



CAC for Refractory Applications

Application of CALUCEM – Calcium Aluminate Cements

INTRODUCTION

Resistance to high temperatures is the main reason for using Calcium Aluminate (CA) Cements in refractory products. High heat resistance combined with simple handling and extended workability make mortars and concretes based on CA cements extremely durable refractory products. Monolithic pan linings that are made of compounds that can



be pumped, cast and sprayed will result in long lasting reliable linings with a clearly reduced demand for time and labor. ISTRA CA cement is a major component of castable refractory mixes used in monolithic linings. Mortars and concretes made of ISTRA CA cements are used in monolithic linings of furnaces, charge chutes and other high temperature areas that may come into contact with molten materials. Monolithic applications are extremely simple, time-saving and cost efficient. By a skillful selection of refractory aggregates and cements, the monolithics can be applied in sections where fired refractory bricks have been traditionally used. ISTRA CA cements are used in conventional castable (CC) and low cement castable (LCC) products.

PROPERTIES OF ISTRA CALCIUM ALUMINATE CEMENTS FOR THE REFRACTORY INDUSTRY

A carefully controlled chemical and mineralogical composition and a consistent fineness are among the key quality criteria of our cements. The Al_2O_3/CaO ratio is monitored closely for all cements and the Fe_2O_3 content is held at 3% maximum for ISTRA 50. This provides for excellent carbon monoxide resistance of ISTRA 50 with classification A (unaffected) according to ASTM C 288 and overall refractory properties.

The excellent refractoriness of ISTRA Calcium Aluminate Cements is tested according to EN 993-12 and summarized in figure 1.

PYROMETRIC CONE EQUIVALENT ISTRA CEMENTS ACCORDING EN 993-12

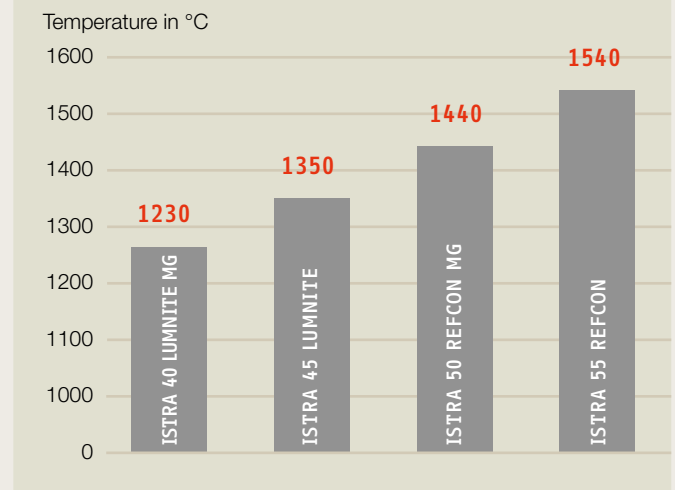


Figure 1: Refractoriness of ISTRA Calcium Aluminate Cements

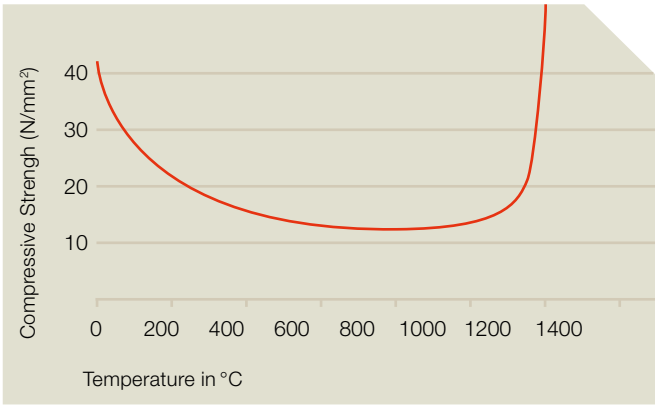


Figure 2

The compressive strength development of ISTRA Calcium Aluminate Cements vs. temperature is described in figure 2. ISTRA Calcium Aluminate Cement increases its compressive strength above 800 °C because of ceramic bonding.

PROPERTIES OF ISTRA CALCIUM ALUMINATE CEMENTS WITH DIFFERENT AGGREGATES

The combination of the different ISTRA Calcium Aluminate Cement types in combination with different aggregates offer the formulator the optimum freedom for a cost balanced technical solution. The temperature service limit for dense concrete made out of ISTRA Calcium Aluminate Cements and general refractory aggregates are listed in table 1.



TEMPERATURE SERVICE LIMIT IN °C/°F FOR DENSE CONCRETE			
Refractory Aggregates	Istra 40	Istra 45	Istra 50
Siliceous sand	500		
Basalt, Granite	800 / 1472		
Blast Furnace Slag	800 / 1472		
Istra Aggregate	1150 / 2102		
Chamotte AIS (40-42% Al ₂ O ₃)	1250 / 2282	1330	1350 / 2462
Chamotte A0 (≥ 42% Al ₂ O ₃)	1300 / 2372	1350 / 2462	1400 / 2552
Sillimanite	1350 / 2462	1400 / 2552	1450 / 2642
Brown Corundum	1400 / 2552	1475 / 2687	1550 / 2822

Table 1



PROPERTIES OF ISTRA CAC IN REFRACTORY APPLICATIONS

ISTRA CAC in combination with lightweight aggregates has over the years produced refractory concretes with good strength, satisfactory resistance to abrasion and corrosion and good insulating properties. For some installations, strength and abrasion and corrosion resistance are of secondary importance, and the major function of the refractory lining is that of insulation e.g. process vessels in petroleum industry or stack linings, ducts and breechings. In these cases, very lightweight aggregate such as vermiculite may be used in conjunction with ISTRA CAC and expanded shale, clay or slate. Table 3 gives the composition of a insulation concrete with Vermiculite and Istra 45 CAC. The properties of the insulation concrete are summarized in figure 3.

INSULATION CONCRETE WITH ISTRA 45 AND VERMICULITE	
lightweight aggregates (expanded shale, clay, slate)	2 Parts by volume
Vermiculite (bulk density 0.15 g/cm ³)	4 Parts by volume
Mix proportions Istra 45:lightweight:Vermiculite	1:2:4
Water to Solids ratio (W/S)	56.1% by weight
Consistency	Wet "Ball-In-Hand"

Table 2

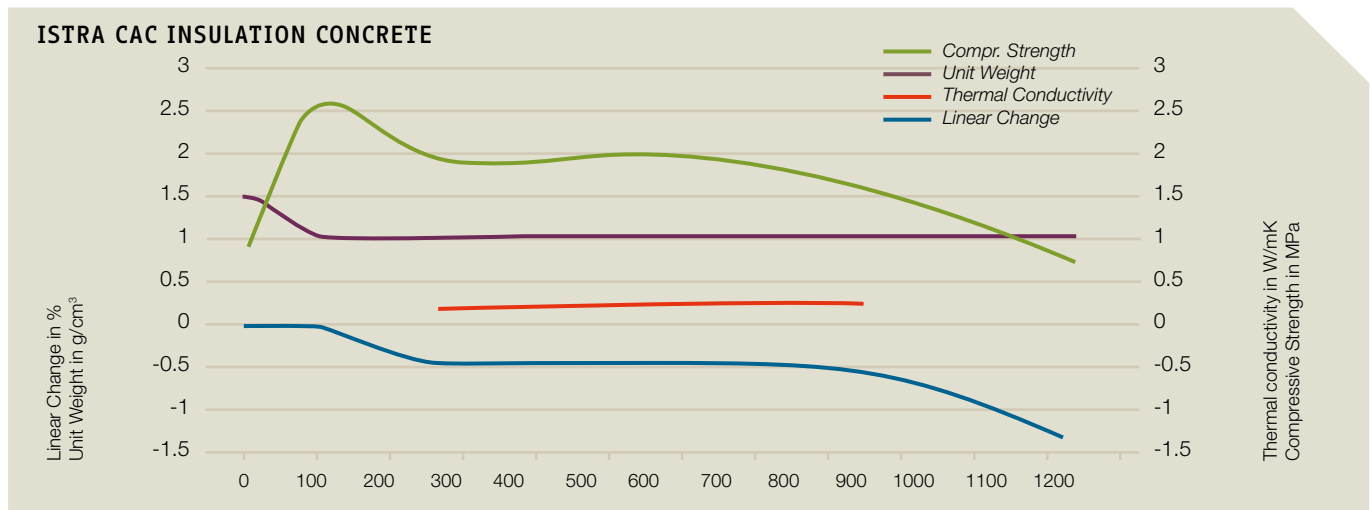


Figure 3: Properties of Insulation Concrete made with ISTRA

REFRACTORY CONCRETE WITH ISTRA 45 AND CFB	
CFB with 40 % alumina	4 parts by volume
ISTRA 45	1 part by volume
Mix proportions Istra 45: CFB	1:4
Water to Solids ratio (W/S)	14.6 % by weight
Consistency	Wet "Ball-In-Hand"

Table 3

For many years ISTRA CAC has been used with crushed fireclay brick (CFB) to produce refractory concrete suitable for service temperatures up to 1480° C. Alumina-Silica firebrick containing 38-45 % alumina is the most commonly used CFB in ISTRA 45 and ISTRA 50 refractory concrete. The abrasion resistance will be fair to good, depending on the type and gradation of the CFB, mix design, consolidation and water/solids ratio. The resistance to thermal shock will be good, and to corrosion only fair. Table 3 gives the composition of a dense refractory concrete made with Istra 45 CAC and Crushed Fire Brick (CFB). The Pyrometric Cone Equivalent is 20.

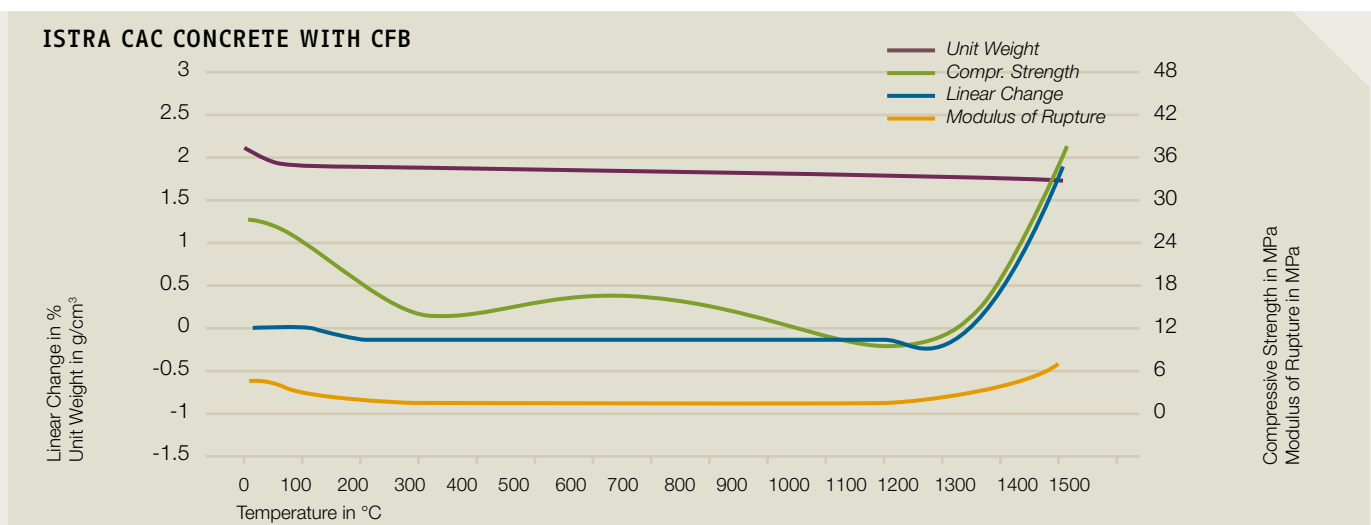


Figure 4: Properties of Refractory Concrete made with ISTRA

The data in the tables were developed on specimens made from small size batches under laboratory conditions where temperature, humidity and curing were closely controlled. Actual field conditions may produce different results.

BENEFITS

ISTRA Calcium Aluminate Cements are a cost efficient solution for insulating and dense refractory products. ISTRA Calcium Aluminate cements are used in precast shapes or in premixed refractory formulations. They can be applied as concretes or gunning mixes and offer the following benefits.

- » High Temperature Resistance
- » Abrasion and Mechanical Resistance
- » Strictly monitored chemical composition for consistent high product quality
- » Reliable behavior of ISTRA Calcium Aluminate Cements during installation

START FORMULATIONS

Starting formulations are available upon request.

MORE INFO

For additional information about ISTRA Calcium Aluminate Cements, please visit the CALUCEM web site at www.calucem.com or contact us worldwide.

www.calucem.com

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