BASF’s Master Builders Solutions brand is built on over a century of experience in the construction industry. That experience has led to the development of the most technologically advanced concrete admixtures for concrete durability.
Durability and service life are major considerations in the design of concrete structures subject to aggressive environments. Typical projects requiring long-term durability include dams, bridges, parking garages, water and wastewater treatment facilities, marine and various other structures. Designing more durable, longer-lasting concrete structures is a constant goal of engineers, architects, owners, government agencies, contractors and concrete producers worldwide.

The durability of concrete is affected by many issues including:
- Corrosion
- Sulfate Attack
- Alkali-Silica Reaction
- Microbial-Induced Corrosion
- Cracking
- Strength

Corrosion

Chloride ions enter concrete from deicing salts on roads and bridges or from seawater in marine environments. Other sources of chloride ions include admixtures made with intentionally-added chlorides, chloride-contaminated aggregates and/or mixing water and salts in ground water. Chloride ions promote corrosion of reinforcing steel and other metals in concrete, which then expand and cause the surrounding concrete to crack and deteriorate.

The MasterLife® CI family of corrosion-inhibiting admixtures offers options to delay the onset and reduce the rate of corrosion of steel reinforced concrete structures.

MasterLife CI 222 admixture
- Organic-based amine-ester corrosion inhibitor
- Reduces concrete permeability
- Forms a protective film at the steel surface

MasterLife CI 30 admixture
- 30% calcium nitrite
- Inorganic anodic-type corrosion inhibitor
- Reacts with ferrous ions to form an oxide film at the steel surface

Further durability enhancement against corrosion is attainable by combining MasterLife CI Series of corrosion inhibitors with the use of MasterLife SF 100 silica fume. MasterLife SF 100 silica fume reduces concrete permeability by providing additional hydration products that reduce the number and size of capillary pores. This makes it even more difficult for chloride ions to penetrate concrete to the surface of the reinforcing steel.
**Sulfate Attack**

Sulfate attack occurs when soil, groundwater, or water bodies containing sulfates come into contact with concrete. The chemical reactions caused by these sulfates can lead to detrimental expansive forces within the concrete matrix, resulting in cracking and deterioration. MasterLife SF 100 silica fume increases the resistance of concrete to sulfate attack by reducing its permeability. MasterLife CI 222 admixture also works to increase sulfate resistance due to its permeability-reducing mechanism.

**Alkali-Silica Reaction (ASR)**

Concrete containing certain reactive siliceous aggregates may experience abnormal internal expansion and cracking due to alkali-silica reaction. BASF’s MasterLife ASR 30 lithium-based admixture is specifically formulated to inhibit deleterious expansion in concrete susceptible to ASR. Lithium in MasterLife ASR 30 admixture forms a gel with reactive silica that is stable and does not absorb water and swell, thus reducing expansion of concrete.

MasterLife SF 100 silica fume, may also be used in concrete to combat ASR. The use of this pozzolan reduces both concrete permeability and the alkalis that react with the silica in the reactive aggregates.

**Microbial-Induced Corrosion (MIC)**

In applications where concrete is exposed to sewage or wastewater, activity by micro-organisms can lead to bio-deterioration of concrete through a process known as microbial-induced corrosion. Consequently, unless protective measures are taken, MIC will cause premature deterioration in concrete pipes, manholes and other structures that carry sewage or wastewater, resulting in increased maintenance and life-cycle costs.

BASF’s MasterLife AMA 100 admixture is an EPA-registered liquid integral concrete admixture for the prevention of microbial-induced corrosion. Based on a novel organosilane chemistry, MasterLife AMA 100 admixture molecularly bonds to cement hydration products and ruptures the cell membrane of harmful bacteria and other micro-organisms on contact through an electro-physical mechanism. This creates a concrete surface that is not conducive to the growth of harmful micro-organisms.

**Cracking**

Cracking of concrete is a major concern. Cracking may be due to plastic shrinkage and plastic settlement of concrete in the unhardened state or to drying shrinkage or other factors in the hardened concrete.

Cracking due to plastic shrinkage and plastic settlement can be minimized by adding BASF’s MasterFiber® M or F Series of microsynthetic fibers to the concrete. Because the fibers are uniformly distributed throughout the concrete mixture, they control bleeding, keep the heavier constituents of the mixture in place, and inhibit cracks. Depending on the application rate, fibers can inhibit up to 80-100% of plastic shrinkage cracking.

BASF’s MasterLife SRA series of shrinkage-reducing admixtures and MasterLife CRA 007 crack-reducing admixture can be used to reduce drying shrinkage and the potential for subsequent cracking in concrete. These admixtures function by reducing capillary tension of pore water, thereby reducing the internal stresses that cause concrete to shrink. Reducing drying shrinkage lowers the potential for cracking thus improving aesthetics, watertightness and durability. Drying shrinkage may be reduced by as much as 80% at 28 days and up to 50% at one year depending on the concrete mixture and the dosage of the admixture used. A secondary benefit of reduced drying shrinkage is reduced curling in slabs-on-ground. Relative to conventional shrinkage-reducing admixtures, MasterLife CRA 007 admixture, a first-of-its-kind crack-reducing admixture, provides better performance under restraint, resulting in smaller initial crack widths.

The MasterFiber MAC series of macrosynthetic fibers can also be used to hold cracks tight, thereby reducing crack width. Synergistic performance is achieved through the use of these fibers and either the MasterLife SRA admixture series or MasterLife CRA 007 admixture.

**Strength**

For many concrete structures, strength is an important property that affects production, quality, and durability. Supplementary cementitious materials are often essential to the production of high-strength concrete. MasterLife SF 100 silica fume is a micro-filling material that physically and chemically fills the voids between cement particles thereby increasing concrete strength at all ages. The use of BASF’s MasterGlenium® and MasterRheobuild® families of high-range water-reducing admixtures in combination with MasterLife SF 100 silica fume will further increase strength, by facilitating the production of concrete mixtures with very low water-cementitious materials ratios. In specialized applications, strengths can be increased to 20,000 psi (138 MPa) and higher.
Economic Benefit

Concrete designed for durability will typically increase the initial cost of the mixture. However, the use of BASF’s durability-enhancing admixtures can provide significant economic benefits over the life of a structure as illustrated in the following chart.

The bridge on the right is experiencing heavy corrosion. The bridge on the left was built to prevent corrosion by using high performance concrete with durability-enhancing admixtures. Durability issues, such as corrosion of reinforcing steel in roads, bridges, and parking structures, can be effectively addressed with durability-enhancing admixtures from BASF.

**Durability Product**

This Admixture Performance Guide can be used to select the optimum BASF product(s) to improve specific durability properties.
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, performance flooring solutions.

Master Builders Solutions products from BASF for the Construction Industry:

- **MasterAir®**: Solutions for air-entrained concrete
- **MasterBrace®**: Solutions for concrete strengthening
- **MasterCast®**: Solutions for manufactured concrete products
- **MasterCem®**: Solutions for cement manufacture
- **MasterEmaco®**: Solutions for concrete repair
- **MasterFiber®**: Comprehensive solutions for fiber reinforced concrete
- **MasterFinish®**: Solutions for formwork treatment
- **MasterFlow®**: Solutions for precision grouting
- **MasterGlenium®**: Solutions for high-performance flowing 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 watertight concrete
- **MasterPolyheed®**: Solutions for moderate slump concrete with superior finishability
- **MasterPozzolith®**: Solutions for conventional slump concrete
- **MasterProtect®**: Solutions for concrete protection
- **MasterRheobuild®**: Solutions for high slump concrete
- **MasterRoc®**: Solutions for underground construction
- **MasterSeal®**: Solutions for waterproofing and sealing
- **MasterSet®**: Solutions for set control
- **MasterSure®**: Solutions for workability control
- **MasterTop®**: Solutions for industrial and commercial floors
- **Ucrete®**: Flooring solutions for harsh environments

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