



Master X-Seed

Solutions for energy efficient
concrete



Master Builders Solutions

Master Builders Solutions

The Master Builders Solutions brand brings all of expertise together to create chemical solutions for new construction, maintenance, repair and renovation of structures. Master Builders Solutions is built on the experience gained from more than a century in the construction industry.

The know-how and experience of a global community of construction experts form the core of Master Builders Solutions. We combine the right elements from our portfolio to solve specific construction challenges. We collaborate across areas of expertise and regions and draw on the experience gained from countless construction projects worldwide. We at Master Builders Solutions leverage global technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make more successful and drive sustainable construction.

Market leading products are developed from technically advanced formulations, optimized for the harsh environmental conditions found in the Middle East.

Our Comprehensive Portfolio

- Concrete admixtures
- Cement additives
- Chemical solutions for underground construction
- Waterproofing solutions
- Sealants
- Tile fixing systems
- Concrete repair and protection solutions
- Performance grouts
- Performance flooring solutions
- Wall systems
- Fire protection systems





Solutions for energy efficient concrete

The construction industry

in general and concrete producers in particular are committed to successfully addressing four main challenges for a sustainable construction industry:

- Efficient processes
- Energy reduction
- Material optimization
- High quality end product

The industry's critical success factors are fast re-utilization of formworks and a high, continuous output with the lowest possible production effort while maintaining the high quality demanded by the customers.

In today's competitive environment, balancing these challenges is a key success factor.

How quickly a concrete attains de-mould strength, while optimizing the mix cost is one such key factor. Therefore, accelerated concrete hardening at early stages is a target for saving time and money.

To help in the early age strength development of concrete, a new solution is offered to the industry by the Crystal Speed Hardening concept developed by Master Builders Solutions, a concept based on a unique technology of concrete hardening acceleration.





Crystal Speed Hardening concept

enables more sustainable concrete production thanks to the unique technology of the new Master X-Seed hardening accelerator. A previously unattainable hardening boost at all temperature levels is achieved in the early ages (6-12 hrs) due to the powerful seeding of the mix design, which is also able to support the final performance of the specified concrete.

The Crystal Speed Hardening concept exceeds, enhances and improves existing strength development for key industry needs and is fully compatible with all Master Builders Solutions admixture technologies, e.g. Smart Dynamic Concrete.

It allows the concrete industry to achieve better process economy, higher concrete quality and increased energy efficiency in order to save time and money and reduce CO₂ emissions.

Master X-Seed is the essential component of the Crystal Speed Hardening concept. It consists of synthetically produced nanoparticles suspended in a liquid and boosts the hardening properties of the concrete mix.

While traditional acceleration methods such as heat application or common accelerators typically affect concrete's cost and durability, Master X-Seed brings a level of hardening acceleration to the mix that supports natural hydration and long-term performance properties by offering attractive overall cost saving potential.

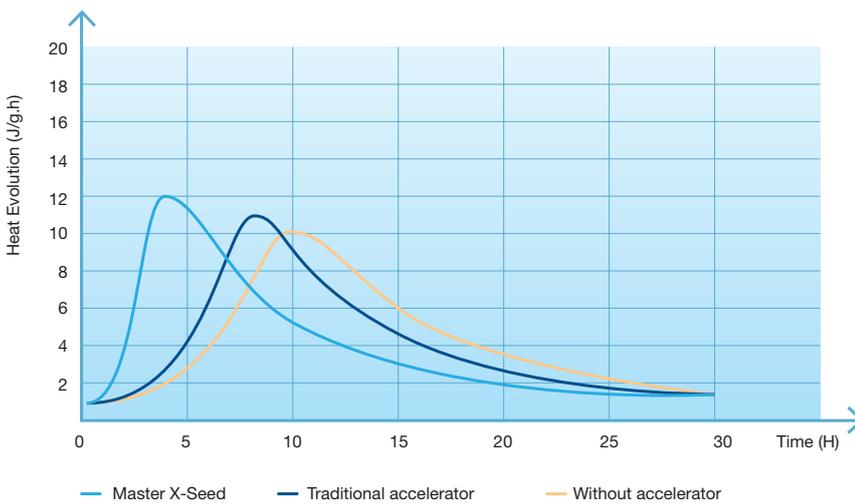




Mechanism of action

In standard

cement hydration, the main clinker phases C_3S and C_2S react with water to form Calcium Silicate Hydrate (CSH) crystals and Calcium Hydroxide. The nucleation of the CSH crystals is an exothermic reaction, which occurs on the cement grain surface and requires overcoming some activation barriers for further growth.



Heat Evolution – Accelerator Effect (380 kg/m³ CEM I 52.5 R)





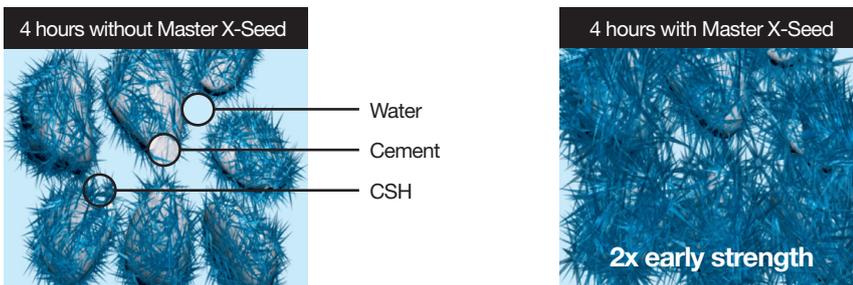
Crystal seeding

With Master X-Seed it is possible to suspend extra fine, synthetically produced CSH crystals in a ready to use admixture suspension and use them as seeding material in the pore solution between the cement grains. The active CSH crystals can virtually grow without energy barrier. This method is known as crystal seeding.

It was found that the crystals show preferential growth behavior in between and not on the

surface of the cement grains. Therefore the growth of the crystal structure is far quicker and an earlier hardening as well as an earlier strength development are observed.

The final, hydrated cement paste shows no microstructural changes compared to standard hydrated cement. In fact, the density of CSH crystals may actually improve the quality of the hardened cement paste and provide durability benefits.



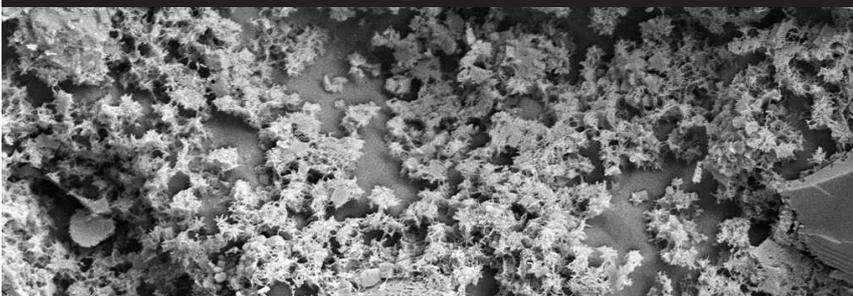
Schematic view of CSH crystals in cement & water pore solution.

The unique Master X-Seed technology provides an unmatched speeding up of the hydration process at early ages and as a result of many production processes.

Master X-Seed is based on Master Builders Solutions proprietary technology which ensures a stable suspension of synthetically produced crystalline CSH nanoparticles. These particles act as active seeds in the concrete mix.

Master X-Seed is active at all concrete temperatures, for example in winter, summer and under steam curing conditions.

CryoSEM of Master X-Seed: Active crystals growing in between the cement grains.

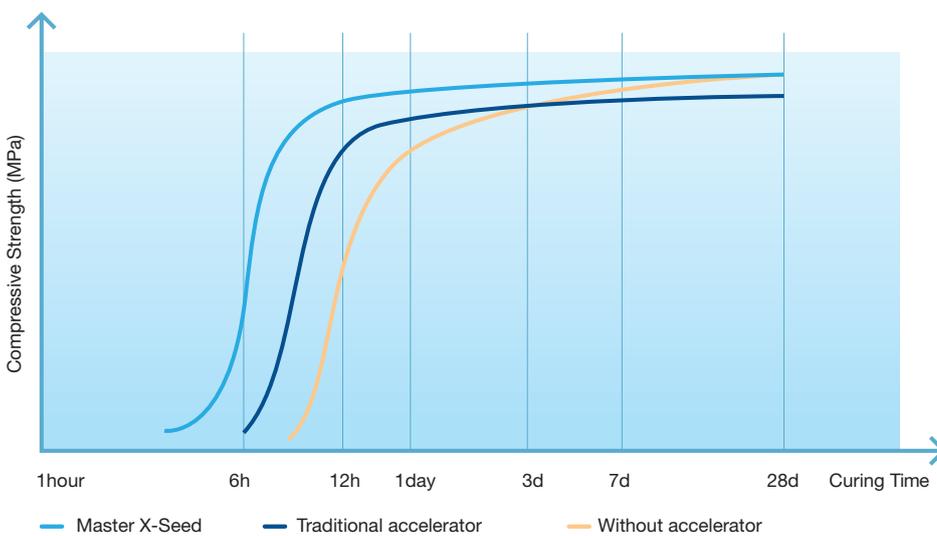




Speed process

The essential performance benefit of this innovative concept is fast strength development at early ages of hydration - at low, ambient and heat curing temperatures. Increased productivity has a direct impact on cost efficiency. The flexibility to increase capacity quickly is required, especially, when unexpected high volume demands are faced. With Master X-Seed no extra installations are needed to

reach this target. Also in times of reduced demand or crisis, the optimization of production capacity is essential. Master X-Seed offers faster processes and increased production output within the regular production setup. Double rotation may lead to tailored formwork use, facilitating work with fewer forms or using existing forms more frequently.



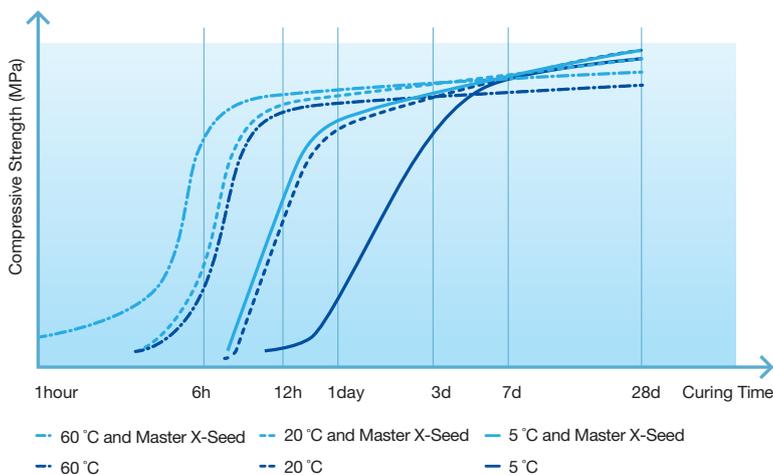
Strength Development – Accelerator Effect (fluid concrete with 380 kg/m³ CEM I 52.5 R)



Hardening benefit – energy reduction

Heat curing is an energy and cost intensive method to achieve higher early strength development, mainly during winter periods or when more production cycles are required to satisfy high market demands. However, the application of direct or indirect heat to the concrete has to be well controlled in order

to minimize durability risks (internal stresses, delayed ettringite formation). Master X-Seed allows elimination or reduction of heat curing of concrete, saving the installation cost of heat curing equipment and reducing CO₂-related emissions.



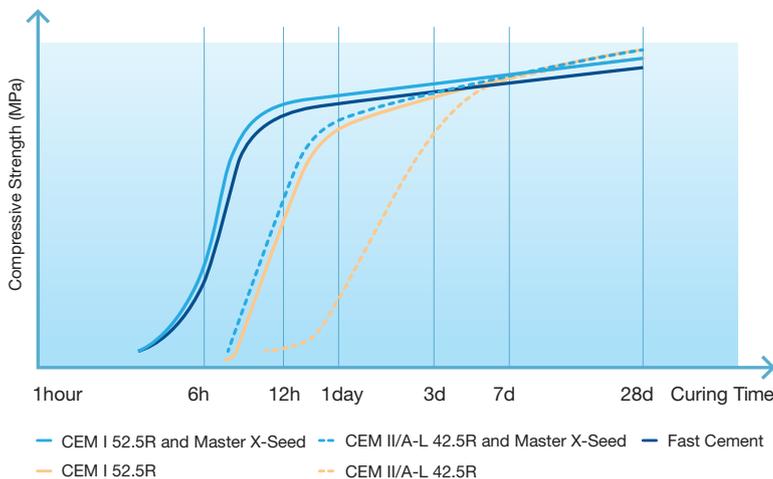
Strength Development – Temperature Effect (fluid concrete with 380 kg/m³ CEM I 52.5 R)

Hardening benefit – material optimization

Composite cements and the use of supplementary cementitious materials (SCMs) are important tools in optimizing mix designs to achieve specific performance requirements. However, this typically comes at the expense of the early strength development needed for pre-cast operations and needs to be compensated for by higher amounts of binder material.

Master X-Seed allows dedicated

binder optimization without losing early strength behavior or changing fresh concrete performances. This has a quantifiable, positive impact on final strength and contributes to lower CO₂ plant emissions. Optimal mix designs are achieved according to the state-of-the-art concrete technology rules and the addition of Master X-Seed.



Strength Development – Cement Effect (fluid concrete with 380 kg/m³)



Hardening benefit – high performance specifications

Master X-Seed strengthens the interparticle bond because of the crystal formation power of the active CSH seeds. This has a positive impact on shrinkage and crack behavior as well as on the property of reduced water absorption. Its combined use with SCMs strengthens durability characteristics and supports the overall life cycle of the concrete.

More and more, high quality specifications for concrete include ecological aspects and require an optimized ECO-profile (balanced ecologic benefit versus economic cost over the full life cycle). With Master X-Seed the concrete producer has all the means to better achieve high performance specifications while optimizing daily operation costs and meeting the required sustainable construction targets.





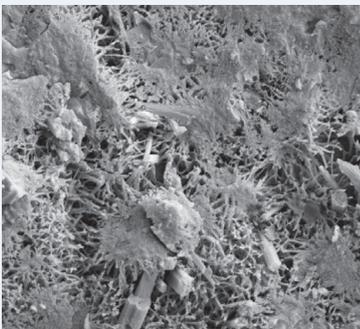
At a glance



Crystal Speed Hardening,

a unique accelerator technology to support sustainable construction.

- Crystal Speed Hardening is designed to support the concrete industry in meeting key sustainable construction targets:
 - Efficient processes
 - Energy reduction
 - Material optimization
 - High quality end product
- The centerpiece of this concept is Master X-Seed, a unique hardening accelerator which enables a quantum leap in high early strength development at low, ambient and heat curing temperatures.
- Crystal Speed Hardening benefits from the principle of Crystal Seeding in all types of cementitious materials.
- The need for speed is satisfied by the excellent performance of Master X-Seed.
- Crystal Speed Hardening adds values to concrete by exploring various options of hardening acceleration and has the potential to move the market up to the next level of advanced construction practice.



CRYSTAL

Seeding

- Unique technology
- Patent protected
- Barrier-free growth



SPEED

Process

- Flexible capacities
- Efficient production
- Cost reduction



HARDENING

Benefits

- Energy reduction
- Material optimization
- High performance specifications



With Master Builders Solutions

you will find a competent and professional partner that will optimize the use of concrete in every situation. Increasing quality and durability, safety and aesthetics, we work within the framework of environmental responsibility and the economic realities of the industry.

Maximizing the performance of concrete is central to everything we do.



Master Builders Solutions for the Construction Industry

MasterAir®

Complete Solutions for air entrained concrete

MasterBrace®

Solutions for strengthening and structural adhesives

MasterCast®

Solutions for the manufactured concrete product industry

MasterCell®

Density reducing admixtures

MasterCem®

Solutions for cement manufacture

MasterEase®

Solutions for low viscosity concrete

MasterEmaco®

Solutions for concrete repair

MasterFiber®

Comprehensive solutions for fiber reinforced concrete

MasterFinish®

Solutions for formwork treatment

MasterFlame®

Passive fire protection system

MasterFlow®

Solutions for precision grouting

MasterGlenium®

Hyperplasticizer formulated from state-of-the-art polymers for the ultimate performance

MasterInject®

Solutions for concrete injection

MasterKure®

Solutions for concrete curing

MasterLife®

Solutions for enhanced durability

MasterMatrix®

Advanced rheology control solutions

MasterPolyheed®

High-performance superplasticizer

MasterPozzolith®

Solutions for water-reduced concrete

MasterProtect®

Solutions for concrete protection

MasterRheobuild®

Superplasticizer for concrete

MasterRoc®

Solutions for underground construction

MasterSeal®

Solutions for waterproofing and sealing

MasterSet®

Solutions for set control

MasterTile®

Solutions for tiling systems

MasterTop®

Solutions for industrial and commercial floors

MasterWeid™

Adhesive Solutions for construction

MasterX-Seed®

Advanced accelerator solutions for concrete

Ucrete®

Flooring solutions for harsh environments

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