Global Product Data

ALMATIS

Calcium Aluminate Cements

Calcium Aluminate Cements

Product Description

Almatis produces high purity Calcium Aluminate Cements with 70 and 80% Al_2O_3 content. The products are widely used throughout the refractory industry.

The **70% alumina cements** are represented by three product types, CA-14, CA-270 and CA-470 TI. In the refractory industry they find their use especially in low and ultra-low cement, low moisture castables with gunning, vibration or self-flowing placement.

CA-14 is a well-established product line. Our process enables us to produce CA-14 cement with three distinct setting time ranges, which provide the opportunity to develop products with consistent and predictable properties.

CA-270 is a product (2nd generation of 70% alumina cements) characterized by very low water demand, excellent flowability, and high strength development.

CA-470 TI - temperature-independent cement - improves the setting behavior of castables at low temperatures whether or not they contain silica fume. Castables with CA-470 TI exhibit a much more robust setting and avoid the setting time variation and uncertainty that are especially apparent at low ambient temperatures. The flow of silica fume-containing mixes is improved when using CA-470 TI instead of standard 70% alumina cement.

Almatis 70% alumina cements do not contain any organic additives in order to give full flexibility in product design without any potential chemical mismatches.

Our **80% alumina cements** are represented by CA-25 R (Regular Grade), CA-25 M (Medium Grade) and CA-25 C (Casting Grade). They are used in the refractory industry in conventional and low cement castables, which require fast setting, high early strength development, and good strength at intermediate temperatures. Our process enables us to produce CA-25 cement with three distinct setting time ranges, which provide the opportunity to develop products with consistent and predictable properties. CA-25 C has a lower water demand when compared to CA-25 M and CA-25 R.

The Almatis cement production process is designed to achieve maximum consistency. We have the ability to precisely control the cement setting times by tight control of the cement phases. The Almatis Business System (ABS) allows us to give better service by dramatically decreasing our response time and improving production flexibility.

Cement Tests & Cement Quality

Almatis Calcium Aluminate Cements are tested to reflect customer's needs. Consistency in setting, flow, strength, particle size distribution, and chemical composition are all essential for good cement performance. Our quality control is designed and carried out to ensure high product consistency, which results in the high performance and reliability of our customers' products.

The Almatis cement testing procedures of flow, set, and strength are as nearly as possible based on the European Norm EN-196 parts 1, 2, 3 and 6. The Normsand based grog was modified to a grog based on Tabular Alumina (NORTAB). Testing was extended by the exothermic reaction and the particle size distribution analysis by Laser granulometry. Chemical analysis is made by X-Ray Fluorescence Spectrometry.

CA-470 TI is tested in a low cement castable based on Tabular Alumina (NORCAST).

Calcium Aluminate Cements

70% Al_2O_3 Cements – Product Data

Product		CA-14 W*			CA-14 M*			CA-14 S*			CA-270*		
Setting		short			medium			long			long		
	Unit	Typ.	Min.	Max.	Typ.	Min.	Max.	Typ.	Min.	Max.	Typ.	Min.	Max.
Cement Properties as Pure Cement													
Chemical Composition													
CaO	[%]	28	26	30	28	26	30	28	26	30	27	25	29
Al_2O_3	[%]	71	68		71	69		71	69		72	70	
Na_2O	[%]			0.3			0.3			0.3			0.3
SiO_2	[%]			0.3			0.3			0.3			0.3
Fe_2O_3	[%]			0.2			0.2			0.2			0.2
MgO	[%]			0.4			0.4			0.4			0.4
Fineness (Cilas)													
-45 µm	[%]	88	79		88	79		88	79		95	85	
D50	[µm]	13			13			13			6		
Cement Properties in NORTAB Mortar													
Water addition	[%]	10									9		
Vicat Setting Time													
Initial Setting	[min]		150			230			320			310	
Final Setting	[min]	220	170	250	300	250	350	400	350	480	370		480
Exothermic Reaction Time													
EXO+5	[min]	270			320			400			370		
EXO MAX	[min]	360			400			480			450		
Vibration Flow													
F10	[cm]	17	15		18	15		18	15		18	15	
F30	[cm]	16	13		17	14		17	14		17	15	
F60	[cm]	16	12		17	13		17	13		17	14	
Cold Modulus of Rupture (CMOR)													
24 h Cured 20°C	[MPa]**	8	6		8	6		8	6		9	5	
24 h Dried 105°C	[MPa]	12	8		12	8		12	8		12	9	
5 h Fired 1000°C	[MPa]	6	3		6	3		6	3		7	5	
Cold Crushing Strength (CCS)													
24h Cured 20°C	[MPa]	48	35		48	35		48	35		52	35	
24 h Dried 105°C	[MPa]	70	55		70	55		70	55		74	55	
5 h Fired 1000°C	[MPa]	37	25		37	25		37	25		44	35	

*) CA-14 W stands for CA-14 Winter; CA-14 M stands for CA-14 Medium; CA-14 S stands for CA-14 Summer
CA-270 stands for second generation of 70% alumina cements.
†) 1 MPa = 145 psi

The typical product properties are based upon the actual averages from production data. The min-max data show our standard product specification for these products. All data are based upon Almatis standard test methods. All test methods are available upon request.

Calcium Aluminate Cements

70% Al_2O_3 Cements – Product Data

Product		CA-470 TI*		
Setting		robust		
	Unit	Typical	Min.	Max.
Cement Properties as Pure Cement				
Chemical Composition				
CaO	[%]	27	25	29
Al_2O_3	[%]	72	70	
Na_2O	[%]	0.2		0.3
SiO_2	[%]	0.2		0.3
Fe_2O_3	[%]	0.1		0.2
MgO	[%]	0.2		0.4
Fineness (Cilas)				
-45 µm	[%]	90	86	
Particle Size D50	µm	8		

Cement Properties in NORCAST Test Castable			
Water addition	[%]	4.9	
Exothermic Reaction Time		Typical	Min
EXO START 1	[min]	270	
EXO START 2	[min]	560	
EXO MAX	[min]	750	
Self Flow			
F10	[cm]		24
F30	[cm]		23
F60	[cm]		22
Cold Modulus of Rupture (CMOR)			
24 h Cured 20°C	[MPa]†		3
24 h Dried 105°C	[MPa]		8
5 h Fired 1000°C	[MPa]		4
Cold Crushing Strength (CCS)			
24h Cured 20°C	[MPa]		20
24 h Dried 105°C	[MPa]		75
5 h Fired 1000°C	[MPa]		35

*) CA-470 TI stands for CA-470 temperature independent
†) 1 MPa = 145 psi

The typical product properties are based upon the actual averages from production data. The min-max data show our standard product specification for these products. All data are based upon Almatis standard test methods. All test methods are available upon request.

Calcium Aluminate Cements

80% Al_2O_3 Cements – Product Data

Product		CA-25 R*			CA-25 M*			CA-25 C*		
Setting		short			medium			long		
	Unit	Typical	Min.	Max.	Typical	Min.	Max.	Typical	Min.	Max.
Cement Properties as Pure Cement										
Chemical Composition										
CaO	[%]	18	17	19	18	17	19	18	17	19
Al_2O_3	[%]	81	78		81	78		81	78	
Na_2O	[%]			0.6			0.8			0.8
SiO_2	[%]			0.3			0.3			0.3
Fe_2O_3	[%]			0.2			0.2			0.2
MgO	[%]			0.4			0.4			0.4
Fineness (Cilas)										
-45 µm	[%]	83	80		83	80		87	81	
Particle Size D50	µm	9			9			6		
Cement Properties in NORCAST Test Castable										
Water addition	[%]	10 %					9 %			
Vicat Setting Time										
Initial Setting	[min]		50			80			100	
Final Setting	[min]	70		90	110		150	140		180
Vibration Flow										
F10	[cm]	18	15		18	16		18	16	
F30	[cm]	13	10		17	15		17	15	
F60	[cm]	9		13	14	12		15	12	
Cold Modulus of Rupture (CMOR)										
24 h Cured 20°C	[MPa]†	6	4		5	4		6	5	
24 h Dried 105°C	[MPa]	8	5		8	5		10	7	
5 h Fired 1000°C	[MPa]	6	5		6	5		8	6	
Cold Crushing Strength (CCS)										
24h Cured 20°C	[MPa]	35	21		30	21		38	25	
24 h Dried 105°C	[MPa]	40	26		45	26		50	28	
5 h Fired 1000°C	[MPa]	30	22		30	22		40	27	

*) CA-25 R stands for CA-25 Regular Grade; CA-25 M stands for CA-25 Medium Grade; CA-25 C stands for CA-25 Casting Grade.

†) 1 MPa = 145 psi

The typical product properties are based upon the actual averages from production data. The min-max data show our standard product specification for these products. All data are based upon Almatis standard test methods. All test methods are available upon request.

Calcium Aluminate Cements

Brief Description of Almatis Test Methods

Tests of Pure Cement

Chemical Composition
CaO, Al_2O_3 and impurities, such as Fe_2O_3, Na_2O, SiO_2 and MgO, are determined by X-Ray Fluorescence (XRF).

Fineness (Cilas)
The Particle Size Distribution (PSD) is measured on a Laser diffractometer. Reported are -45 µm in [%] and D50 in [µm].

NORTAB PSD	
Square mesh size [mm]	Sieve Residue [%]
+2.0	3±2
+1.4	13±3
+1.0	14±5
+0.5	35±5
+0.125	29±5
+0.063	4±3
-0.063	2±2

Raw Material: Tabular Alumina T60/T64

NORTAB Mortar Composition
80% NORTAB & 20% cement plus:
- 10% H_2O for CA-14 cements
- 10% H_2O for CA-25 R & CA-25 M
- 9% H_2O for CA-270
- 9% H_2O for CA-25 C

Tests of cement in NORTAB Mortar

All mechanical and hydration reactivity data are tested in NORTAB, a Tabular Alumina T60/T64 based mortar. For NORTAB grog sieve analysis and mortar composition see table. All laboratory equipment, conditions and procedures are as nearly as possible based on the EN-196. All tests are conducted at 20 ± 1.0 °C. All cement grades have individual water additions according to their typical flow characteristics.

Vicat Setting Properties
Setting properties in NORTAB are determined with a Vicat apparatus as described in EN-196, part 3. The total needle weight is 1000 g, the needle diameter 1.13 mm. After mixing, the mortar is filled in Vicat moulds and covered. At required time intervals the setting behavior is determined by checking the needle penetration into the mortar. The value for Initial Setting represents the time when the needle stops penetrating the mortar 10 mm above the bottom plate. At Final Setting the needle stops >30 mm above the bottom plate (total Vicat mould height 40 mm).

Exothermic Reaction
Hydration Reactivity Properties in NORTAB are tested by recording the exothermic heat development during cement hydration. 1.5 kg mortar is put in a plastic box and a thermocouple is inserted. The box is covered and held at 20 ± 1.0 °C. The time when the mix temperature has increased by +5°C is recorded as EXO+5. The time when the mix has reached its maximum temperature is recorded as EXO max. It corresponds to the time when there is sufficient green strength development for demoulding.

Flow Properties
Flow Properties in NORTAB are tested on a vibration table on a steel plate. After mixing the mortar is filled in 3 Vicat moulds and covered. The starting diameter is given by the inner bottom diameter of the Vicat mould of 80 mm. After time intervals of 10, 30, and 60 min a sample is placed on the table and vibrated for 30 sec at 0.5 mm amplitude. The average diameter after vibration is noted as Flow F. (i.e. F30: Flow diameter 30 min after start of mixing).

Strength Properties
Cold Strength Properties in NORTAB are determined with bars sized 40 x 40 x 160 mm as described in EN-196, part 1. After mixing the mortar is filled in bar moulds and compacted by vibration. The bars are cured in the moulds for 24 h at 20 °C and then demoulded. The bars will be tested directly after demoulding for cured strength, be dried another 24 h at 105 °C for dried strength, and be fired another 5 h at 1000 °C for fired strength.

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Almatis Cement test Methods (cont.)

Test of CA-470 TI cement in NORCAST Castable

Detailed information on NORCAST test method is given in Almatis brochure “Cement Test Methods”.
For additional information on Cement Testing please refer to the Almatis “Cement Test Methods” brochure.

Packaging

- Plastic bags
- Big bags
- Bulk

Shelf Life

Stored under adequate dry conditions and in the original packaging, the properties of all Almatis Calcium Aluminate Cements remain stable for a period of 24 months. Experience has shown that even after longer storage time the properties are not impaired. Exposure to ultraviolet radiation from direct sunlight can alter the plastic foil and ultimately reduce the shelf life. An additional protection from direct sunlight is required in such cases. The shrink wrap shall remain until the material is being used. Removal of the shrink wrap reduces the shelf life of the cement in big bags.

Contact for sales, technical information and application assistance

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