



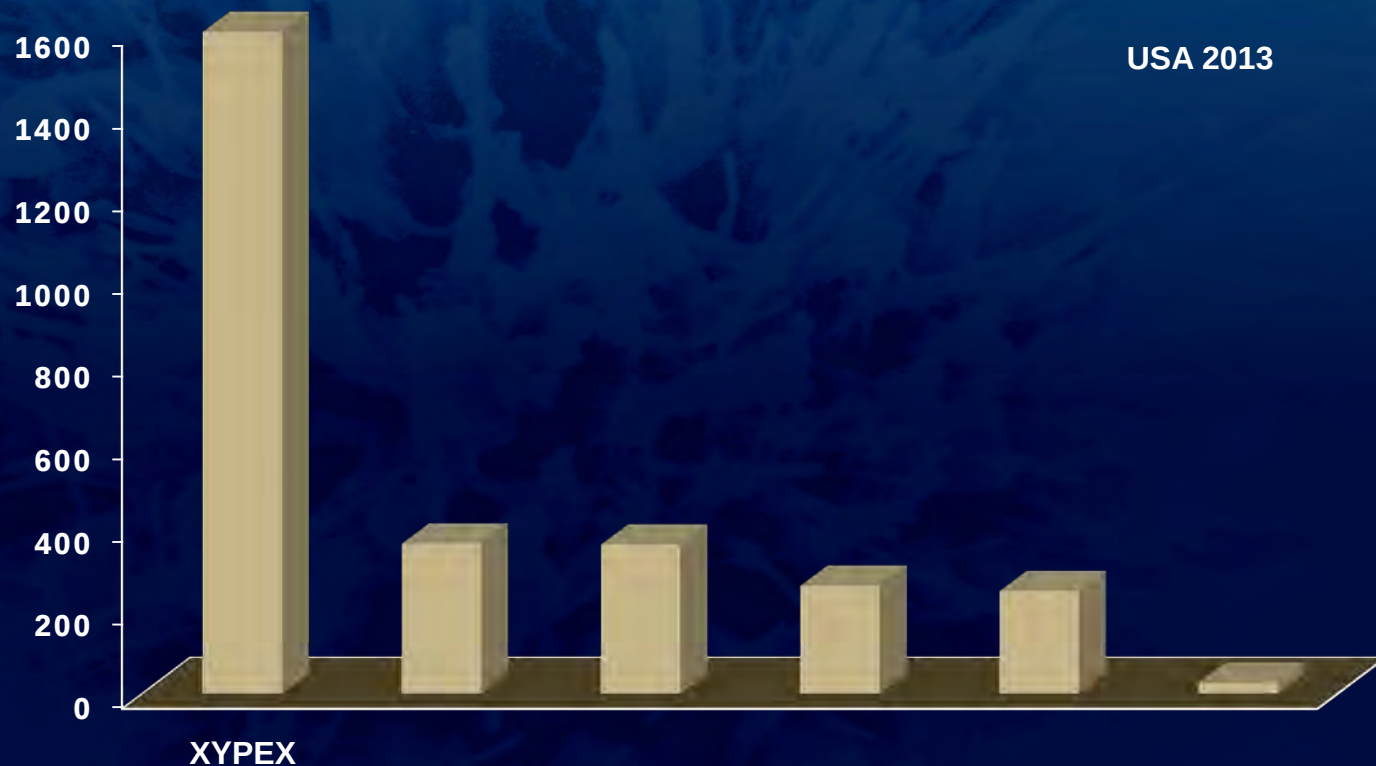
Xypex Chemical Corporation

- Founded 1969 in Vancouver, British Columbia
- Concrete Waterproofing & Protection by Crystallization
- Present in over 80 countries worldwide
- Worldwide manufacturing base in 12 locations



Leader

Number of specifications of Xypex Crystalline Technology





Xypex products and services are available in over 80 countries.





Concrete Challenges



Hydrostatic Pressure



- Dams
- Canals
- Tanks
- Reservoirs



Water Table



- Rivers
- Lakes
- Seas
- Mountains



Chemical Attack



- Water Treatment
- Waste Water Collection and Treatment
- Industry
- Agriculture
- Environmental



Environmental Attack



- Carbonation
- Chloride
- Sulfate
- Freezethaw



Waterproofing Failure



- Coatings
- Membranes
- Cementitious



Porous Concrete

- Mix-design
- Type of structure
- Construction conditions
- Poor workmanship
- Cracks
- Cold joints
- Construction joints
- Poor consolidation

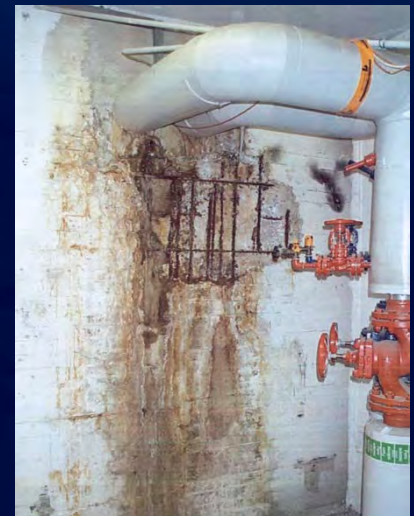
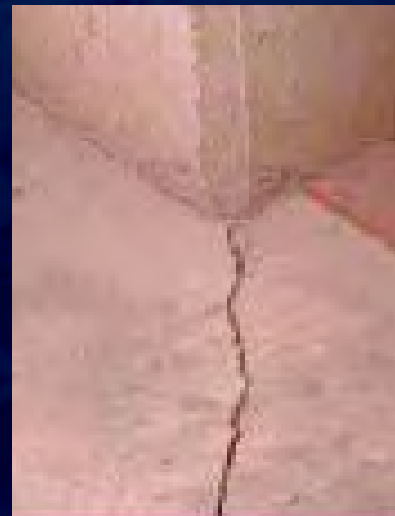




Cracks

The most common causes of cracking in walls and slabs are:

- Drying Shrinkage
- Thermal Cracking
- Strain Formed Cracks
- Settlement
- Plastic Shrinkage Cracking
- Rebar Corrosion





Key Problems and Costs

Four phases of concrete corrosion

Phase 1	Design, construction and concrete curing	\$ 1
Phase 2	Corrosion initiation processes are underway, but increased damage has not yet begun	\$ 5
Phase 3	Increase in damage has just begun	\$ 25
Phase 4	Increase in corrosion is advanced with extensive damage clearly evident.	\$125

Equivalent cost of \$1 spent in Phase 1



Current Solutions

XYPEX®



Concrete Surface Protection

ADVANTAGES

LIMITATIONS

LINERS

HDPE, PVC, PE



- Impermeable
- Excellent chemical resistance especially in areas where pH is lower than 3.0
- Visible protection system

- Errors in workmanship
- Seam failure
- False spark test
- Liners can be affected by negative side pressure
- One breach can affect the integrity of the entire system
- Expensive

CEMENT BASED LINERS

Portland, high alumina, speciality



- Reduce inflow
- Structural integrity
- Some corrosion protection
- Withstand negative side pressure
- No VOCs

- Physical permeability barrier
- Application requires expertise
- Specialized equipment
- Residual overspray material difficult to remove



Liner Problems

Spark Test



Seams





Concrete Surface Protection

ADVANTAGES

LIMITATIONS

COATINGS

Epoxies, urethanes, polyurethanes, coal tar epoxies



- Impermeable
- Good chemical resistance
- Visible protection system

- Costly surface preparation required
- Installation errors leading to pin holes and thin spots
- No crack healing
- Concrete needs to be dry
- Limited abrasion resistance
- Single breach affects integrity of entire system
- Performance deteriorates over time
- Do not resist negative side vapour and liquid pressure

CEMENT BASED COATINGS

Polymer cement mortars



- Easy application
- Inexpensive
- Can be applied to moist concrete
- Significant and costly surface preparation required
- Limited resistance to hydrostatic pressure
- Can be pushed off by negative side hydrostatic pressure
- Limited abrasion resistance
- Poor crack bridging, no crack healing
- Limited chemical resistance
- "One scratch" affects integrity of entire system
- Performance deteriorates over time



Coating Problems

Negative side water pressure



Pinholes



Blistering



Limited Lifespan





Admixtures

ADVANTAGES

LIMITATIONS

HYDROPHOBIC ADMIXTURES

- | | | |
|--|--|---|
| <ul style="list-style-type: none">• Long-chain fatty acids (ammonium or calcium stearate)• Vegetable oils• Petroleum derivatives (mineral oils, paraffin wax, bitumen emulsions) | <ul style="list-style-type: none">• Added at batch plant• Low labor costs• Low risk of error• Water repelling• Effective where no presence of hydrostatic pressure | <ul style="list-style-type: none">• Low performance under hydrostatic pressure• Diminishing performance over time• Not recommended by ACI for concrete under hydrostatic pressure• No crack bridging or healing properties |
|--|--|---|

ANTI-MICROBIAL AGENTS

Anti-microbial agents dosed into concrete at time of batching

- | | |
|---|---|
| <ul style="list-style-type: none">• Interrupts the microbial induced corrosion process• Newer technology (1996) but appears to be effective• Can be added to concrete | <ul style="list-style-type: none">• Moderately new system, no real long term field exposure• Expensive• Provides corrosion protection only, does not stop water infiltration or ex-filtration |
|---|---|



Repair systems

	ADVANTAGES	LIMITATIONS
INJECTION SYSTEMS		
• Epoxy • Polyurethane	• Epoxies reinstate structural integrity • Polyurethanes allow movement • Polyurethanes can be applied on wet concrete • Effective for wider cracks	• High cost • Requires high level of application expertise • Requires specialty equipment • Poor aesthetics of typical injection job • Complicated re-working • Will not heal new cracks
ROUT & REPAIR		
Chipping out of crack then filling with cement-based mortar	• Inexpensive • Can be applied to wet or moist concrete & actively leaking cracks • Moderate level of expertise required • No special equipment needed	• Not a full depth repair • Will not cure future cracking • Not for cont. moving cracks



Injection Systems Limitations

Epoxy & Polyurethane





Our System



Concrete Waterproofing by Crystallization

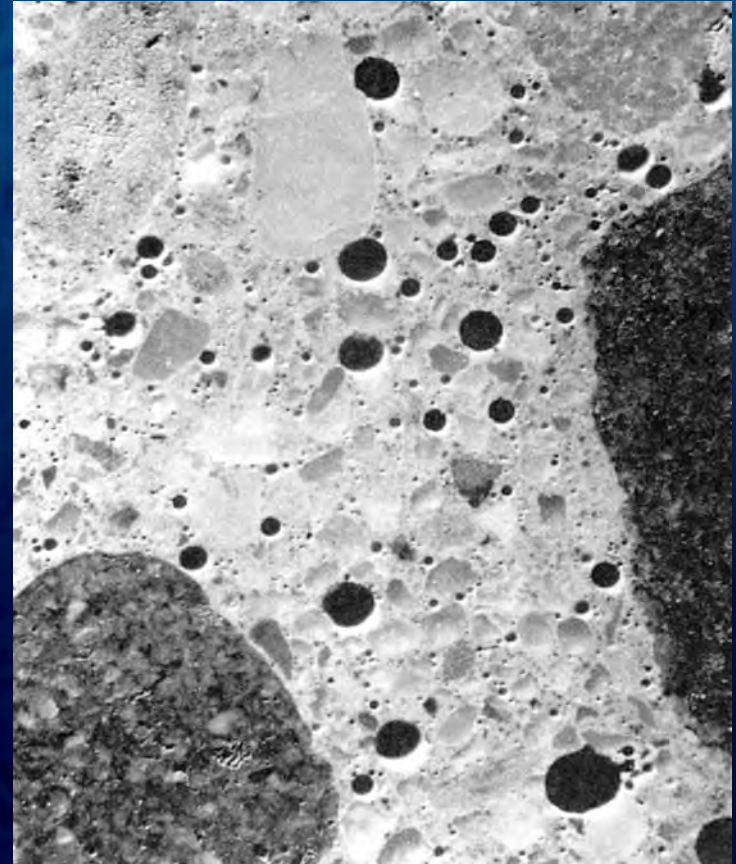
The Nature of Concrete





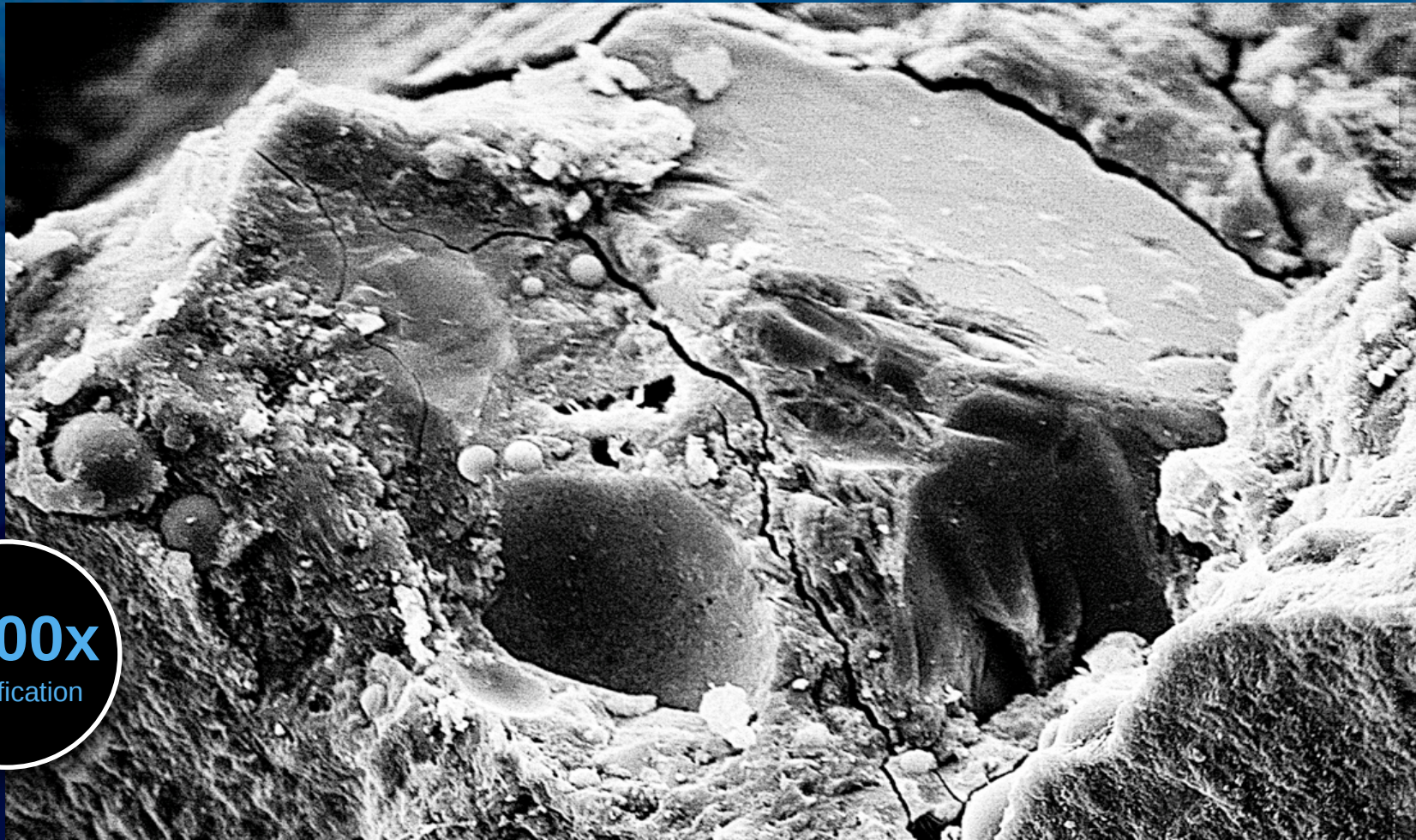
Composition & Characteristics

- Composed of a mixture of rock, sand, cement and water.
- To be workable, more water than needed for cement hydration is used.
- Excess water bleeds out and leaves a network of capillaries and pores.
- As it dries, concrete shrinks and changes volume causing micro and macro cracks.





Micro Cracks



5000x
magnification

The nature of concrete can be determined by petrographic examination.



Permeability

Entrapped Void



1mm to 10mm

Crack



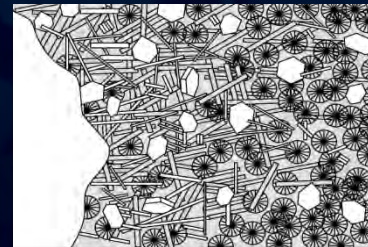
0.1mm to 3mm

Micro Crack



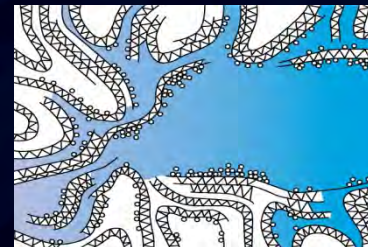
<0.0001mm to 0.1mm

Transition Zone



0.01 mm to 0.05 mm

Capillary Pore



0.0001mm to 0.001 mm

Permeable in several, different size scales.



Xypex Crystalline Technology







What is Xypex?

Coating



Dryshake



Admixture





How It Works

Calcium Hydroxide
and other by-products
of cement hydration

+

Crystalline
Waterproofing
Chemicals

=

**Non-soluble
crystalline formation
permanently fixed
within the concrete's
pore structure**



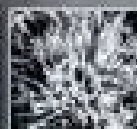
The World Standard in Concrete Waterproofing by Crystallization™



Concrete Crystallization



Xypex Crystalline Concentrate (Dry Mix)



Xypex Crystallization Matrix

When you select Xypex, you're choosing the best, most tried & true years of independent testing of the original crystallization technology, and still the equal, not many years in over 70 countries from many top specialists, for integrated product and service standards provide confidence and peace of mind to architects, engineers, contractors and concrete producers, versus about long-term concrete water pooling, protection and durability.

1.800.961.4477 | xypex.com

**NO
EQUAL**

Exceed throughout lifespan and the integrity and look of all Xypex Crystalline Programs.



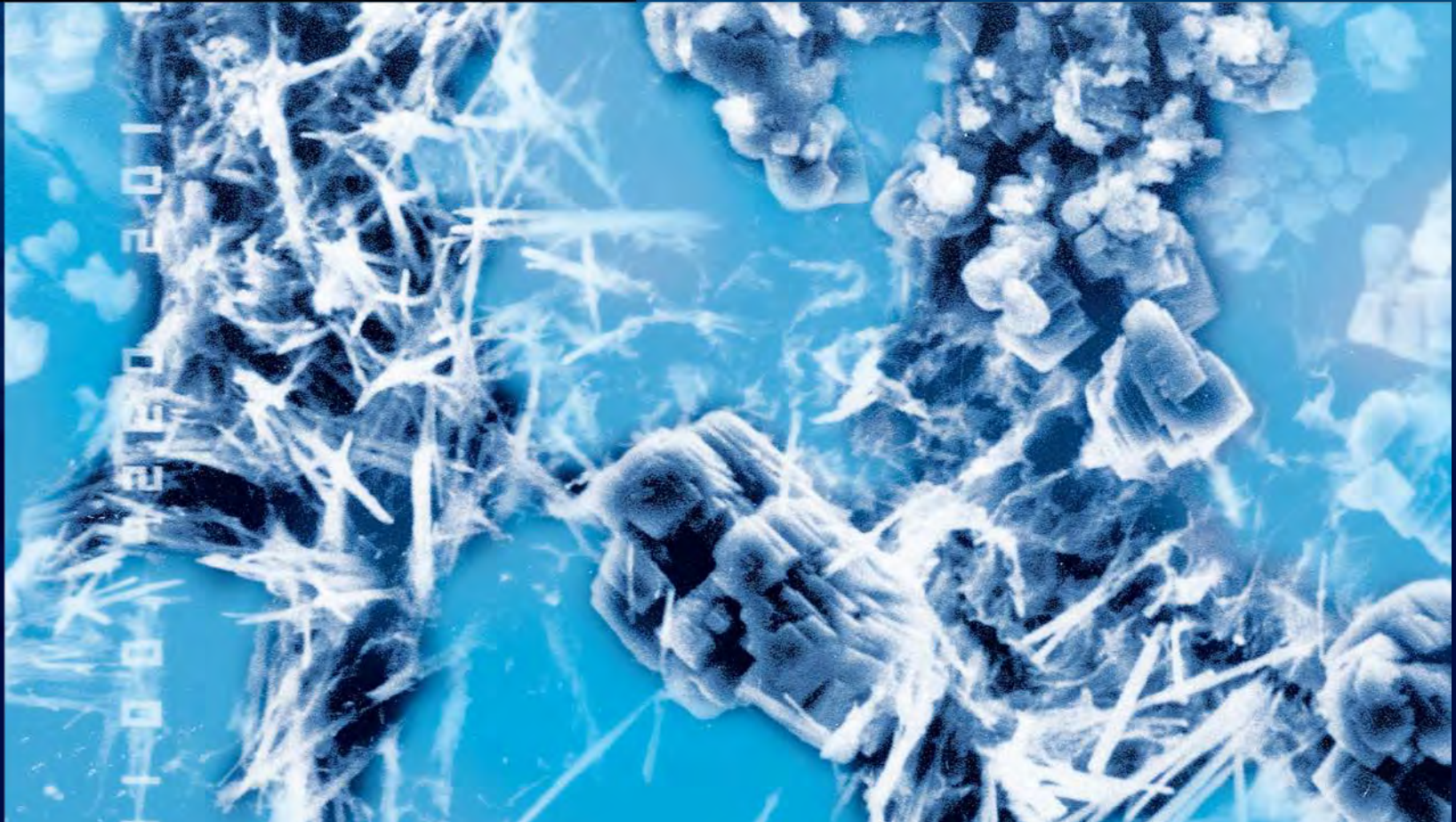
Crystalline Formation

By-products of cement hydrations



Crystalline Formation

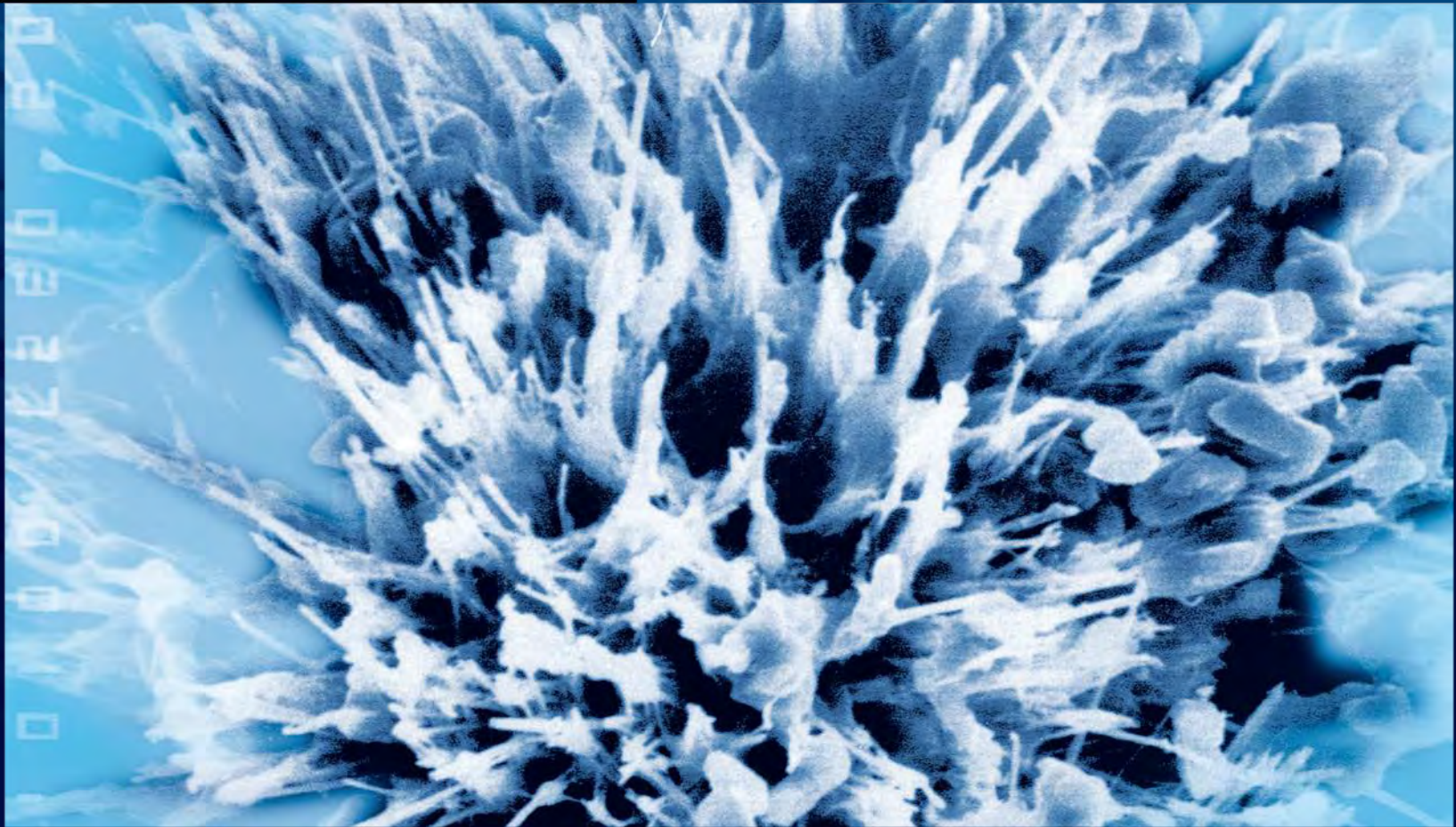
By-products + Xypex

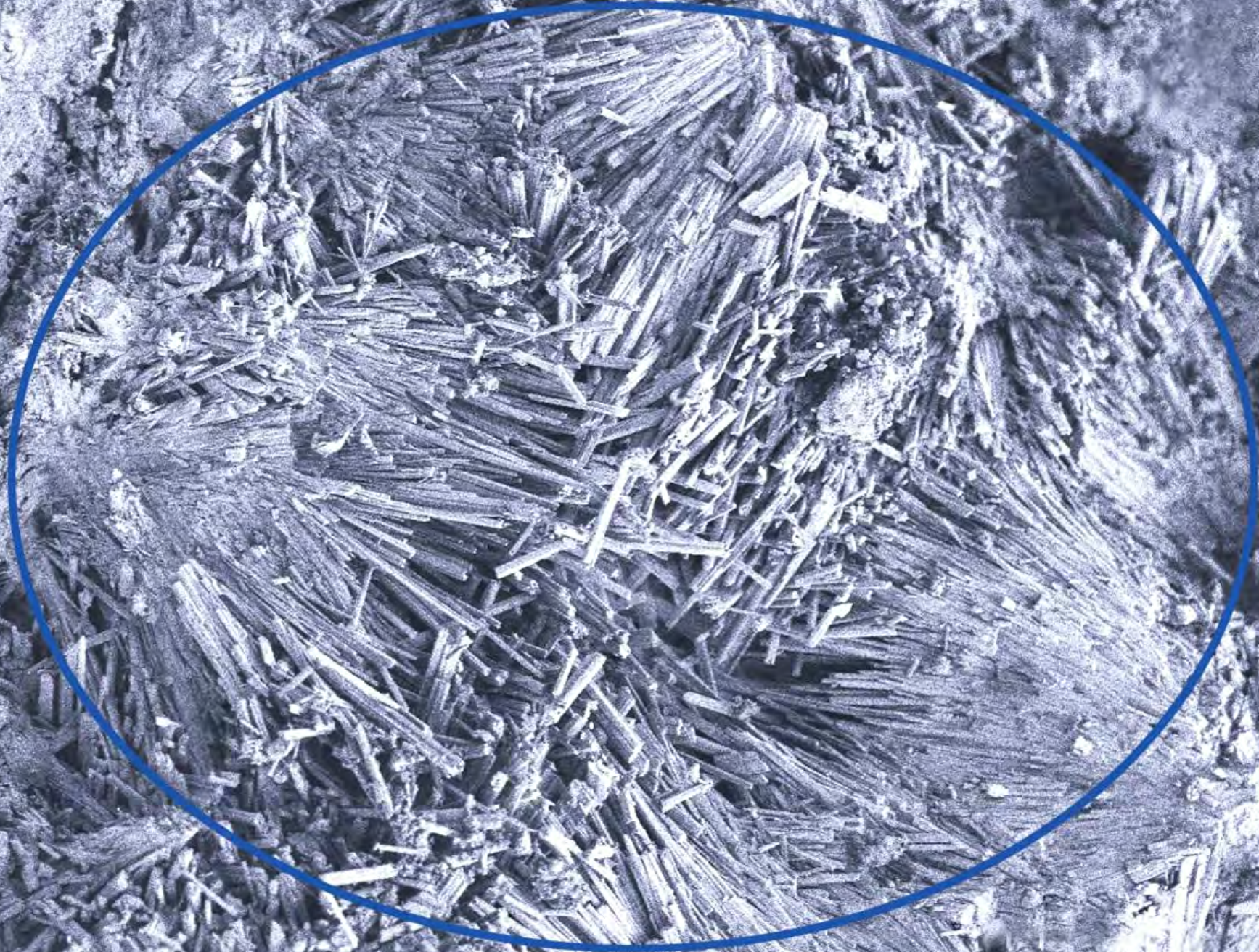




Crystalline Formation

Non-soluble crystalline structure







What is Xypex?

- Becomes an integral, permanent part of the concrete matrix.
- Seals concrete from the penetration of water and other liquids from both the negative and positive side, even when subjected to hydrostatic pressure.
- Heals static cracks up to 0.4 mm, or 0.8 mm from both sides.
- Highly resistant to chemicals where the ph range is from 3.0 - 11.0 in constant contact and 2.0 - 12.0 in periodic contact.
- Cannot be punctured or damaged like a liner or surface coating.
- Enhances the durability of concrete.



Additional Advantages

- Not affected by humidity, ultraviolet light and oxygen levels
- Protects from freeze thaw
- Increased compressive strength
- Reduced shrinkage crack
- Is non-toxic
- Does not contain VOCs
- Does not produce any fumes
- Approved for use in potable water structures



Where is Xypex used?

- Hydrostatic Pressure
 - High Water Table
 - Tanks, Pools, Reservoirs, Dams
 - Tunnels
- Harsh Chemical Environments
 - Marine
 - Industry & Agriculture
 - Waste Water Collection & Treatment
 - Carbonation and Sulphate Attack
- Repair and Rehabilitation
 - Negative side after coating or membrane failure
 - Wet/Most concrete



Xypex and Concrete Properties

Xypex will have no negative effect on

- Slump
- Set time*
- Air
- Shrinkage
- Compressive strength



SCMs & Other Additives

Xypex can be used in conjunction with SCMs and additives

- Fly-ash
- Slag
- Silica fume
- Set retarders
- Water reducer
- Super plasticizers
- Air-entrainers



Trial batches always recommended



Proven Performance

XYPEX®



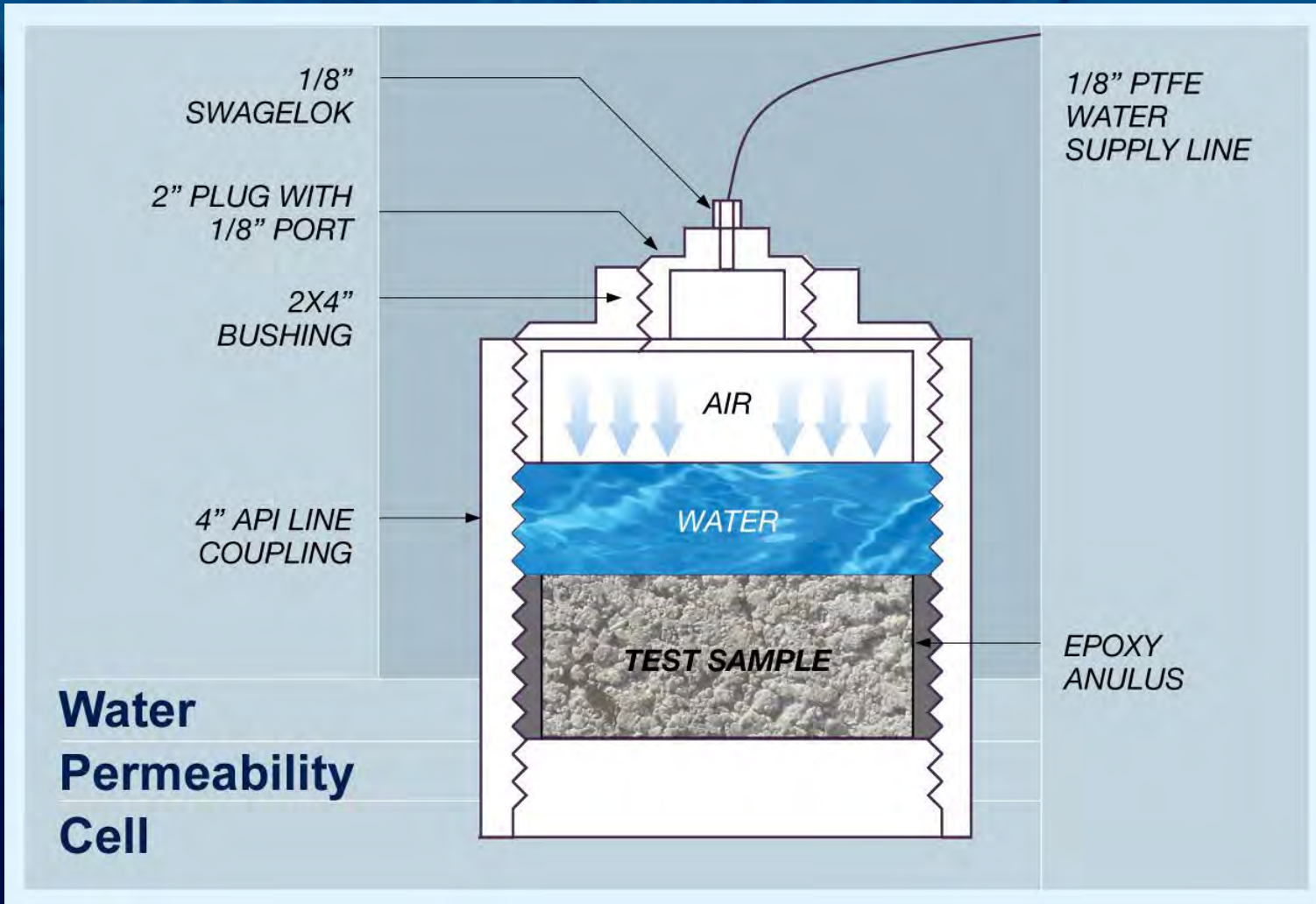
Independent Testing

Xypex has been independently tested worldwide for these characteristics

- Permeability
- Chemical Resistance
 - Acids
 - Sulfates
- Carbonation
- Compressive Strength
- Crack Sealing
- Scanning Electron Microscopy (SEM)



Permeability





Permeability

Taywood Engineering, CRDC C48-73, Singapore

Sample Reference		Control Concrete						Xypex-treated Concrete					
Date of Cast		22/01/97						14/01/97					
Date of Coring		30/01/97			20/02/97			22/01/97			2/12/97		
Age of Curing (days)		8			29			8			29		
Specimen Size (mm)		150 x 50						150 x 50					
Specimen Reference		1	2	3	1	2	3	1	2	3	1	2	3
Volume of water moving through the sample (mL):													
At 1 bar on	1 st day	0	0	0	0	0	0	0	0	0	0	0	0
At 2.4 bar on	2 nd day	0	0	0	0	0	0	0	0	0	0	0	0
At 4.2 bar on	3 rd day	0	0	0	0	0	0	0	0	0	0	0	0
At 7.0 bar on	4 th day	0	0	0	0	0	0	0	0	0	0	0	0
	5 th day	10	0	4	10	0	0	0	0	0	0	0	0
	6 th day	30	20	25	74	13	0	0	0	0	0	0	0
	7 th day	65	20	60	78	20	0	0	0	0	0	0	0
	8 th day	70	30	60	45	10	0	0	0	0	0	0	0
	9 th day	70	30	60	35	10	0	0	0	0	0	0	0
	10 th day	70	30	60	46	10	0	0	0	0	0	0	0

Permeability

DIN 1048, Bautest, Germany,

Treated

bautest Corporation for research and testing of building materials

To determine water impermeability After DIN 1048

Order Number: A 362/80

Customer: XYPEX Kemptenstr. 55, 8900 Augsburg

Water permeable concrete with coating

Part: Coated with Xypex

General Data

Order from: 26.11.79 Received: 26.11.79

Type of material to be tested: WU Blocks 20 x 20 x 12 cm Test date: 18.1.80

Test submitted: 26.11.79 by Customer

Testing results

DESCRIPTION	WATER FACTORING DATE	START OF TEST	END OF TEST	LARGEST PENETRATION	REMARKS
1	26.11.79	14.1.80	18.1.80	6	With Coating
2	26.11.79	14.1.80	18.1.80	9	With Coating
3	26.11.79	14.1.80	18.1.80	7	With Coating
				4	Sealant bleeding about 1mm

Augsburg: 25.3.1980

Tests carried out by: ThG/Gro

(2)

Untreated

bautest Corporation for research and testing of building materials

To determine water impermeability After DIN 1048

Order Number: A 362/80

Customer: XYPEX Kemptenstr. 55, 8900 Augsburg

Water permeable concrete without coating

Part: O - Test untreated

General Data

Order from: 26.11.79 Received: 26.11.79

Type of material to be tested: WU Blocks 20 x 20 x 12 cm Test date: 18.1.80

Test submitted: 26.11.79

Testing results

DESCRIPTION	WATER FACTORING DATE	START OF TEST	END OF TEST	LARGEST PENETRATION	REMARKS
3	26.11.79	14.1.80	18.1.80	82	
5	26.11.79	14.1.80	18.1.80	92	
5	26.11.79	14.1.80	18.1.80	78	
				84	Sealant bleeding about 1mm

Augsburg: 25.3.1980

Tests carried out by: ThG/Gro

PERM-200
bautest/bertuspeck/perme-perm-200.pdf

Untreated control sample had average 84 mm of water penetration. Xypex treated control sample had average 6 mm of water penetration. Hydrostatic pressure equivalent to 224 ft of hydraulic head .



Chemical Resistance

Sulfuric Acid Exposure

Chemical Durability, Iwate University, Tokyo, Japan

The typical means of evaluating the ability of the Xypex treatment to provide chemical resistance include: measuring amount of mass loss, length change or relative dynamic modulus of elasticity.

Before Soaking



UNTREATED

XYPEX

5 Weeks



UNTREATED

XYPEX

10 Weeks



UNTREATED

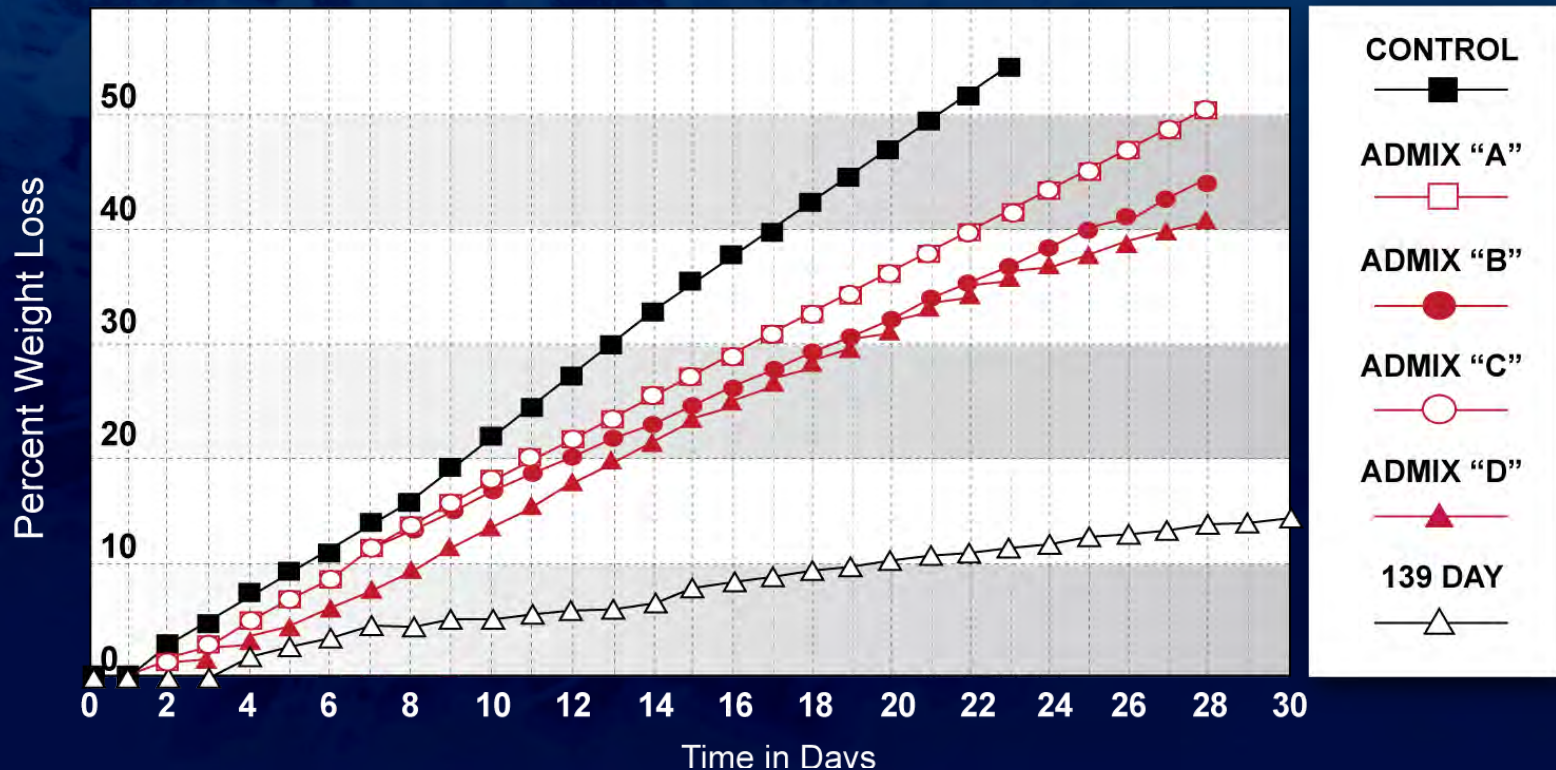
XYPEX

Chemical Resistance

Sulfuric Acid Exposure

Aviles Engineering, Texas, USA

- 40 day cure acid comparison test in 7% $H_2(SO_4)$
- Control, 3%, 5% and 7% Admix (Regular Grade)
- Curing periods were varied to determine effects





Chemical Resistance

Ammonium Sulfate Exposure

Taywood Engineering, Sydney, Australia

- 1 molar - 132 g/l
- Six mixes: control, low slag cement, silica fume, high slag cement, silica fume cement, Xypex Admix

MIX DESIGNATION						
Component	GB80	GP	LH	SR	SF	ADMIX
Total Percentage Weight Loss	14.60	12.00	28.40	7.20	8.80	8.80
Loss Percentage Length Change	0.01	—	0.12	0.00	-0.01	-0.02

Note 1: Total Percentage Weight Loss is given for 25 weeks exposure.

Note 2: Percentage Length Change is given as the change compared to the GP mix, at 25 weeks.



Carbonation

Resistance to carbonation

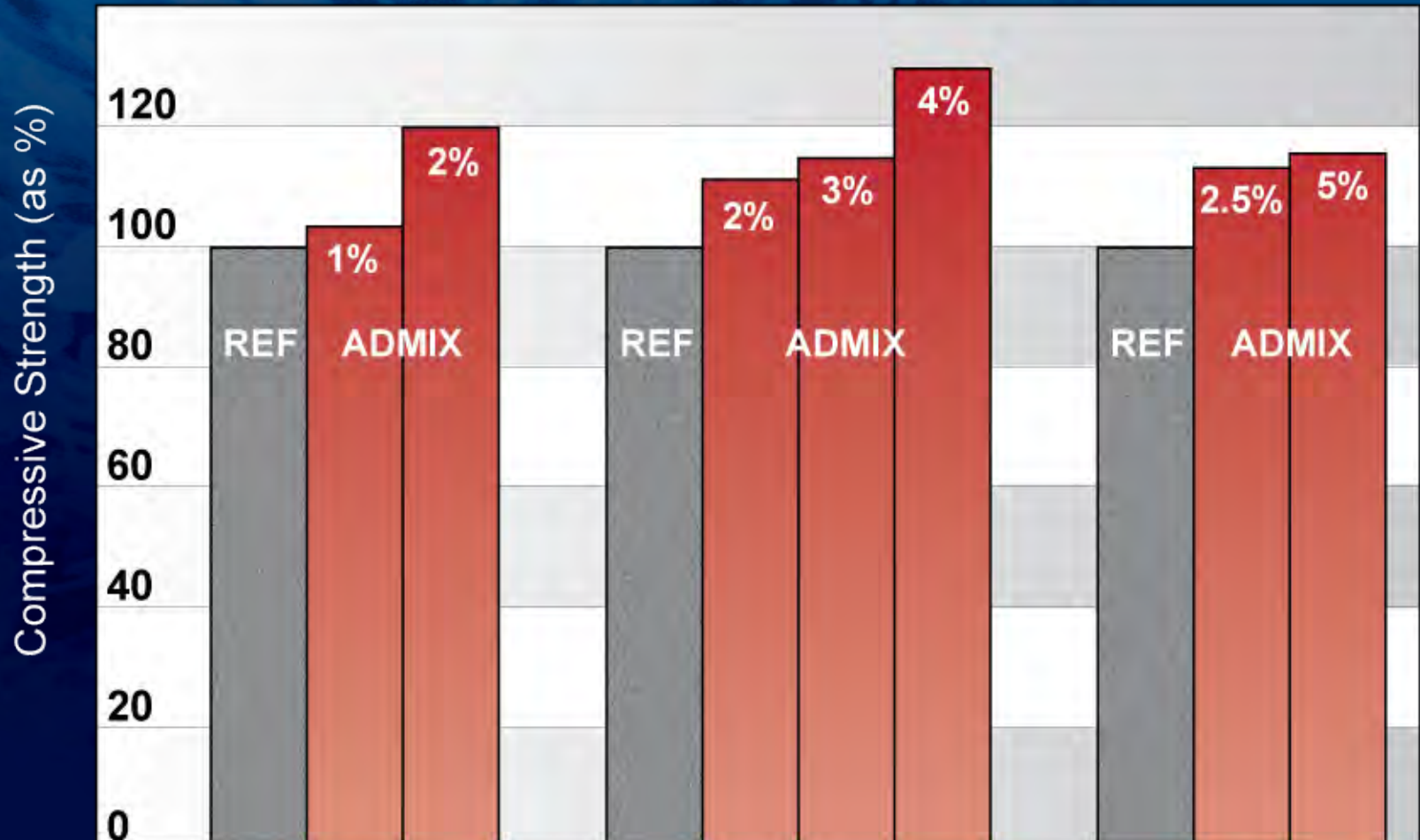
Slovenska Akademia Vied, Institute of Construction and Architecture (Bratislava 2002)

Plain Mortar (51)	Mortar with 1 Coat (52)	Mortar with 2 Coats (53)
 3 days	 3 days	 3 days
 7 days	 7 days	 7 days
 14 days	 14 days	 14 days



Compressive Strength

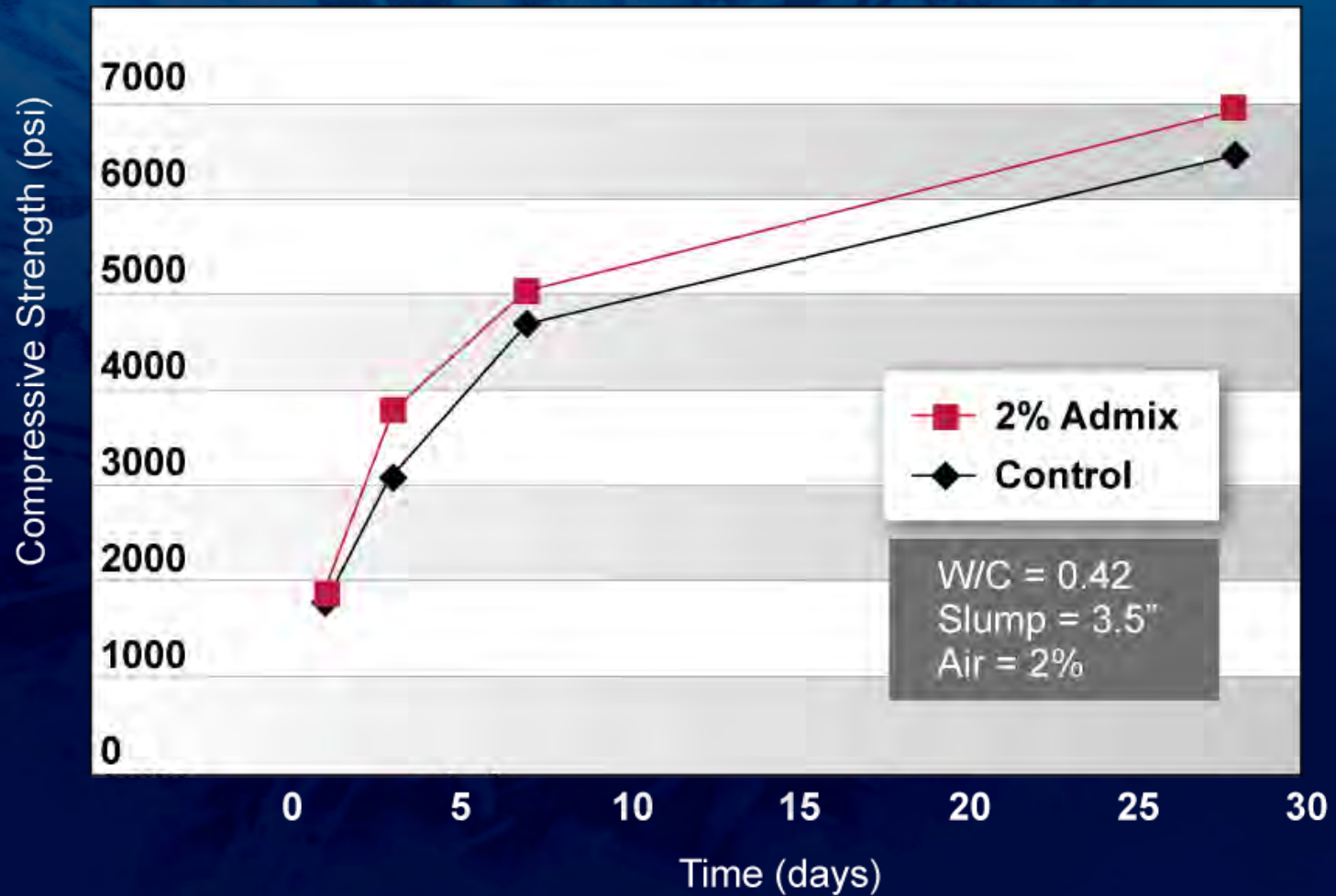
HBT AGRA, Vancouver, British Columbia, Canada





Compressive Strength

Kleinfelder Laboratories, San Francisco, California, USA





Crack Sealing Test

The Construction Bureau of Chubu District, Japanese Ministry of Construction (Sept 1996)



Photo 1: Evidence of cracking in concrete on underside of the deck slab



Crack Sealing Test

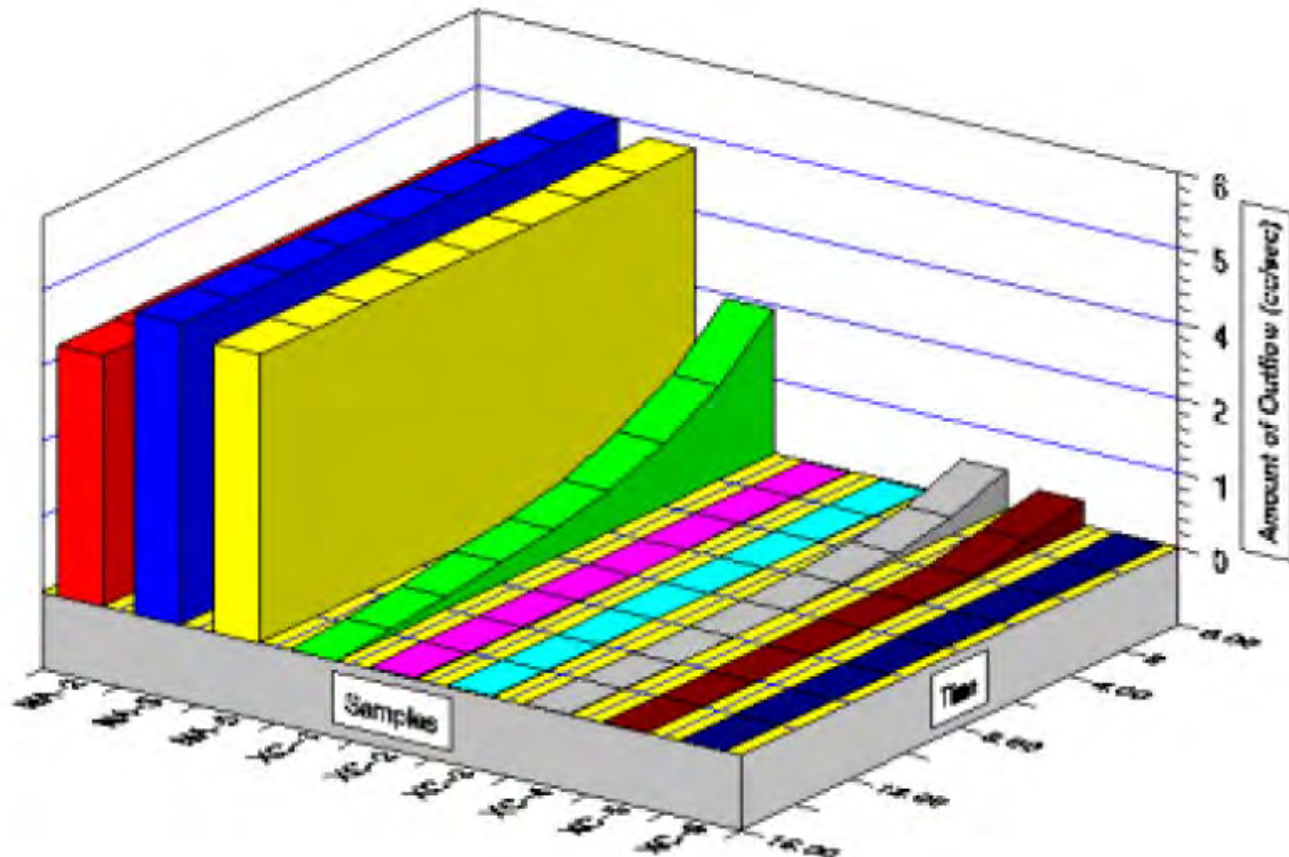
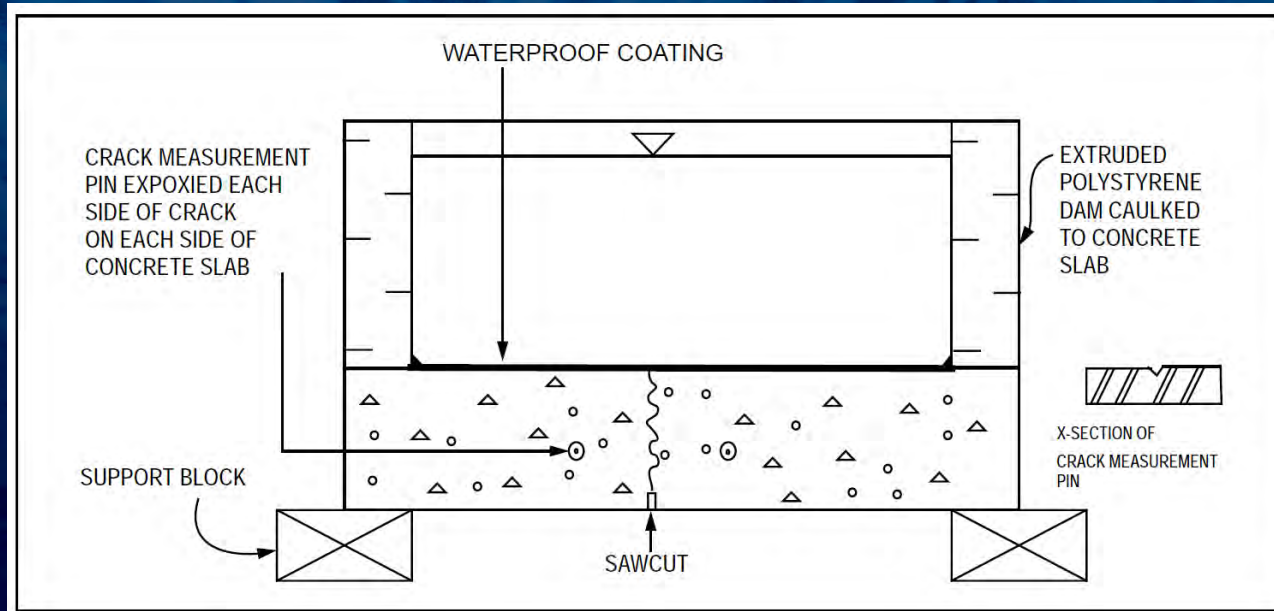


Figure 3: Change in Amount of Outflow with Time



Crack Sealing Test

Results of Cracked Slab Test



Sample Series	Materials	Crack Width (mm)	Initial Flow Rate (mm/min)	Time to Stop Leak (days)
Series 1	Xypex	0.2	0.25	35
Series 2	Xypex	1.0	3.50	70

Coating



Crystalline waterproofing chemicals can penetrate to a depth of 30 cm or 12" in a year.



Summary of Xypex

- **Waterproofs and protects concrete**
against chemical attack.
- **Heals cracks up to 0.4mm**
and reactivates any time with moisture when micro crack occurs.
- **Permanent, integral solution**
as a new systems and as a rehabilitation system.
- **Advantages of barrier systems,**
with none of the disadvantages.
- **Proven worldwide**
through thousands of projects successfully completed and independent testing.

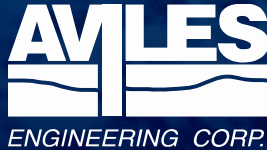


Summary of Xypex

- **Extends service life**
amortizing investments over a longer period.
- **Reduces maintenance costs**
allowing for significant savings.
- **Makes concrete more environmentally friendly**
amortizing it's damage over a longer period.
- **Adds value to owners, engineers and contractors**
all around the globe.

Xypex Testing

Xypex products have been extensively and successfully tested by leading, independent scientific laboratories throughout the world for durability permeability and chemical resistance.





XYPEX Main Products



Coating



- Concentrate
- Modified

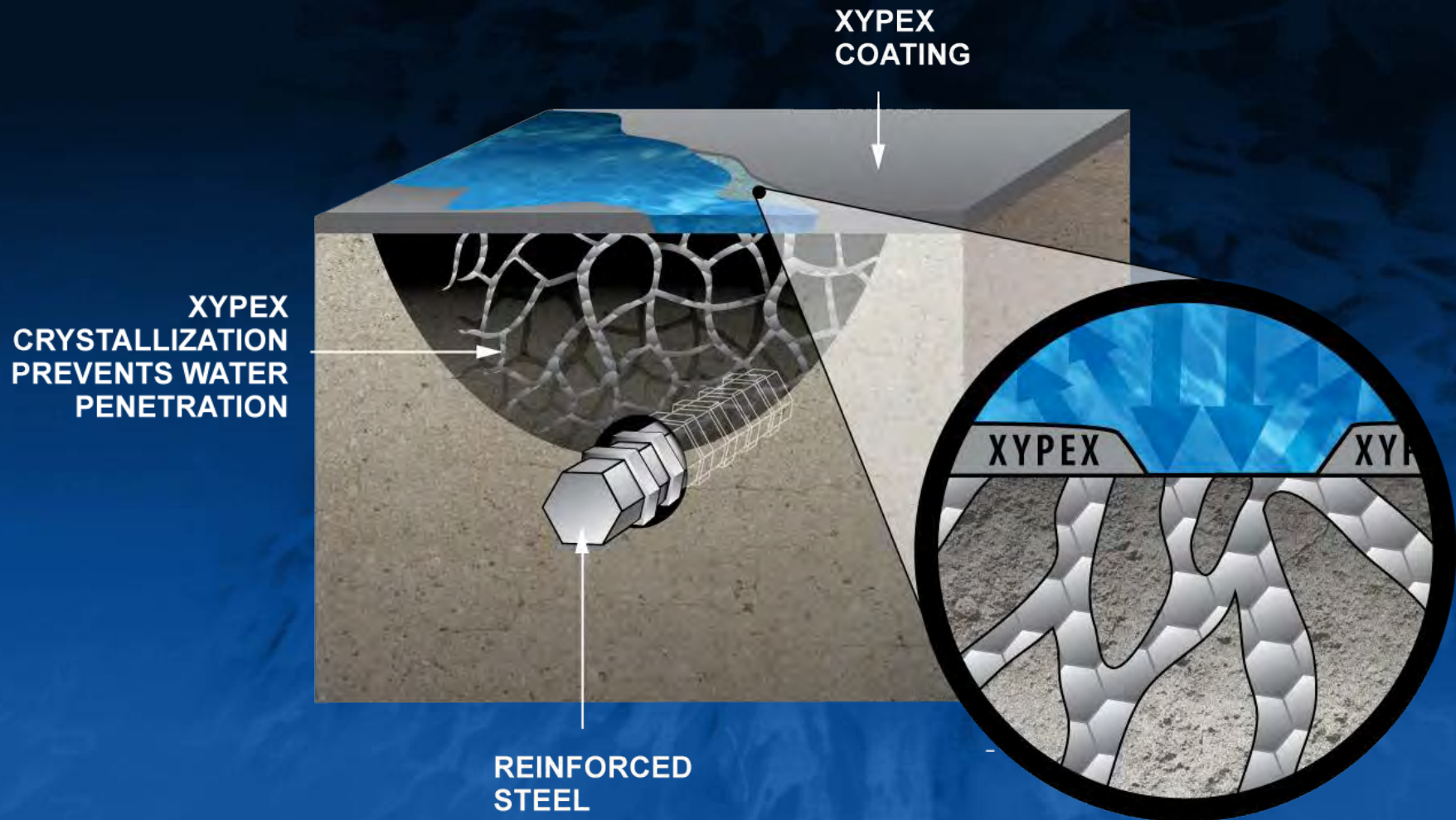
Spray Applied



Brush Applied



Coating



Coating

- Does not require costly surface priming and leveling
- Does not require a dry surface
- Sealing, lapping or finishing is not needed
- Can be applied to both positive and negative side
- No protection required during back-filling
- Can be applied in confined spaces – no VOCs
- Crystalline waterproofing penetrates deeply into the concrete substrate and becomes an integral part of the concrete.
- Does not depend on surface adhesion like barrier systems
and does not have seams that come apart.
- Permanent, one-time only treatment

Admixture



Dry batch
Central Mix



Pre-cast

- Admix C-500
- Admix C-1000
- Admix C-2000

Also available in NF (no fines)
and non-soluble bags.



Admixture

Ready-mix Concrete



Shotcrete



Precast Concrete



Admixture

Admix Type	For Normal Waterproofing and Durability	For Extra Chemical Protection or Special Applications
C-500		
C-1000	2%	3%
C-2000*		
C-500 NF		
C-1000 NF	1%	1.5%
C-2000 NF*		

Based on % of cement or cement + pozzolan/slag depending on mix design

Admixture

May be used in conjunction with other admixtures

- Set retarders
- Water reducer
- Superplasticizers
- Air-entrainers

Trial Batching is always recommended





Admixture

- Added at time of batching.
- Minimizes installation costs
- Takes a trade off the job site
- Shortens construction schedule

Patching & Repair

Patch 'n Plug

- Fast setting
- For crack repair and mortar joints with flowing water



Other Patching & Repair

- FCM 80 (Flexible Cementitious Membrane)
- Megamix I and II
- Xycrylic Admix
- Gamma Cure





Are there any questions?

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