EMC Cement BV

Technical Information Series

Summary of CemPozz® (Natural Pozzolan)
Performance in Concrete

Contents

CemPozz® (NP) Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

EMC CemPozz® Natural Pozzolan

MATERIAL IDENTIFICATION AND INFORMATION

INGREDIENTS	FORMULA	%(1)	OSHA PEL(2)	ACGIH TLV(2)
Aluminosilicate Glass	Contains Al,Si,Fe,Ca,Mg	80-95	Not Listed(3)	Not Listed(3)
Crystalline Silica (total)	SiO_2	3-7	30/(%SiO2+2)(4)	0.3
(respirable)		Note (5)	10/(%SiO2+2)(4)	0.1
Fly ash		0-10	10/(%SiO2+2)(4)	
Portland Cement		0-15	10/(%SiO2+2)	0.05

Notes:
(1) Values approximate, material is derived from naturally occurring minerals.
(2) Airborne exposure limits in mg/m3.
(3) Not listed specifically by substance name. Exposure to Alumino silicate glass dust may be covered by inert or nuisance dust limits of 15 mg/m3 for total dust and 5 mg/m3 for respirable portion.
(4) The percentage of Crystalline Silica in the formula is the amount determined from airborne samples.
(5) Presence of respirable Crystalline Silica has not been established.

PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point	N/A	**Specific Gravity (H2O=1)**	2.45-2.55
Vapor Pressure (mm Hg and Temperature)	N/A	**Melting Point**	N/A
Vapor Density (Air = 1)	N/A	**Evaporation Rate**	N/A
Solubility in Water	Negligible	**Water Reactive**	Minimal

Appearance and Odor - Gray to tan color, no odor; average particle size is 10-25 microns.

FIRE AND EXPLOSION HAZARD DATA

Extinguisher Media:	No special media required	**Auto-Ignition Temperature:**	N/A
Flammability Limits in Air % by Vol	N/A	**LEL/UEL:**	N/A
Special Fire Fighting Procedures:	No special procedures required	**Flash Point and Method Used:**	N/A

Unusual Fire and Explosion Hazards: None, this material is considered non-flammable and non-combustible. Use fire extinguishing agent suitable for surrounding media.

REACTIVITY HAZARD DATA

Stability: Considered to be stable will react with water to form cement like products
Hazardous Decomposition Products: Decomposition products are unknown and not suspected.
Hazardous Polymerization: Hazardous polymerization not known to occur.
Reactivity: Material is considered inert, avoid contact with strong acids, reducing agents, and oxidizers.

HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY:

Inhalation - Can be inhaled.
Ingestion - Can be ingested.
Skin Absorption - Can irritate skin.

CARCINOGEN LISTED IN:

NTP - Yes* (Crystalline Silica)
IARC Monograph - Yes* (Crystalline Silica)
OSHA - No

* Respirable Crystalline Silica is listed as a carcinogen in IARC and NTP. Presence of Crystalline Silica in respirable dust has not been established.

HEALTH HAZARDS:

Acute - Dust may irritate eyes, skin, respiratory tract and mucous membranes. Dust hazard should not occur under normal use.
Chronic - Pnuemoconiosis
Signs and Symptoms of Exposure - Eye, skin or respiratory tract irritation.
Medical Conditions Generally Aggravated by Exposure - May aggravate existing pulmonary condition if high dust situation is created.
Dusting conditions should not occur under normal use.

EMERGENCY FIRST AID PROCEDURES:

Eye Contact - Immediately flush eyes with water to remove dust particles and seek medical attention.
Skin Contact - Wash skin with soap and water, if irritation develops, seek medical attention.
Inhalation - Immediately remove affected person to fresh air, if irritation develops, seek medical attention.
Ingestion - Rinse mouth out with water. Induce vomiting is significant quantities ingested.

CemPozz® (NP) Material Safety Data Sheet

(cont'd)

MATERIAL SAFETY DATA SHEET

EMC CemPozz® Natural Pozzolan

CONTROL AND PROTECTIVE MEASURES

Respiratory Protection - If airborne dust exposure approaches the TLV or PEL (Section 1) use half-mask or full-face air purifying respirator equipped with NIOSH or MSHA-approved high efficiency filters for protection against pneumoconiosis-producing dust. An airline respirator may be required where dust levels are extremely high.

Protective Gloves - Limit contact with skin. Use rubber or cloth gloves as necessary.

Eye Protection - Wear goggles or face shield as appropriate. Avoid contact lenses.

Ventilation To Be Used - Keep dust levels below PEL. Use general and local exhaust ventilation and dust collection systems to keep dust levels within acceptable limits.

Other Protective Clothing and Equipment - None normally required, wear long sleeves and long pants to reduce skin contact. Use work gloves, goggles and face shield as necessary.

Hygienic Work Practices - Do not allow dust to get into eyes, to be inhaled, to be swallowed, or remain on skin if irritation occurs. Practice good personal hygiene. Wash or shower after use. Lauder clothes as normal.

PRECAUTIONS FOR SAFE HANDLING/LEAK PROCEDURES

Steps To Be Taken If Material Is Spilled Or Released - Avoid creating airborne dust. Pick up with shovel or mechanical equipment. Wet methods and vacuuming may be used on spills.

Waste Disposal Methods - Handle as inert bulk material. Material may be disposed of as a non-hazardous solid waste consistent with state, federal and local disposal regulations. Disposal in a sanitary landfill is usually adequate.

Precautions To Be Taken In Handling And Storage - Keep material dry in storage. No special handling required. Avoid creating airborne dust.

Other Precautions And/Or Special Hazards - None.

Note: Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed by vendor for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

CemPozz® (NP) Chemical Composition

CHEMISTRY OF CONCRETE WWW.CHEMISTRYOFCONCRETE.COM

Richard Haug
Twining Laboratories, Inc.
3310 Airport Way
Long Beach, CA 90806

June 22, 2011

Sample Description: White Chemical Admixture
Date Sampled: 6/20/2011
Sampled By: R. Davenport
Sample Location: N/A
Job Name: EMC
Job No.: N/A
TLSC Customer: EMC

It was requested to determine the elemental composition of one(1) powder sample as per requirements outlined in ASTM 618 by wavelength dispersive X-ray fluorescence method. The sample was submitted by Twining Labs and received on June 21, 2011

Table 1. Elemental composition of powder material.

Analyte	CH11-142 wt%
SiO_2	70.81
Al_2O_3	13.03
Fe_2O_3	1.34
CaO	1.44
MgO	0.01
Na_2O	2.35
K_2O	4.70
TiO_2	0.09
P_2O_5	0.01
SO_3	0.18
Moisture content at 110°C	0.82
Loss on ignition at 750°C	5.23
$SiO_2 + Al_2O_3 + Fe_2O_3$	85.17

- Elemental composition is based on as-received weight.
- Loss on ignition at 750°C is based on the moisture free weight.

6409 CAMINO VISTA #E, GOLETA, CA 93117 TEL. (805) 685-9844 FAX (805) 685-9082

CemPozz® (NP) Chemical Composition
(cont'd)

Please let us know if you have any questions regarding these results.

Thomas Holzheu
CHEMISTRY OF CONCRETE

Ludwig Keller, Ph.D
Chemistry of Concrete

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Strength activity index (SAI), ASTM C 618

TWINING

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Phone 562.426.3355 / **Fax** 562.426.6424 / **Web** twininginc.com

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CMT Research Associates
ATTN: Dr. Boris Stein
2883 East Spring Street, Suite 300
Long Beach, CA 90806

EMC presented sample of CemPozz to Twining Incorporated on June 30, 2011, and requested testing the submitted material for compliance with the chemical and physical requirements of ASTM C-618, Table 1 and Table 2.

The chemical composition of the natural processed pozzolan CemPozz was determined by dispersive XRF method by Chemistry of Concrete. This analysis is include as an attachment and considered part of this report.

Identification: **"CEMPOZZ"**

Date Received: **June 30, 2011**

References:

1. ASTM C-311: Standard Test Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Concrete
2. ASTM C-618: Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

Results:

Table 1 - Chemical Requirements:

Chemical Properties	Requirement Class N	Result	Compliance Class N
Silicon Dioxide (SiO_2) plus aluminum oxide (Al_2O_3) plus iron oxide (Fe_2O_3), min, % (*)	70.0	83.5	Yes
Sulfur Trioxide (SO_3), max, % (*)	4.0	0.32	Yes
Moisture content, max, %	3.0	0.62	Yes
Loss on ignition, max, %	10.0	4.87	Yes

(*) Chemistry of Concrete determined the chemical composition by dispersive XRF method.

Strength activity index (SAI), ASTM C 618
(cont'd)

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Table 2 – Physical Requirements:

Physical Properties	Requirements Class N	Result	Compliance Class N
Fineness: Amount retained when wet-sieved on 45-µm (No.325) sieve, max, %	34	1.16	Yes
Strength Activity Index: With Portland cement, at 7 days, min, percent of control: Control Mix, at 7 Days, psi Test Mix, at 7 Days, psi With Portland cement, at 28 days, min, percent of control: Control Mix, at 28 Days, psi Test Mix, at 28 Days, psi	75 75	80 4500(*) 3590(*) 88 6250(*) 5520(*)	Yes Yes
Water requirement, max, percent of control	115	100	Yes
Soundness: Autoclave expansion or contraction, max, %	0.8	-0.02	Yes

(*) The compressive strength is the average of three specimens cast on July 1, 2011 for both the control and test mixes.

TWINING INCORPORATED

Prepared By:

Richard Haug
Consultant

Attachment: Results of Compositional Analysis

Concrete mix designs using CemPozz® (NP), Strength Development (MPa)

Excerpt from Independent Technical Report by Construction Materials Research Associates LLC (CMT)

The following example illustrates the strength gain of concrete containing CemPozz® (NP):

- 50% of PC in the test-mix was replaced with CemPozz® at a 1:1 ratio. The total cementitious content was identical to a typical mix with the same aggregate (1-inch maximum size) designed for compressive strength of 3,000 psi at 28 days. The water-to-cementitious material ratio was limited to 0.51. The mix contained a high-range water reducer.

The table below demonstrates that at 28 days the concrete-mix meets the strength requirements for 3,000 psi and 3,500 psi concrete. Additionally, at 56 days the mix meets the strength requirements for 4,000 and 4,500 psi concrete.

Age, days	Compressive Strength, psi [MPa]	Required qualifying-strength for concrete of:			
		3,000 psi strength(*) psi/[MPa]	3,500 psi strength(*) psi/[MPa]	4,000 psi strength(*) psi/[MPa]	4,500 psi strength(*) psi/[MPa]
7	2,190 [15.0]				
28	4,180 [28.8]	3,500 [24.0]	4,000 [27.6]		
56	5,190 [35.8]	3,630 [25.0]	4,130 [28.5]	4,630 [32.0]	5,130 [35.4]

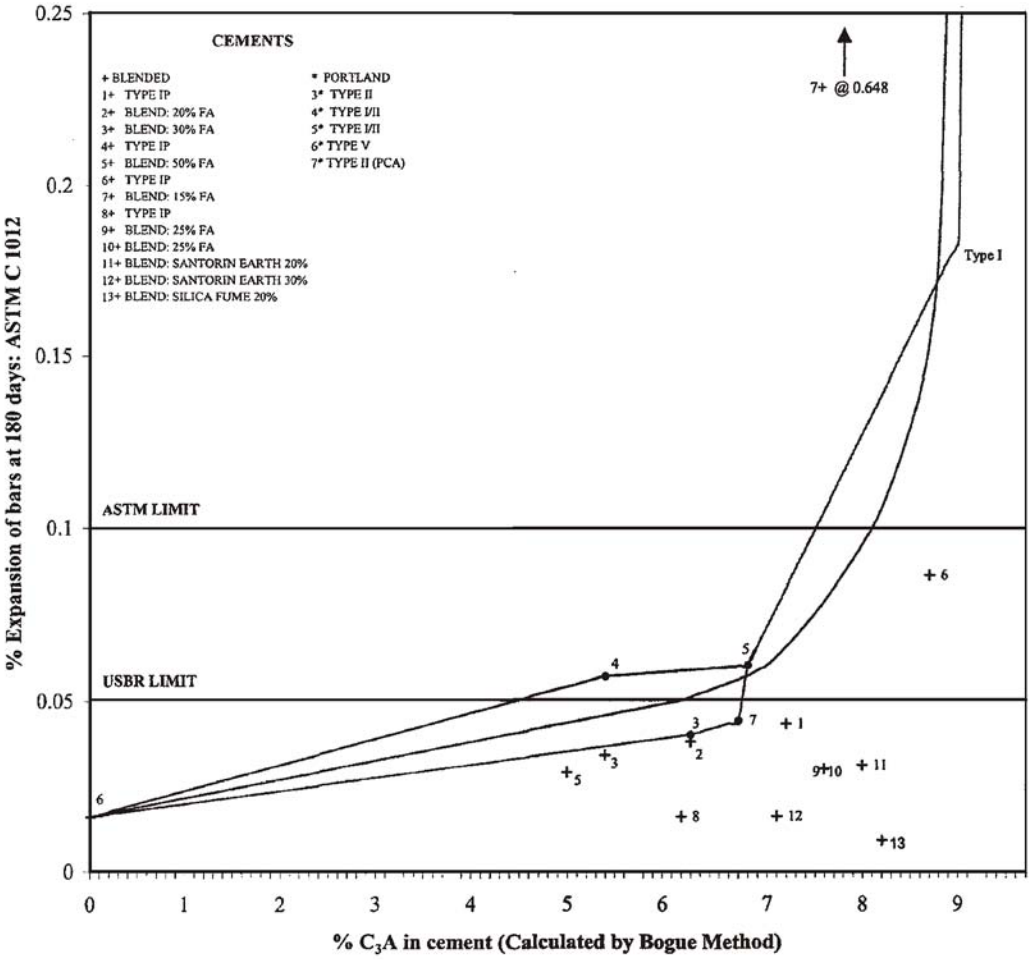
Table: The Strength Characteristics of Concrete Containing CemPozz®

NOTE: (*) The required strength was calculated as the specified strength plus the safety margin. The safety margin was calculated as the assumed standard deviation increased by the coefficient of 1.34 (after the provisions of **ACI 318** "Building Code Requirements for Structural Concrete and Commentary"). The standard deviation was assumed to be 9% of the average strength at the given specific age.

EMC Comment: The test was performed upon the lowest strength class with the lowest total cementitious content and the highest water content and which, therefore, is the most sensitive to Portland cement replacement. As can be seen, 50% Portland cement replacement with CemPozz® (NP) not only met the required 28 days strength; at 56 days it met the requirements for several higher strength classes that normally require significantly higher total cementitious content. This means that in practice concrete made with CemPozz® (NP) may achieve even higher than 50% of Portland cement replacement or lower total cementitious content or a combination of both. This is particularly the case for higher strength classes.

Sulfate Resistance, according to ASTM C 1012

Improvement of concrete sulfate resistance (ASTM C 1012) at different replacement levels of Portland cement by natural pozzolans



(data from ACI 232.1R-00 Report "Use of Raw and Processed Natural Pozzolans in Concrete", Ed. Dr. P. Tikalsky, 2000)

Drying shrinkage measurements, ASTM C 157

Total cementitious (lbs/CY)	CemPozz® content (%)	Shrinkage (7-days moist curing), % at drying age		
		7	*14*	28
705	0	–0.027	*–0.039*	–0.045
705	30.0	–0.018	*–0.026*	–0.034
705	40.0	–0.024	*–0.031*	–0.036

Resistance to Alkali-Silica Reaction (ASR), ASTM C 1567

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POTENTIAL ALKALI REACTIVITY OF AGGREGATES (MORTAR-BAR METHOD)
ASTM C1567

CLIENT: **EMC**

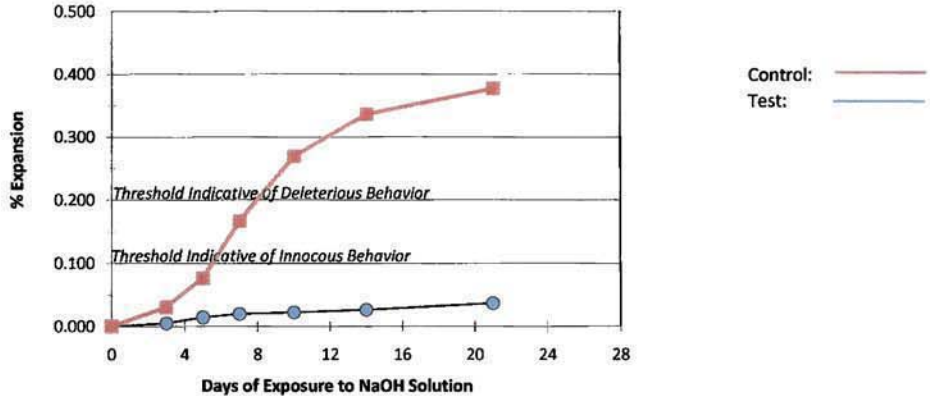
DATE: September 30, 2011
Project #EMC
Lab # CH11-315 & 316

MIXTURE PROPORTIONS:
Cement, Mitsubishi
Admixture, CemPozz NP
Alkali Content of Portland Cement:
Total Alkalies as Na_2O, %
Na_2O, %
K_2O, %
Autoclave Exp., %

Aggregate: Source -Vernallis
The control sample is without the addition of Cempozz NP (Red).
The test sample has the addition of Cempozz NP (Blue).

SOLUTION: 1N NaOH

DATE CAST: September 14, 2011



		Expansion of Bars (%)							
		A		B		C		Average	
Date	Exposure	Control	Test	Control	Test	Control	Test	Control	Test
9/16/2011	0 Days	0.000	0.000	0.000	0.000	0.000	0.000	0.00	0.00
9/19/2011	3 Days	0.026	0.004	0.032	0.005	0.032	0.005	0.03	0.00
9/21/2011	5 Days	0.072	0.013	0.077	0.013	0.080	0.016	0.08	0.01
9/23/2011	7 Days	0.162	0.018	0.170	0.020	0.167	0.021	0.17	0.02
9/26/2011	10 Days	0.266	0.021	0.272	0.022	0.267	0.023	0.27	0.02
9/30/2011	14 Days	0.336	0.026	0.337	0.025	0.333	0.027	0.34	0.03
10/7/2011	21 Days	0.377	0.038	0.379	0.034	0.373	0.038	0.38	0.04
10/14/2011	28 Days								

Richard Haug, Consultant

Prepared By EMC Cement BV

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Unless stated otherwise, references to “tons” means U.S. Short tons.

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