



Surface Treatment

MIGRATORY CORROSION INHIBITOR (MCI®) PRODUCTS FOR CONCRETE



MCI®-2020/MCI®-2020 V/O



DESCRIPTION

MCI-2020 is a surface applied, migrating corrosion inhibitor designed to penetrate through cementitious materials including concrete, mortar, and limestone. MCI-2020 migrates in both liquid and vapor (gas) phases through the pore structure, forming a protective, molecular layer on embedded reinforcement. MCI-2020 provides corrosion protection against carbonation, chlorides, and other contaminants. MCI-2020 V/O is a high viscosity version of MCI-2020 which is specifically designed for vertical and overhead applications.

HOW IT WORKS

MCI-2020/MCI-2020 V/O are organic corrosion inhibitors. They are considered ambiodic (mixed) inhibitors which means they protect both anodic and cathodic areas within a corrosion cell. MCI-2020/MCI-2020 V/O contain a synergistic blend of amino-alcohols and salts of carboxylic acids which form a protective layer on embedded reinforcement delaying the onset of corrosion as well as reducing existing corrosion rates.

WHERE TO USE

MCI-2020 and MCI-2020 V/O are recommended for:

- Preventative maintenance of existing reinforced, precast, prestressed, post-tensioned, or marine concrete structures
- Bridges, highways, and industrial floors exposed to aggressive environments (chemicals, deicing salts, carbonation, atmospheric attack)
- Parking garages
- Concrete piers, dams, offshore platforms, piles, pillars, pipes, utility poles, and cooling towers
- Concrete potable water structures
- As a component of Cortec's High Performance Repair System™ (HPRS®)

ADVANTAGES

MCI-2020/MCI-2020 V/O offer engineers, owners, contractors, DOTs, and other government agencies a time proven, corrosion inhibiting technology that will extend the service life of their reinforced concrete structures.

- Protects against corrosion caused by carbonation, chlorides, and other aggressive contaminants
- Effectively reduces corrosion rates on metals with existing corrosion
- ANSI/NSF Standard 61 Approval for structures containing potable water
- Water based and non-flammable
- Does not etch, stain, discolor, or otherwise harm glass, metals, or automotive paint
- Does not contain calcium nitrite
- Does not contain wax
- Does not require removal of sound concrete
- Allows vapor diffusion (not a vapor barrier)
- Easily applied by spray, brush, or roller
- Minimal curing time, traffic may resume minutes after application if necessary (dry to touch)
- Migrates independent of orientation (horizontal, vertical, overhead)
- Migrates up to 3 inches in 30 days
- Proven performance in both lab and field testing
- MCI-2020 V/O available for vertical and overhead surfaces



MIGRATING CORROSION INHIBITORS
FROM GREY TO GREEN

PHYSICAL PROPERTIES

MCI-2020

Appearance	Clear to slightly hazy, amber liquid
pH	9.0-9.5 (neat)
Density	8.6-8.8 lb/gal (1.03-1.05 kg/l)
Water Vapor	
Transmission	1.72 perms (TCG Project # 09146)
Shelf Life	24 months in sealed container
Storage	32°F (0°C)-150°F (60°C) Do NOT Freeze

MCI-2020 V/O

Appearance	Clear, yellow, viscous liquid
pH	9.0-9.7 (neat)
Density	8.6-8.8 lb/gal (1.03-1.05 kg/l)
Shelf Life	24 months in sealed container
Storage	32°F (0°C)-150°F (60°C) Do NOT Freeze

COVERAGE

MCI-2020 is applied in a single coat at 150 ft²/gallon (3.68 m²/liter) to horizontal surfaces. It is applied in two coats at 300 ft²/gallon (7.36 m²/liter) to vertical and overhead surfaces. MCI-2020 V/O is applied in a single coat at 150 ft²/gallon (3.68 m²/liter) on most surfaces. In the case of extremely dense overhead surfaces, it can also be applied in two coats at 300 ft²/gallon (7.36 m²/liter).

PACKAGING

MCI-2020 and MCI-2020 V/O are available in 5 gallon (19 liter) pails, 55 gallon (208 liter) drums, and 275 gallon (1040 liter) totes.

MCI-2020 and MCI-2020 V/O are also available with a blue fugitive dye (MCI-2020 BFD and MCI-2020 V/O BFD) which helps to easily identify treated areas.

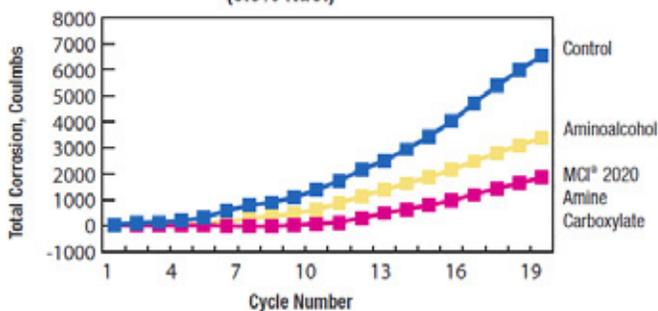
PERFORMANCE DATA

Corrosion Rate Reduction – Crack Performance

(adapted from ASTM G109)

Cracked Beam Testing of Surface Treatments

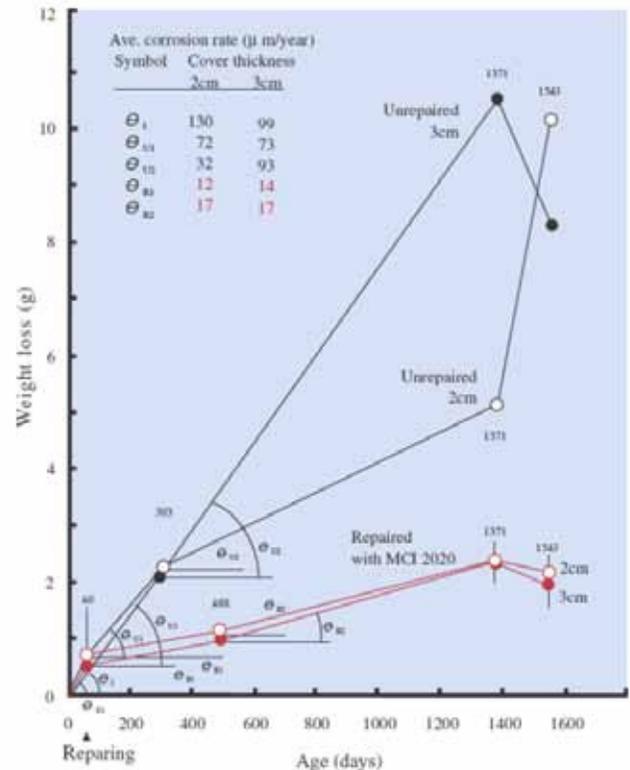
Amine Based Products (3.5% NaCl)



MCI-2020 reduced corrosion current by 72% compared to the untreated sample, and also outperformed the aminoalcohol based surface treatment.

Sherman, Matthew R., Krauss, Paul D. Cracked-Beam Corrosion Tests of Concrete Treated with MCI-2000 and MCI-2020 Corrosion Inhibitors, Final Report, WJE No. 922041. January 1995.

Corrosion Rate Reduction – Pre-existing Chlorides



MCI-2020 treated specimens decreased the amount of corrosion up by 1/2 to 1/6 that of the control samples. When applying MCI-2020 after cracks appeared, it worked very well in reducing corrosion rates in samples. Study used ASTM G109 sized beams cast with 3 rebar in a triangular array. Chloride solution was ponded on the surface for 2 weeks of a 4 week test cycle. Half-cell potentials and corrosion current readings were taken monthly.

Nagayama, Dr. Masaru; Shimozawa, Mr. Kazuyuki. Long Term Corrosion Testing of MCI-2020 (November 1994-April 1999). General Building Research Corporation of Japan. April 1999.

Penetration Into Concrete, Film Forming Capability, Chloride Displacement

Mass Concentration %

Sample	Etch Time (seconds)	Fe 2p	O 1s	C 1s	N 1s	Cl 2p	Ca 2p	Si 2p
Untreated	0	6.27	42.71	30.67	0.19	1.07	14.19	4.97
Untreated	120	13.60	39.43	23.08	0.14	1.06	17.59	5.19
Untreated	240	14.65	38.77	22.35	0.11	1.01	18.18	5.03
L2020	0	2.30	42.22	29.90	1.16	0.95	17.28	6.26
L2020	120	2.53	43.01	25.17	1.12	0.93	20.14	7.18
L2020	240	2.56	43.85	21.95	1.05	1.40	22.19	7.09
L2020M	0	2.02	40.20	38.55	1.32	0.87	11.54	5.53
L2020M	120	2.22	41.74	32.13	1.29	0.86	15.41	6.42
L2020M	240	2.82	43.61	28.99	1.15	0.83	15.92	6.68

Table 1 - XPS analysis on concrete samples after 500 days, showing the changes in chemistry with each time.

XPS analysis demonstrated the presence of inhibitor on steel rebar surfaces at levels 85 nm below the unetched surfaces (MCI-2020 M) and 75 nm (MCI-2020). The XPS results showed similar diffusion rates for the MCI and the corrosive species. The MCI-2020/MCI -2020 M inhibitors were able to provide a protective film on the rebar surface, whereas the untreated samples were subjected to localized corrosion attack. From the XPS depth profiling, chloride was detected at depths of 60 nm from the analysis surface on the bar and at a concentration of roughly 0.44 weight percent for the untreated samples and 0.14% for treated samples, confirming displacement of the chloride ions. (NOTE: 10 nm = 100 Å)

Bavarian, Behzad, PhD. and Reiner, Lisa. The Efficacy of using Migrating Corrosion Inhibitors (MCI 2020 & MCI 2020M) for Reinforced Concrete. California State University, Northridge, College of Engineering and Computer Science. March 2004.

SURFACE PREPARATION

Surfaces should be dry, clean, and free of all oil, grease, efflorescence, water repellants, coatings, membranes, and asphalt. Cleaning may be done by steam cleaning, waterblasting, or sandblasting.

FOR INDUSTRIAL USE ONLY

KEEP OUT OF REACH OF CHILDREN

KEEP CONTAINER TIGHTLY CLOSED

NOT FOR INTERNAL CONSUMPTION

CONSULT MATERIAL SAFETY DATA SHEET FOR MORE INFORMATION

APPLICATION

Apply MCI-2020/MCI-2020 V/O by spray (conventional airless or hand pressure spray equipment), brush, or roller according to coverage rates listed above. If applying more than one coat, allow the surface to dry enough between applications so that the second coat penetrates into the surface within 15 minutes. When applying a water repellent, coating, repair mortar, or overlay over MCI-2020/MCI-2020 V/O, the surface should be rinsed with water, pressure washed, or blast-cleaned to remove any residue unless prior adhesion testing has been performed. Consult product specifications for more detailed application instructions.

CONSIDERATIONS

- Substrate and ambient temperature should be above 35°F (2°C) and below 125°F (50°C)
- Do not apply if temperature is expected to fall below 32°F (0°C) within 12 hours after application
- MCI-2020/MCI-2020 V/O will not penetrate water repellants, coatings, paints, membranes, or asphalt
- If structure will be submerged after application of MCI-2020/MCI-2020 V/O, it is recommended to use a waterproofing coating over MCI-2020/MCI-2020 V/O prior to submersion
- Maximum chloride content at the depth of reinforcement in structures being treated with MCI-2020/MCI-2020 V/O is 6 lb/yd³ (3.5 kg/m³). For higher levels, consult Cortec technical service
- Do not apply if precipitation is expected within 8 hours after application

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