistance in concrete is directly related to its strength and concrete strength is determined by a high cement content and low water/cement ratio. Since **Chryso®Fibres** reduce bleeding, they can assist concrete in maintaining a low water/cement ratio.

Chryso®Fibres assists in the efficient hydration of cement and improve the bonding of the cement matrix, achieving a more durable concrete surface.



The biggest dolosse can be found at the Ngqura deep water harbour of Port Elizabeth, where 26500 dolosse weighing each 30 tons make the upper layer of the 2.5km-long breakwater.

Impact resistant

Concrete is a brittle material and is prone to damage through the impact of heavy items and loads or if precast concrete is mishandled during production or transportation. This impact damage can cause a reduction in the life span of concrete, leading to early replacement due to premature failure. **Chryso®Macro Fibres** in particular improve impact resistance due to the high amount of energy absorbed in the de-bonding, stretching and pulling out of fibres after the cement matrix has cracked.

Freeze/thaw resistant

Freeze-thaw damage occurs when large amounts of water penetrate concrete pores. In cold conditions, when that water freezes to ice, it occupies more volume and if there is no space in the concrete for expansion, it will cause distress to the concrete. The primary solution is to produce durable concrete. Using **Chryso®Fibres** will prevent the influx of water into concrete by the reduction of cracking, permeability, bleeding, ductility, the increase of impact and abrasion resistance of concrete. **Chryso®Fibres** are a reliable replacement to air entraining agents.

Passive fire protection

Good resistance under fire and extremely high temperature conditions.

Although intrinsically fire resistant, concrete can under certain circumstances be subject to the violent phenomenon known as explosive spalling (common in high density concrete, found in high rise buildings and tunnels).

When subjected to high temperatures, moisture within the concrete attempts to escape from the heat source but is unable to do so due to the lack of porosity of the concrete.

As a result, internal stress generated by the steam causes an explosion of hot debris. This is a threat to firemen; people escaping from the structure and the integrity of the structure as the spalling weakens the structure and causes it to collapse, which could lead to serious injuries or fatalities.

Chryso®Micro Fibres added to high density concrete provide cost effective passive resistance to spalling concrete. In a fire scenario, the **Chryso®Micro Fibres** melt at 160 °C. This creates millions of voids and channels through which the vapour/steam can escape. The internal stresses, therefore never reach a critical point where concrete is spalled from the structure.



Chryso®Fibres
when included in the concrete mix,
prevents explosive spalling.

Passive Fire Protection Fibres





A better alternative to mesh reinforcement

Concrete containing Chryso®Macro Fibres minimises the use of reinforcing steel.

Chryso®Macro Fibres are not a replacement to structural reinforcement, however are a very good alternative to mesh reinforcement due to:

- Minimised cost.
- Minimised labour.
- Reduction in construction time due to a saving on steel fixing.
- Requires less storage space and therefore less transport loads.
- Improved durability (crack control mesh often corrodes, causing concrete spalling).
- Crack control mesh must be placed correctly at or slightly above mid height of the slab, and this is often difficult to achieve in practice.
- It is difficult to use wire mesh in precast applications, particularly when casting complex shapes. One has to place mesh or a wire cage and then cast around it. Using **Chryso®Macro Fibres** help to simplify the production process of concrete components, especially those of complex shapes.
- Great impact resistance around the whole volume of concrete, reducing the sensitivity to impacts that may occur during handling, particularly at the edges of the concrete component.
- If plastic settlement cracks develop on a concrete structure – crack control mesh may prevent the problem. If not placed correctly, crack control mesh may cause differences in height levels of the concrete slab which may cause the concrete to crack over the crack control mesh.
- In flooring applications, there have been instances where crack control mesh has moved towards the top section of the screed, delaminating the surface.
- **Chryso®Macro Fibres** form a three dimensional bond with the concrete matrix, unlike crack control mesh
- Using **Chryso®Macro Fibres** instead of crack control mesh allows the quantity of concrete to be restricted as it does not have to cover the mesh.
- **Chryso®Macro Fibres** are less likely to perforate a water repelling film before applying shotcrete.
- The health and safety hazards associated with the handling, cutting and placing of mesh reinforcement is eliminated when using **Chryso®Macro Fibres**.

Chryso® Design & Technical Offer



Cohesive concrete mix conditions

The inclusion of **Chryso®Fibres** significantly increases the cohesive nature of the concrete through mechanically binding the cementitious material together. This greatly reduces waste and assists **Chryso®Fibres** to mix easily without balling and clogging pumps and pipes.

Increased bonding conditions

When used in shotcrete or plaster applications, **Chryso®Fibres** improves the plaster or shotcrete bond to the relevant backing material. This improvement is directly related to **Chryso®Fibres** ability to reduce bleed, which allows more water interfacing for better concrete hydration.

Better surface appearance conditions

The fibres generally improve the surface quality of concrete by reducing the amount of bleed holes.

Design service

Chryso is available to provide a tailored design service to you for your specific projects. We work closely with you to supply required calculations and technical specifications. Additionally, Chryso produces a detailed commercial

proposal that sets out the benefits of **Chryso®Macro** polypropylene fibres, as your concrete reinforcement solution and replacement of mesh reinforcement.

If you have a construction project you would like advice on, our innovative design service provides a cost-effective solution to reduce construction time. We provide a full design service with professional indemnity and a warranty package.

Technical offer

In order to assist the customer, **Chryso** supplies technical support.

Our concrete laboratory has all the necessary equipment to expertise to create tailor made fibre reinforced concrete mixes, optimise the fibre dosage according to the required performance, and use the correct **Chryso®Fibre** for the correct application.



Choosing the right fibre for your application



PRODUCTS

	Chryso® Fibrin XT 12mm	Chryso® Fibrin 6mm	Chryso® Easyfinish	
	High performance monofilament polypropylene fibres	Passive fire protection fibres	Macro-synthetic fibres	
FEATURES	Crack prevention	✓	✓	
	Steel mesh replacement		✓	
	Design service		✓	
	Increased impact resistance	✓	✓	
	Reduced plastic settlement	✓	✓	
	Reduced bleeding	✓	✓	
	Abrasion resistance	✓	✓	
	Spalling protection	✓	✓	
	Explosive spalling protection	✓	✓	
	Energy absorption	✓	✓	
	Plastic shrinkage	✓	✓	
	Fibre length	blend	6mm	40mm
	Packaging size	600g	600g	3kg

- ✓ Most suitable
- ✓ Suitable



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