



# Master X-Seed®

Solutions for energy efficient  
pre-cast concrete



## Master Builders Solutions from BASF



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

The comprehensive portfolio under the Master Builders Solutions brand encompasses concrete admixtures, cement additives, chemical solutions for underground construction, waterproofing solutions, sealants, concrete repair & protection solutions, performance grouts and performance flooring solutions.



## Solutions for energy efficient pre-cast 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 pre-cast 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 BASF Construction Chemicals – 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 BASF admixture technologies, e.g. Smart Dynamic Concrete™. It allows the concrete industry to achieve better process economy, higher concrete quality and

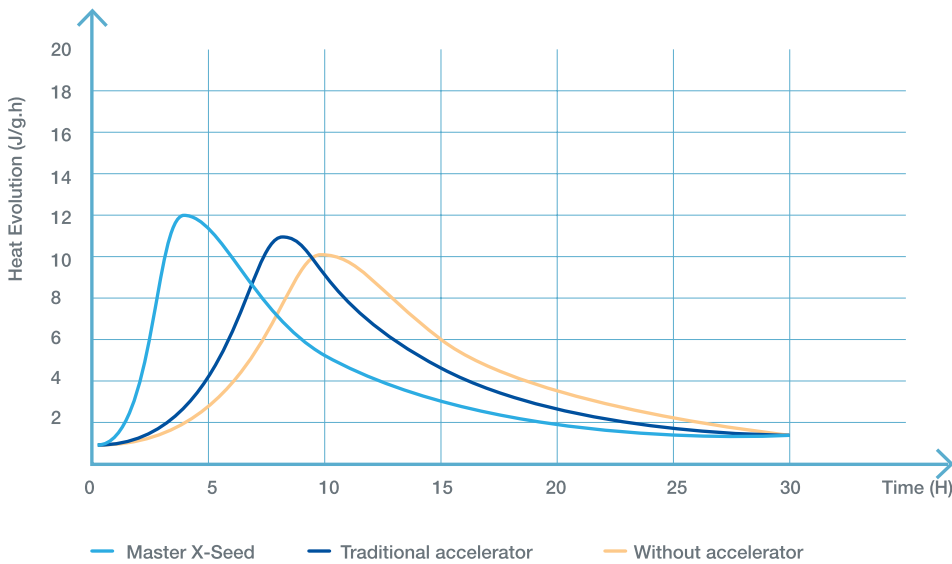
increased energy efficiency in order to save time and money and reduce CO<sub>2</sub> emissions. Master X-Seed is the essential component of the Crystal Speed Hardening concept. It consists of synthetically produced nanoparticles suspended in a liquid and boosts the hardening properties of the concrete 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 C3S and C2S 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/m<sup>3</sup> CEM I 52.5 R)

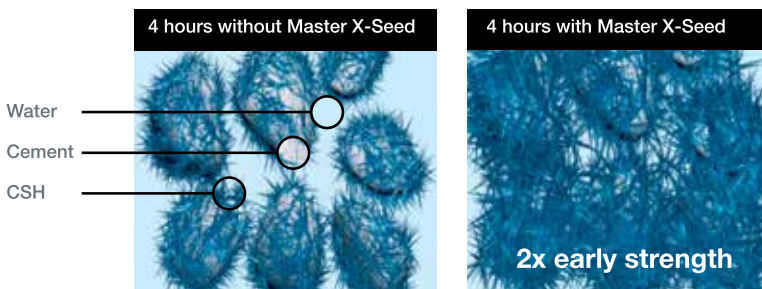
### Crystal seeding

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.

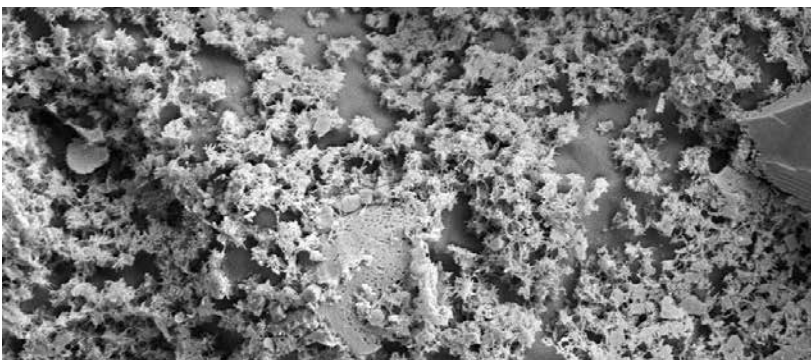


Schematic view of CSH crystals in cement & water pore solution.

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 BASF 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.



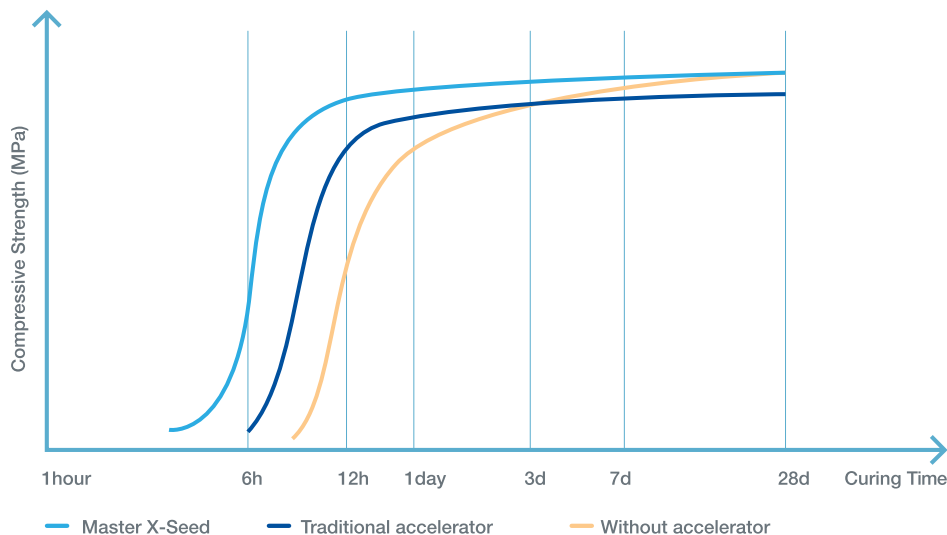
CryoSEM of Master X-Seed: Active crystals growing in between the cement grains.



### 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.

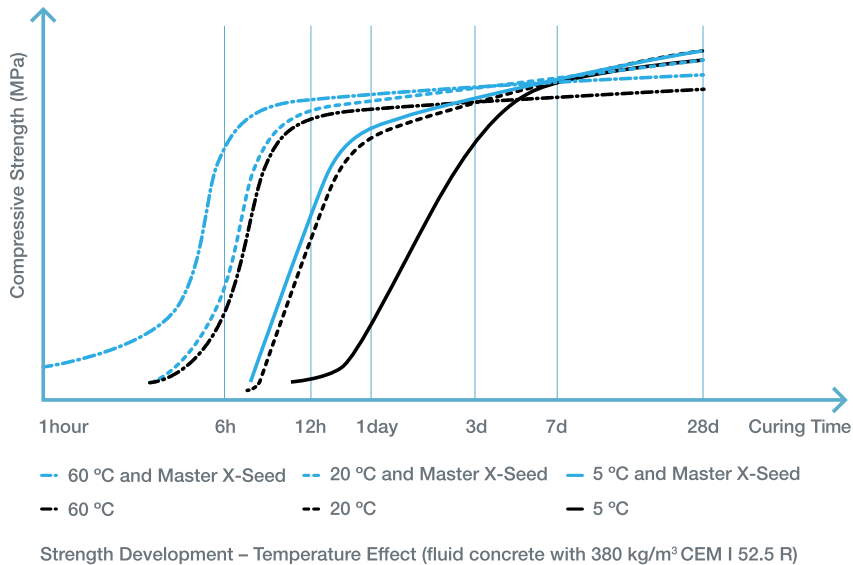


Strength Development – Accelerator Effect (fluid concrete with 380 kg/m<sup>3</sup> CEM I 52.5 R)

### 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

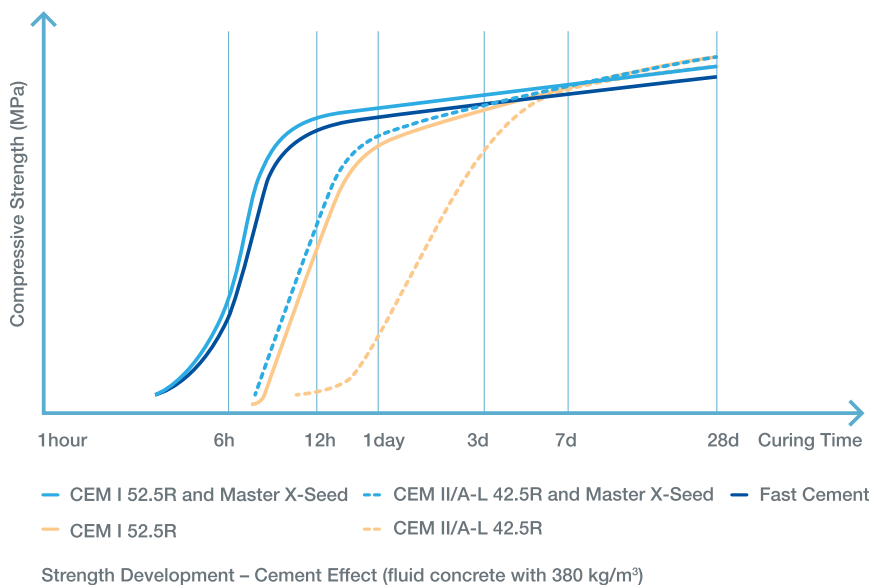
concrete has to be well controlled in order to minimize durability risks (internal stresses, delayed ettringite formation). Master X-Seed allows elimination or reduction of heat curing of concrete, saving the installation cost of heat curing equipment and reducing CO<sub>2</sub>-related emissions.



### 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 CO<sub>2</sub> plant emissions. Optimal mix designs are achieved according to the state-of-the-art concrete technology rules and the addition of Master X-Seed.





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 conomic 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 from BASF, 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 from BASF for the Construction Industry

**MasterAir®**

Complete solutions for air entrained concrete

**MasterBrace®**

Solutions for concrete strengthening

**MasterCast®**

Solutions for the manufactured concrete product industry

**MasterCem®**

Solutions for cement manufacture

**MasterEmaco®**

Solutions for concrete repair

**MasterFinish®**

Solutions for formwork treatment

**MasterFlow®**

Solutions for precision grouting

**MasterFiber®**

Comprehensive solutions for fiber reinforced concrete

**MasterGlenium®**

Solutions for hyperplasticized concrete

**MasterInject®**

Solutions for concrete injection

**MasterKure®**

Solutions for concrete curing

**MasterLife®**

Solutions for enhanced durability

**MasterMatrix®**

Advanced rheology control solutions for self-consolidating concrete

**MasterPel®**

Solutions for water tight concrete

**MasterPolyheed®**

Solutions for high performance concrete

**MasterPozzolith®**

Solutions for water-reduced concrete

**MasterProtect®**

Solutions for concrete protection

**MasterRheobuild®**

Solutions for superplasticized concrete

**MasterSeal®**

Solutions for waterproofing and sealing

**MasterRoc®**

Solutions for underground construction

**MasterSet®**

Solutions for retardation control

**MasterSure®**

Solutions for workability control

**MasterTop®**

Solutions for industrial and commercial floors

**Master X-Seed®**

Advanced accelerator solutions for pre-cast concrete

**Ucrete®**

Flooring solutions for harsh environments

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