



**Multi-crystalline Intermixed Concrete
Admixture for Waterproofing and
Improving Concrete Durability
and Performance**

**CHEM-CRETE®
MCE™**

PRODUCT DESCRIPTION

Chem-Crete® MCE™ (MCE™) is an intermixed multi-crystalline enhancer and an innovative concrete waterproofing material. It is a significant step forward in increasing long-term concrete performance and durability that functions effectively with both Portland Cement and 1L (Limestone) Cement. It is categorized according to ASTM C494/C494M as Type S admixture. MCE™ is a multi-compound aqueous solution that is mixed into fresh concrete during the batching process resulting in a uniform distribution throughout the cement paste. MCE™ cures within cement hydration stages forming a network of hygroscopic and hydrophilic crystals (pore blocking) coupled with molecular layers (pore lining) that become an integral part of concrete structure. The porosity and permeability of resulting concrete structure is significantly decreased leading to concrete protection against nearly all types of water-related attacks and thereby enhances both the concrete durability and structure sustainability. The material performance has been shown through extensive laboratory studies and field trials and is approved by Iowa Department of Transportation.

A key feature of MCE™ is its ability to actively manage water in the concrete thereby minimizing or eliminating moisture-related damage including freeze/thaw cycling and alkali silica reactivity (ASR). In addition, by controlling the amount of water entering the concrete, chloride intrusion is minimized, mold growth is inhibited, and overall concrete sustainability is greatly enhanced. Furthermore, MCE™ improves the workability, enhances the hydration of the cement, and increases the strength of fully cured concrete. MCE™ may allow for the elimination of fly ash in concrete for ASR mitigation.

MCE™ is applicable to both central mixed and ready mixed plant operations. The method of incorporating the material into the concrete during the batching process is somewhat dependent on the specific batching equipment. However, MCE™ is generally added into the water feed similar to chemical admixtures. MCE™ can be added to a concrete mix at a batching plant, in a volumetric mixing truck or at a job site similar to adding typical chemical admixtures.



Picture 1: Concrete with MCE™ can be placed using traditional methods, including slipform paving.



Picture 2: Dr. Mike Ayers inspects concrete curb and gutter with the MCE™ admixture

FIELDS OF APPLICATION

- Highways, Streets, Roads and Manholes
- Bridges, Tunnels and Retaining Walls
- Slabs-on-Grade and Below Grade Structures
- Precast/tilt-up and Cast-in-Place Concrete
- Concrete Parking Lots, Sidewalks and Driveways
- Dams, Reservoirs, Canals and Waterways
- Water Tanks and Treatment Plants
- Secondary Containment Structures
- Sea Walls and Port Facilities
- Commercial and Residential Structures
- Parking Structures (Above and Below Grade)
- Basements, Foundations, Floors, Patios and Pools

PRODUCT FEATURES

- Type S admixture (ASTM C494/C494M) that functions effectively with both Portland Cement and 1L (Limestone) Cement
- An innovative sustainable solution to moisture-related distresses that is compatible with most water-reducers and air-entrainment materials used in concrete mix design.
- A long-term protection internal waterproofing and moisture blocking for concrete against water penetration, in all its phases (vapor, liquid and ice)
- A dynamic crystallization system that interacts with water in its three phases which enhances water management (reduced liquid and water vapor movement within the hardened concrete and reduced ice adhesion)
- Reduction in PCC capillary porosity and water permeability (by 2-3 orders of magnitudes)

- ❑ Reduced jet fuel and oil penetration through concrete surfaces.
- ❑ Hydrophobicity characteristics that help preventing water from wetting and saturating concrete surfaces
- ❑ Reduced ice adhesion and hence reduced consumption of deicing salts & agents
- ❑ Preventing freezing of freshly cast concrete: MCE™ has a distinguished and unique thermal behavior of preventing water freezing in MCE-dosed fresh concrete under severe continuous freezing conditions. Figure 1 shows that the temperature of MCE modified fresh concrete remained above freezing temperature for about 2 months (when the concrete is continuously subjected to -50°F), while the temperature of the control sample dropped to a value below freezing within three days

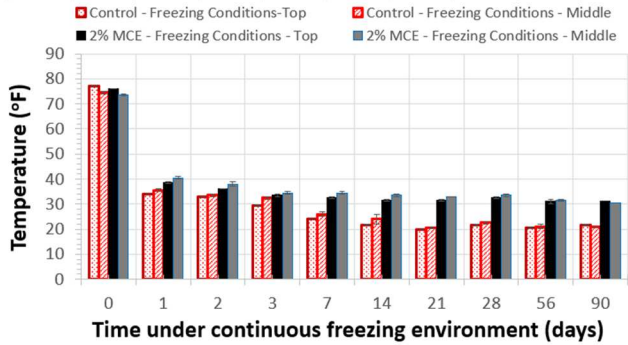


Fig. 1: Concrete thermal performance under continuous freezing environment, reporting the temperatures at two positions: top (0.5 inch below surface) and middle (1.5 inch below surface) for a concrete with a mix design of IDOT C4, comparing control sample with concrete mixed with 2% MCE™. The tests were made in freezing chambers used for ASTM C-666, with the temperature of the chamber adjusted to -50°F and remained constant to create more severe freezing conditions

- ❑ Improved freeze-thaw durability. Experimental data of IDOT C4 mix concrete samples with 2% MCE™ indicate a reduction of mass loss by 91.6% and an increase in the relative dynamic modulus by 20.3%. The results of % mass loss presented in figure 2 are from an independent laboratory testing according to ASTM C 666.

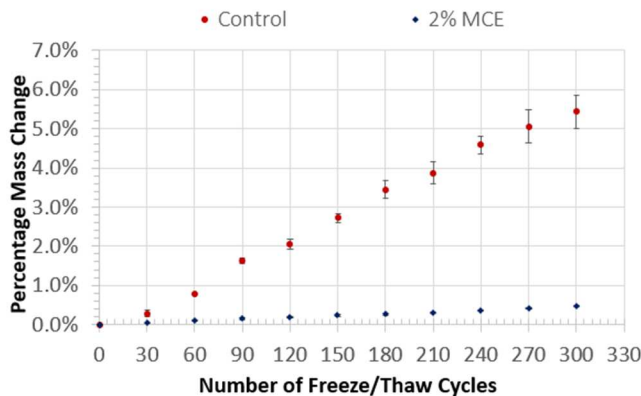


Fig. 2: Increasing resistance to freeze thaw cycles with MCE™ at 2% of cement weight. According to ASTM C 666 using IDOT C4 PCC mix

- ❑ Reduced chloride ion penetration from deicing salts, increased concrete electrical resistivity by a percentage over 90% and reduced associated steel corrosion and paste degradation.
- ❑ Reduced Alkali Silica Reactivity (ASR) problems and silicate dusting: The percentage reduction in length change due to ASR in 2% MCE- dosed concrete including reactive aggregates can be in the range of 45-77% (according to ASTM C1567, 28 days testing). Fig. 3 shows that MCE™ meets the requirement of ASTM C1293 (long term testing) on length change by not going above the 0.04% ASTM limit (for one year), see Fig. 3

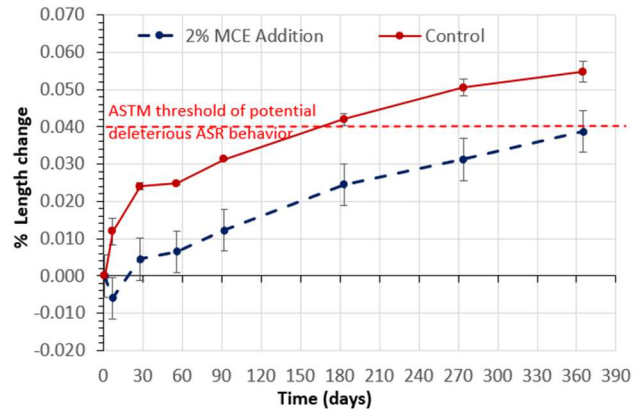


Fig. 3: The results of the long-term ASR experiments using the concrete-prism (ASTM C1293) for reactive coarse aggregates showing results for control specimens made with reactive coarse aggregates of Knife River compared to those for MCE-Dosed specimens. The standard errors of the replicates are shown as error bars. Also shown is the ASTM threshold indicative of potential deleterious ASR behavior (dashed line)

- ❑ Reduced fungal and microbial growth according to anti-fungal and microbial test method MIL-SDD810G (reduced mold associated problems)
- ❑ Enhanced workability and finishability: the effective compounds of MCE™ enhance concrete slump as indicated in fig.4. The results in Fig. 4 are for concrete mix designs with and without fly ash, obtained by an independent laboratory testing

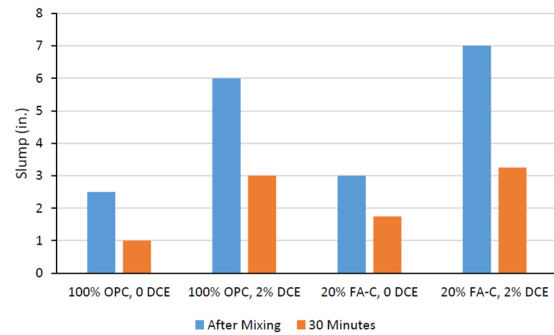


Fig. 4: Enhanced workability and retention of concrete with 2% MCE™

- ❑ Reduced formation of calcium hydroxide (CH) during hydration (with accompanying increase in calcium-silicate-hydrate (C-S-H)) and reduced encapsulation of cement and enhanced hydration
- ❑ Reduced heat generation during early stages of cement hydration and reduced temperature differential in mass concrete
- ❑ Improved cement hydration and enhanced compressive strength of fully cured concrete by a percentage within the range of 3-13% depending on the curing age and the mix design (appears at 28 or 56 days)
- ❑ Reduced shrinkage and surface cracking
- ❑ Helps concrete stay whiter & brighter (Albedo Surface)

PACKAGING

Product	Packaging
CHEM-CRETE MCE™	5 GAL (18.925 LITER) PAIL
	55 GAL (208 LITER) DRUM
	265 GAL (1000 LITER) TOTE

TECHNICAL DATA

PROPERTY	VALUE
Specific Gravity @ 77°F/25°C (ASTM, D1475)	1.1 – 1.2
Viscosity, Brookfield	2.4 centipoises
Freezing Point	24°F (-4.4°C)
Color	Violet
Environmental Hazards	None
Odor	None
Toxicity	None
Fumes	None
Flammability	None



Product Performance is tested according to the following test standards:

- Type S admixture (ASTM C494/C494M) that functions effectively with both Portland Cement and 1L (Limestone) Cement
- CRD-48-92 US Army Corps of Engineers Standard Test Method for Water Permeability of Concrete
- ASTM D6489-99 Determining the Water Absorption of Hardened Concrete Treated with a Water Repelling Coating.
- ASTM C642-97 Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
- ASTM C642-97 Density, Absorption, and Voids in Hardened Concrete
- ASTM C1202-91 Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
- AASHTO T260 Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials
- AASHTO T277 Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
- AASHTO T259-00 Resistance of Concrete to Chloride Ion Penetration
- ASTM C1218 Water-Soluble Chloride in Mortar and Concrete.
- ASTM C672-98 Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals
- ASTM C457-98 Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.
- MIL-STD-810G Fungal Resistance According to Test Method Standard for Environmental Engineering Considerations and Laboratory Tests
- ASTM D7234 Pull-Off Adhesion Strength of Coatings on Concrete
- ASTM D4541-95 Pull-Off Strength of Coatings Using Portable Adhesion Testers
- ASTM C1583 Bond Strength or Tensile Strength of Overlay Materials by Direct Tension.
- ASTM F609-96 Standard Test Method for Using a Horizontal Pull Slipmeter (HPS)
- ASTM E303-93 Measuring Surface Frictional Properties Using the British Pendulum Tester
- ASTM D7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers

- ASTM C666-97 Resistance of Concrete to Rapid Freezing & Thawing
- ASTM C1567 Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
- ASTM C1293 Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction

APPLICATION DATA

Method of Application: MCE™ is shipped in a ready-to-use state, with no additional preparation prior to use. The product is simply mixed with the concrete at the time of batching and is applicable to both ready-mixed and central mix production.

Blending: MCE™ can be introduced into the water stream at the time of batching or added to fresh concrete mixture at the job site.

Consumption/Dosage: One gallon per cubic yard (yd³) of concrete, based on a design mix containing 585 lbs. of cementitious material or four liters per cubic meter (m³).

CLEANING

Clean all equipment and tools with clean water immediately after use.

STORAGE

Two-year shelf life when stored in its original, unopened container, in a cool, dry place. Always agitate the product before using. **DO NOT ALLOW PRODUCT TO FREEZE.** Repeated freezing and thawing may cause damage to the product.

SAFETY PRECAUTIONS

As with all construction chemical products, adequate precautions and care must be taken during usage and storage. Avoid direct contact with foodstuff, eyes, skin and mouth. Contacted areas should be washed thoroughly with clean running water and soap. Always wear protective goggles and gloves. In case of eye contact, flush for fifteen minutes with warm water. If eye irritation persists, seek medical attention. In case of ingestion or swallowing, drink two glasses of clean water and seek medical attention. **KEEP OUT OF REACH OF CHILDREN.**

TECHNICAL ASSISTANCE

Contact International Chem-Crete for Technical Personnel.

WARRANTY

LIMITED WARRANTY: International Chem-Crete warrants that, at the time and place we make shipment, our materials will be of good quality and will conform to our published specifications in force on the date of acceptance of the order.

DISCLAIMER: The information contained herein is included for illustrative purposes only, and to the best of our knowledge, is accurate and reliable. International Chem-Crete cannot, under any circumstances, make any guarantee of results or assume any obligation or liability in connection with the use of this information.

As International Chem-Crete has no control over product usage, it is recommended that the product be tested to determine suitability for a specific application and/or that our information is valid in a particular circumstance. Responsibility remains with the architect or engineer, contractor and owner for the design, application and proper installation of each product. Specifier and user shall determine the suitability of products for specific application and assume all responsibilities in connection therewith. Any liability is limited to the replacement of material if proven faulty. AM020323-03.

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