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(54) Titre : MATERIAU REFRACTAIRE ET MODE D'UTILISATION CONNEXE
(54) Title: REFRACTORY COMPOSITION AND USE THEREOF

(57) Abrégé/Abstract:
A refractory composition for use in forming a refractory lining on a surface to protect the surface against high temperatures and against abrasion, consists of 6 to 8 percent by weight of a volatilised silica, 5 to 8 percent by weight of a calcium aluminate cement, 0,1 to 3,0 percent by weight of a dispersant such as a sodium polyphosphate, and the balance of a hard refractory oxide aggregate having a particle size distribution such that at least 45 percent by weight of the particles are 1mm or greater in size.

ABSTRACT

A refractory composition for use in forming a refractory lining on a surface to protect the surface against high temperatures and against abrasion, consists of 6 to 8 percent by weight of a volatilised silica, 5 to 8 percent by weight of a calcium aluminate cement, 0,1 to 3,0 percent by weight of a dispersant such as a sodium polyphosphate, and the balance of a hard refractory oxide aggregate having a particle size distribution such that at least 45 percent by weight of the particles are 1mm or greater in size.

BACKGROUND OF THE INVENTION

This invention relates to a refractory composition for use in forming a refractory lining on a surface to protect the surface against high temperatures and against abrasion, and to a method of forming such a refractory lining.

The surfaces of equipment used in many industrial processes need to be protected against high temperatures and against abrasion. Generally this is achieved by locating on the surfaces to be protected a thin refractory lining, typically 20 to 50mm in thickness. Generally, these linings are formed by locating on the surface to be protected, studs, hexmesh or S-bar anchors or the like to hold a refractory composition in place, and then covering the surface with the refractory composition which is applied by trowelling, ramming or hand-placing.

In the petrochemical industry, the standard refractory composition used to form such linings is Resco-AA-22.* This composition is a two-component, phosphate bonded, high alumina composition. In recent years other phosphate bonded compositions, either two-component compositions or one-component compositions, have been considered as alternatives to Resco-AA-22.*

In addition, the development of the so-called "low-cement bonding technology" has led to the development of very high strength compositions, supplied as one-component mixes, as alternatives to Resco-AA-22.* Such compositions typically contain 5 to 7,5 percent by weight of the composition of a calcium aluminate cement, 2,5 to 5,0 percent by weight of the composition of a volatilised (fumed) silica and 0,1 to 1,0 percent by weight of the composition of a dispersing agent. In these compositions, the amount by weight of calcium aluminate cement is always the same as or greater than the amount by weight of the volatilised silica in the composition. In these compositions, the maximum percentage by weight of volatilised silica is 5 percent by weight. Volatilised or fumed silica generally is of two types. The first type is that produced as a waste by-product from silicon smelters or the like. The second type is that specifically produced from a silicon source.

Although there are several types of refractory compositions which may be used to form refractory linings on surfaces, there is always a need for a new refractory composition which will provide greater abrasion resistance or some other advantage.

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SUMMARY OF THE INVENTION

According to a first aspect of the invention, there is provided a refractory composition comprising:

(a) 6 to 8 percent by weight of the composition of a volatilised silica;

(b) 5 to 8 percent by weight of the composition of a calcium aluminate cement;

(c) 0,1 to 3,0 percent by weight of the composition of a suitable dispersant; and

(d) the balance by weight of the composition of a hard refractory oxide aggregate having a particle size distribution such that at least 45 percent by weight of the particles are 1mm or greater in size.

The composition of the invention is adapted to be mixed with water to form a composition of sufficient plasticity for application to a surface to form a refractory lining.

According to another aspect of the invention, there is provided a method of forming a refractory lining from a refractory composition on a surface which includes the steps of:

(i) locating means for supporting the refractory composition in place, such as studs, a metallic mesh, e.g. hexmesh, or S-bar anchors, on the surface;

(ii) mixing the refractory composition comprising:

(a) 6 to 8 percent by weight of the composition of a volatilised silica;

(b) 5 to 8 percent by weight of the composition of a calcium aluminate cement:

(c) 0,1 to 3,0 percent by weight of the composition of a suitable dispersant; and

(d) the balance by weight of the composition of a hard refractory oxide aggregate having a particle size distribution such that at least 45 percent by weight of the particles are 1mm or greater in size.

with water to form a mixture of suitable plasticity; and

(iii) applying to the surface the mixture of step (ii) to form the lining.

DESCRIPTION OF PREFERRED EMBODIMENTS

The refractory composition of the invention comprises four components.

The first component of the composition is 6 to 8 percent by weight of the composition of a volatilised silica. The volatilised silica is preferably that produced as a waste by-product from silicon smelters or the like.

The second component of the composition is 5 to 8 percent by weight of the composition of a calcium aluminate cement. An example of a suitable calcium aluminate cement is Secar 71* which is a proprietary product of Lafarge.

The third component of the composition is 0,1 to 3,0 percent by weight of the composition of a suitable dispersant. Suitable dispersants include a sodium polyphosphate or a sodium silicate.

The fourth component of the composition is a hard refractory

* trade-mark

oxide aggregate. The aggregate may, for example, tabular alumina, fused alumina or natural corundum. The aggregate must have a particle size distribution such that at least 45 percent by weight of the particles are 1mm or greater in size. The maximum particle size of the aggregate will depend on the method of application of the composition to a surface to form a refractory lining. For example, when hexmesh is used to support the refractory composition in place, then the maximum particle size will be between 6mm and 8mm. However, when S-bar anchors are used, the maximum particle size may be greater, e.g. 12 to 20mm. It has been found that a composition which has an aggregate wherein at least 45 percent of the particles have a particle size of 1mm or greater provides much better abrasion resistance than a composition with an aggregate having a smaller particle size.

The composition of the invention is designed to be mixed with a suitable percentage of water, e.g. about 3,5 to 4,5 percent by weight, to form a mixture which may be applied to a surface to form a refractory lining.

The second aspect of the invention is a method of forming a refractory lining using the refractory composition of the invention. This method includes the steps of locating means for supporting the refractory composition in place, such as studs, a metallic mesh such as hexmesh, or S-bar anchors, on the surface to be protected, and then applying to the surface the refractory composition mixed with water, which may be applied by means of trowelling, ramming or hand-placing, to form the lining.

Examples of the refractory composition of the invention will now be given. In the examples, all percentages are given by weight. Various compositions of the invention were formed as dry mixes and these are set out in Examples 1A, 1B, 2A, 2B, 3A, 3B 4A and 4B below. Each of these compositions was mixed with a percentage of water, as set out in Table 1 to form a mixture for use in

forming a refractory lining. The mixtures, after drying at 350°C, were tested for their bulk density and for their cold crushing strength. The cold crushing strength test was performed on sample cubes 76 x 76 x 76mm in size, prepared by hand-placing the mixture in a mould, without ramming or vibration. The results of these tests are also set out in Table 1.

EXAMPLE 1A

- 6mm graded tabular alumina	86,75 %
Volatilised silica	6,5 %
Secar 71 *	6,5 %
Dispersant	0,25 %

EXAMPLE 1B

- 6mm graded tabular alumina	85,0 %
Volatilised silica	6,5 %
Secar 71 *	6,5 %
Dispersant	2,0 %

EXAMPLE 2A

- 6mm graded tabular alumina	87,25 %
Volatilised silica	6,5 %
Secar 71 *	5,0 %
Dispersant	1,25 %

EXAMPLE 2B

- 6mm graded tabular alumina	88,38 %
Volatilised silica	6,5 %
Secar 71 *	5,0 %
Dispersant	0,12 %

* trade-mark

EXAMPLE 3A

- 6mm graded tabular alumina	83,5 %
Volatilised silica	6,5 %
Secar 71 *	8,0 %
Dispersant	2,0 %

EXAMPLE 3B

- 6mm graded tabular alumina	85,0 %
Volatilised silica	6,5 %
Secar 71 *	8,0 %
Dispersant	0,5 %

EXAMPLE 4A

- 6mm graded tabular alumina	81,0 %
Volatilised silica	8,0 %
Secar 71 *	8,0 %
Dispersant	3,0 %

EXAMPLE 4B

- 6mm graded tabular alumina	83,8 %
Volatilised silica	8,0 %
Secar 71 *	8,0 %
Dispersant	0,2 %

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TABLE 1

	Example No							
	1A	1B	2A	2B	3A	3B	4A	4B
Water Addition %	4,5	4,5	3,5	3,5	4,5	4,0	5,0	4,5
Bulk Density g/cm^3	2,95	2,96	3,05	3,12	2,95	2,97	2,90	2,91
Cold Crushing Strength MPa	120	140	120	120	180	190	115	110

The comparative erosion resistance of the compositions of Examples 1A, 1B, 2A, 2B, 3A, 3B, after mixture with water as set out in Table 1, as well as of certain known products was tested and the results are set out in Table 2 below.

TABLE 2

Material	Average mm Eroded
Plasticised Tabular Alumina Castable	1200
Resco-AA-22*	1000
Low Cement, Sintered Alumina Ball Mix (HICAST 90BR)*	300
1A	214
1B	232
2A	274
2B	229
3A	Less than 200
3B	Less than 200
50% Chamotte Mix Balance Corundum	495
55% Andalusite Mix Balance Corundum	532
30% Natural Corundum 30% Andalusite Mix, Balance Corundum	265

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From these results, it can be seen that the compositions of the invention have a much better abrasion or erosion resistance than previously known refractory compositions. Thus, the main advantage of the composition of the invention is its superior abrasion resistance, in relation to its cost.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of forming a plastic refractory lining from a refractory composition on a surface includes the steps of:

(i) locating means for supporting the refractory composition in place on the surface;

(ii) mixing the refractory composition comprising;

(a) 6 to 8% by weight of the composition of a volatilized silica;

(b) 5 to 8% by weight of the composition of a calcium aluminate cement;

(c) 0,1 to 3,0% by weight of the composition of a dispersant; and

(d) the balance by weight of the composition of a hard refractory oxide aggregate having a particle size distribution such that at least 45% by weight of the particles are 1 mm or greater in size,

with 3,5 to 4,5% by weight of the composition of water to form a mixture of suitable plasticity; and

(iii) applying to the surface the mixture of step (ii) to form the lining.

2. A method according to claim 1 wherein in step (I) the means for supporting the refractory composition in place is selected from studs, a metallic mesh and S-bar anchors.