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(54) Titre : SYSTEME DE MORTIER BICOMPOSANT RESISTANT AU FEU A BASE DE CIMENT ALUMINEUX POUR LA FIXATION CHIMIQUE D'ELEMENTS D'ANCRAGE ET DE BARRES DE RENFORCEMENT INSTALLEES A POSTERIORI, ETUTILISATION CORRESPONDANTE

(54) Title: FIRE-RESISTANT TWO-COMPONENT MORTAR SYSTEM BASED ON ALUMINOUS CEMENT FOR A FIRE-RESISTANT CHEMICAL FASTENING OF ANCHORS AND POST-INSTALLED REINFORCING BARS AND USE THEREOF

(57) Abrégé/Abstract:

The present invention pertains to a two-component mortar system comprising a curable aqueous-phase aluminous cement component A and an initiator component B in aqueous-phase for initiating the curing process, component A further comprising at least one blocking agent selected from the group consisting of phosphoric acid, metaphosphoric acid, phosphorous acid and phosphonic acids, at least one plasticizer and water, and component B comprising an initiator, at least one retarder, at least one mineral filler and water. Moreover, the present invention pertains to a two-component system, which is ready-for-use, for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars in mineral surfaces, such as structures made of brickwork, concrete, pervious concrete or natural stone as well as its use for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars.

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(54) **Title**: FIRE-RESISTANT TWO-COMPONENT MORTAR SYSTEM BASED ON ALUMINOUS CEMENT FOR A FIRE-RESISTANT CHEMICAL FASTENING OF ANCHORS AND POST-INSTALLED REINFORCING BARS AND USE THEREOF

(57) **Abstract**: The present invention pertains to a two-component mortar system comprising a curable aqueous-phase aluminous cement component A and an initiator component B in aqueous-phase for initiating the curing process, component A further comprising at least one blocking agent selected from the group consisting of phosphoric acid, metaphosphoric acid, phosphorous acid and phosphonic acids, at least one plasticizer and water, and component B comprising an initiator, at least one retarder, at least one mineral filler and water. Moreover, the present invention pertains to a two-component system, which is ready-for-use, for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars in mineral surfaces, such as structures made of brickwork, concrete, pervious concrete or natural stone as well as its use for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars.

Fire-resistant two-component mortar system based on aluminous cement for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars and use thereof

FIELD OF THE INVENTION

The present invention pertains to a fire-resistant two-component mortar system for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars, comprising a curable aqueous-phase aluminous cement component A and an initiator component B in aqueous-phase for initiating the curing process, component A further comprising at least one blocking agent selected from the group consisting of phosphoric acid, metaphosphoric acid, phosphorous acid and phosphonic acids, at least one plasticizer and water, and component B comprising an initiator, at least one retarder, at least one mineral filler and water. Moreover, the present invention pertains to a fire-resistant two-component mortar system, which is ready-for-use, for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars, in mineral surfaces, such as structures made of brickwork, concrete, pervious concrete or natural stone as well as its use for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars.

BACKGROUND OF THE INVENTION

Today, there are organic and inorganic mortar systems available, which are used for chemical fastening of anchors and post-installed reinforcing bars. For example, organic systems based on free-radically polymerizable resins are used when fast curing is desired. However, such systems are generally known to be polluting, expensive, potentially hazardous and/or toxic for the environment and for the person who handles them and they often need to be specifically labelled. Moreover, organic systems often show a much reduced or even no stability when thermally exposed to strong sunlight or otherwise elevated temperatures, such as fire, thereby decreasing their mechanical performance when it comes to chemically fastening of anchors and post-installed reinforcing bars. In addition, organic mortar systems often do not possess any sufficient fire-resistance, in particular when anchors and post-installed reinforcing bars are subject to fire and heat.

With regard to fire-resistance of anchors and post-installed reinforcing bars, the assessment is laid down in the acceptance criteria ACI 355.4-11 and AC308, “Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4-11)” from the American Concrete Institute and “Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements (AC308, 2016)” from the ICC Evaluation Service, respectively.

In par. 10.24 of ACI 355.4-11 it is laid down that assessment of resistance to fire exposure shall be based on a recognized national standard for the testing and assessment of structural components under fire conditions. According to R10.24.1 of ACI 355.4-11, anchor testing under fire exposure conditions typically consists of placing a static weight on the anchor in a burn chamber and measuring the time to failure for a specific time-temperature curve. While standards have been issued for the testing and assessment of anchors for exposure to fire, little guidance exists for the use of the resulting resistance values in design.

So, in general, any adhesive anchors could be used for fire design, as long as a standard recognized nationally to qualify them is available. However, in many cities the use of adhesive anchors is rejected and expansion anchors must be used instead, or the adhesive anchor must be sized for reduced allowable load for applicable fire rating.

In order to overcome these drawbacks, predominantly mineral systems based on aluminous cement have been developed. Aluminous cement has as its major constituent monocalcium aluminate and is widely used in the building and construction industries as the final products evidence a high level of mechanical performance over extended periods of time. Also, aluminous cement is resistant to bases and attains its maximum strength more rapidly than Portland cement and is capable of withstanding solutions of sulfates. Hence, aluminous cement systems are preferably employed in the field of chemical anchoring.

There are a few inorganic systems available, such as Cemeforce from Sumitomo Osaka Cement Co Ltd, Japan; a one-component injection system which has to be mixed with water prior to application and two types of Ambex anchoring capsules from Ambex Concrete Repair Solutions, Canada; capsules with cementitious content, which have to be immersed in water prior to use, then inserted into the borehole.

However, these commercially available systems have several drawbacks such as possessing very high dispensing forces, unacceptable handling in mixing, very short working time, risk of leaching of compounds in water bucket, poor insertion of soft/wet capsules into deep boreholes, inhomogeneous content, produce a large scattering of load values as well as having very low load values, in particular when it comes to chemically fastening of reinforcement bars and tested for fire-rating, e.g. at 250°C. Moreover, it is known that the load values drop at higher temperatures such as 250°C when compared to the load values obtained at ambient temperature indicating that these systems are not suitable for a fire-resistant application as well as they cannot guarantee a sufficient anchoring at elevated temperatures which is necessary when fastening anchors and post-installed reinforcing bars.

When it comes to a fire-resistant chemical fastening of anchors and post-installed reinforcing bars in mineral surfaces, a short working time is not always desired. Further, most of the known systems lack sufficient fluidity for most practical applications of the resultant compositions. Often anchors and reinforcement bars must be forced into the borehole which makes the installation very hard and inefficient. Moreover, such prior art compositions also evidence a tendency to crack in a relatively short time and do not exhibit the required mechanical performance, in particular under the influence of elevated temperatures, such as fire.

Therefore, there is a need for a fire-resistant ready-for-use multiple-component system, preferably a fire-resistant two-component system, which is superior over the prior art systems with regard to environmental aspects, health and safety, handling, storage time and a good balance between setting and hardening of the mortar. In particular, it is of great interest to provide a fire-resistant system that can be used for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars in mineral surfaces without adversely affecting the handling, characteristics and the mechanical performance of the chemical anchoring system, especially at elevated temperatures such as 250°C.

In view of the above, it is an object of the present invention to provide a fire-resistant multiple-component system, in particular a fire-resistant two-component mortar system, which overcomes the disadvantages of the prior art systems. In particular, it is an object to provide a fire-resistant two-component mortar system that is ready-for-use, which can be handled easily and is eco-friendly, which can be stably stored for a certain period of time prior to use, which exhibits a good balance between setting and hardening and still has an excellent mechanical performance when it comes to a fire-resistant chemical fastening of anchors and post-installed reinforcing bars, even under the influence of elevated temperatures, such as fire. Moreover, fire-resistant multiple-component anchoring system should have load values that do not decrease at higher temperatures, preferably they should even increase at higher temperatures such as 250°C to guarantee a sufficient anchoring at elevated temperatures which is necessary when fastening anchors and post-installed reinforcing bars.

Moreover, it is an object of the present invention to provide a fire-resistant two-component mortar system that can be used for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars in mineral surfaces, such as structures made of brickwork, concrete, pervious concrete or natural stone.

These and other objectives as they will become apparent from the ensuring description of the invention are solved by the present invention as described in the independent claims. The dependent claims pertain to preferred embodiments.

SUMMARY OF THE INVENTION

In one aspect, the present invention provides a fire-resistant ready-for-use two-component mortar system comprising a curable aqueous-phase aluminous cement component A and an initiator component B in aqueous-phase for initiating the curing process, component A further comprising at least one blocking agent selected from the group consisting of phosphoric acid, metaphosphoric acid, phosphorous acid and phosphonic acids, at least one plasticizer and water, and component B comprising an initiator, at least one retarder, at least one mineral filler and water for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars. In particular, component B comprises an initiator comprising a mixture of alkali and/or alkaline earth metal salts, at least one retarder selected from the group consisting of citric acid, tartaric acid, lactic acid, salicylic acid, gluconic acid and mixtures thereof, and at least one mineral filler selected from the group consisting of limestone fillers, sand, corundum, dolomite, alkaline-resistant glass, crushed stones, gravels, pebbles and mixtures thereof.

In another aspect, the present invention provides a fire-resistant two-component mortar system that is used for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars in mineral surfaces, such as structures made of brickwork, concrete, pervious concrete or natural stone.

DETAILED DESCRIPTION OF THE INVENTION

The following terms and definitions will be used in the context of the present invention:

As used in the context of present invention, the singular forms of “a” and “an” also include the respective plurals unless the context clearly dictates otherwise. Thus, the term “a” or “an” is intended to mean “one or more” or “at least one”, unless indicated otherwise.

The term “aluminous cement” in the context of the present invention refers to a calcium aluminate cement that consists predominantly of hydraulic active calcium aluminates. Alternative names are “high-alumina cement” or “Ciment fondu” in French. The main active constituent of calcium aluminate cements is monocalcium aluminate ($CaAl_2O_4$, $CaO \cdot Al_2O_3$, or CA in the cement chemist notation).

The term “shelf life” in the context of the present invention refers to the time during which a component stays in the form of a more or less fluid aqueous suspension of solid products, capable of coming back to the aqueous-suspension by mechanical means, without setting or losing its reactivity.

The term “initiator” in the context of the present invention refers to a compound or composition that modifies the chemical environment to start a particular chemical reaction. In the present invention the initiator modifies the pH-value of the mortar suspension thereby de-blocking the hydraulic binder in the final mixture.

The term “retarder” in the context of the present invention refers to a compound or composition that modifies the chemical environment to delay a particular chemical reaction. In the present invention the retarder modifies the hydration ability of the calcium aluminate cement of the mortar suspension thereby delaying the hydraulic binder action in the final mixture.

The term “initial set-time” in the context of the present invention refers to the time at which the mixture of component A and component B starts to set after mixing. During the time period after mixing, the mixture stays in the form of a more or less fluid aqueous suspension or paste of solid products.

The present invention pertains to a fire-resistant two-component mortar system for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars in mineral surfaces, comprising a curable aqueous-phase aluminous cement component A and an initiator component B in aqueous-phase for initiating the curing process. In particular, according to the present invention, component A further comprises at least one blocking agent selected from the group consisting of phosphoric acid, metaphosphoric acid, phosphorous acid and phosphonic acids, at least one plasticizer and water, and component B comprises an initiator, at least one retarder, at least one mineral filler and water, wherein the initiator comprises a mixture of alkali and/or alkaline earth metal salts, the at least one retarder is selected from the group consisting of citric acid, tartaric acid, lactic acid, salicylic acid, gluconic acid and mixtures thereof, and the mineral filler is selected from the group consisting of limestone fillers, sand, corundum, dolomite, alkaline-resistant glass, crushed stones, gravels, pebbles and mixtures thereof.

Component A according to the present invention is based on an aqueous-phase aluminous cement (CA) or an aqueous-phase calcium sulfoaluminate cement (CAS). The calcium aluminate cement which can be used in the present invention is characterized by rapid set and rapid hardening, rapid drying and shrinkage compensation when mixed with calcium sulfates, excellent resistance to corrosion and shrinkage. Such a calcium aluminate cement suitable to be used in the present invention is for example Ternal® White (Kerneos, France).

If component A comprises a mixture of aluminous cement (CAC) and calcium sulfate ($CaSO_4$), rapid ettringite formation takes place during hydration. In concrete chemistry hexacalcium aluminate trisulfate hydrate, represented by the general formula $(CaO)_6(Al_2O_3)(SO_3)_3 \cdot 32\ H_2O$ or $(CaO)_3(Al_2O_3)(CaSO_4)_3 \cdot 32H_2O$, is formed by the reaction of calcium aluminate with calcium sulfate, resulting in quick setting and hardening as well as in shrinkage compensation or even expansion. With moderate increase of the sulfate content shrinkage compensation can be achieved.

Component A of the present invention comprises at least about 40 wt.-%, preferably at least about 50 wt.-%, more preferably at least about 60 wt.-%, most preferably at least about 70 wt.-%, from about 40 wt.-% to about 95 wt.-%, preferably from about 50 wt.-% to about 85 wt.-%, more preferably from about 60 wt.-% to about 80 wt.-%, most preferably from about 70 wt.-% to about 75 wt.-% of aluminous cement, based on the total weight of component A.

According to an alternative embodiment of the invention, component A comprises at least about 20 wt.-%, preferably at least about 30 wt.-%, more preferably at least about 40 wt.-%, most preferably at least about 50 wt.-%, from about 20 wt.-% to about 80 wt.-%, preferably from about 30 wt.-% to about 70 wt.-%, more preferably from about 35 wt.-% to about 60 wt.-%, most preferably from about 40 wt.-% to about 55 wt.-% of aluminous cement, based on the total weight of component A and at least about 5 wt.-%, preferably at least about 10 wt.-%, more preferably at least about 15 wt.-%, most preferably at least about 20 wt.-%, from about 1 wt.-% to about 50 wt.-%, preferably from about 5 wt.-% to about 40 wt.-%, more preferably from about 10 wt.-% to about 30 wt.-%, most preferably from about 15 wt.-% to about 25 wt.-% of calcium sulfate, preferably calcium sulfate hemihydrate, based on the total weight of component A. In a preferred alternative embodiment of the two-component mortar system of the present invention, the ratio of $CaSO_4$/CAC of component A should be less or equal to 35:65.

The blocking agent comprised in component A according to the present invention is selected from the group consisting of phosphoric acid, metaphosphoric acid, phosphorous acid and phosphonic acids, preferably is phosphoric acid or metaphosphoric acid, most preferably is phosphoric acid, in particular an 85% aqueous solution of phosphoric acid. Component A comprises at least about 0.1 wt.-%, preferably at least about 0.3 wt.-%, more preferably at least about 0.4 wt.-%, most preferably at least about 0.5 wt.-%, from about 0.1 wt.-% to about 20 wt.-%, preferably from about 0.1 wt.-% to about 15 wt.-%, more preferably from about 0.1 wt.-% to about 10 wt.-%, most preferably from about 0.3 wt.-% to about 10 wt.-% of said blocking agent, based on the total weight of component A. In a preferred embodiment, component A comprises from about 0.3 wt.-% to about 10 wt.-% of 85% aqueous solution of phosphoric acid, based on the total weight of component A. Preferably, the amounts of aluminous cement and/or calcium sulfoaluminate cement by weight relative to the hydraulic binder total weight are higher than any of the following values: 50%, 60%, 70%, 80%, 90%, 95%, 99% or are 100%.

The plasticizer comprised in component A according to the present invention is selected from the group consisting of low molecular weight (LMW) polyacrylic acid polymers, superplasticizers from the family of polyphosphonate polyox and polycarbonate polyox, and ethacryl superplasticizers from the polycarboxylate ether group, and mixtures thereof, for example Ethacryl™ G (Coatex, Arkema Group, France), Acumer™ 1051 (Rohm and Haas, U.K.), or Sika® ViscoCrete®-20 HE (Sika, Germany). Suitable plasticizers are commercially available products. Component A comprises at least about 0.2 wt.-%, preferably at least about 0.3 wt.-%, more preferably at least about 0.4 wt.-%, most preferably at least about 0.5 wt.-%, from about 0.2 wt.-% to about 20 wt.-%, preferably from about 0.3 wt.-% to about 15 wt.-%, more preferably from about 0.4 wt.-% to about 10 wt.-%, most preferably from about 0.5 wt.-% to about 5 wt.-% of said plasticizer, based on the total weight of component A.

In an advantageous embodiment, component A further comprises the following characteristics, taken alone or in combination.

Component A may additionally comprise a thickening agent. The thickening agents which can be used in the present invention may be selected from the group consisting of organic products, such as xanthan gum, welan gum or DIUTAN® gum (CPKelko, USA), starched-derived ethers, guar-derived ethers, polyacrylamide, carrageenan, agar agar, and mineral products, such as clay, and their mixtures. Suitable thickening agents are commercially available products. Component A comprises at least about

0.01 wt.-%, preferably at least about 0.1 wt.-%, more preferably at least about 0.2 wt.-%, most preferably at least about 0.3 wt.-%, from about 0.01 wt.-% to about 10 wt.-%, preferably from about 0.1 wt.-% to about 5 wt.-%, more preferably from about 0.2 wt.-% to about 1 wt.-%, most preferably from about 0.3 wt.-% to about 0.7 wt.-% of said thickening agent, based on the total weight of component A.

Component A may further comprise an antibacterial or biocidal agent. The antibacterial or biocidal agents which can be used in the present invention may be selected from the group consisting of compounds of the isothiazolinone family, such as methylisothiazolinone (MIT), octylisothiazolinone (OIT) and benzoisothiazolinone (BIT) and their mixtures. Suitable antibacterial or biocidal agents are commercially available products. Exemplarily mentioned are Ecocide K35R (Progiven, France) and Nuosept OB 03 (Ashland, The Netherlands). Component A comprises at least about 0.001 wt.-%, preferably at least about 0.005 wt.-%, more preferably at least about 0.01 wt.-%, most preferably at least about 0.015 wt.-%, from about 0.001 wt.-% to about 1.5 wt.-%, preferably from about 0.005 wt.-% to about 0.1 wt.-%, more preferably from about 0.01 wt.-% to about 0.075 wt.-%, most preferably from about 0.015 wt.-% to about 0.03 wt.-% of said antibacterial or biocidal agent, based on the total weight of component A. In a preferred embodiment, component A comprises from about 0.015 wt.-% to about 0.03 wt.-% of Nuosept OB 03, based on the total weight of component A.

In an alternative embodiment, component A comprises at least one filler, in particular an organic or mineral filler. The filler which can be used in the present invention may be selected from the group consisting of quartz powder, preferably quartz powder having an averaged grain size (d50%) of about 16 µm, quartz sand, clay, fly ash, fumed silica, carbonate compounds, pigments, titanium oxides, light fillers, and their mixtures. Suitable mineral fillers are commercially available products. Exemplarily mentioned is quartz powder Millisil W12 or W6 (Quarzwerke GmbH, Germany). Component A comprises at least about 1 wt.-%, preferably at least about 2 wt.-%, more preferably at least about 5 wt.-%, most preferably at least about 8 wt.-%, from about 1 wt.-% to about 50 wt.-%, preferably from about 2 wt.-% to about 40 wt.-%, more preferably from about 5 wt.-% to about 30 wt.-%, most preferably from about 8 wt.-% to about 20 wt.-% of said at least one filler, based on the total weight of component A.

The water content comprised in component A is at least about 1 wt.-%, preferably at least about 5 wt.-%, more preferably at least about 10 wt.-%, most preferably at least about 20 wt.-%, from about 1 wt.-% to about 50 wt.-%, preferably from about 5 wt.-% to about 40 wt.-%, more preferably from about 10 wt.-% to about 30 wt.-%, most preferably from about 15 wt.-% to about 25 wt.-%, based on the total weight of component A.

The presence of a plasticizer, thickening agent as well as an antibacterial or biocidal agent does not change the overall inorganic nature of the cementitious component A.

Component A comprising the aluminous cement or calcium sulfoaluminate cement is present in aqueous-phase, preferably in form of a slurry or paste.

Component B of the present invention comprises an initiator, at least one retarder, at least one mineral filler and water. To ensure a sufficient processing time, whereby the initial-set time is at least 5 min or more, at least one retarder, which prevents premature hardening of the mortar composition, is used in a distinct concentration in addition to the initiator component.

The initiator present in component B is comprised of an activator component and an accelerator component which comprise a mixture of alkali and/or alkaline earth metal salts.

In particular, the activator component is constituted of at least one alkali and/or alkaline earth metal salt selected from the group consisting of hydroxides, chlorides, sulfates, phosphates, monohydrogen phosphates, dihydrogen phosphates, nitrates, carbonates and mixtures thereof, preferably the activator component is an alkali or alkaline earth metal salt, more preferably is a calcium metal salt, such as calcium hydroxide, calcium sulfate, calcium carbonate or calcium phosphate, a sodium metal salt, such as sodium hydroxide, sodium sulfate, sodium carbonate or sodium phosphate, or a lithium metal salt, such as lithium hydroxide, lithium sulfate, lithium carbonate or lithium phosphate, most preferably is lithium hydroxide. In one preferred embodiment the lithium hydroxide used in component B is a 10% aqueous solution of lithium hydroxide.

Component B comprises at least about 0.01 wt.-%, preferably at least about 0.02 wt.-%, more preferably at least about 0.05 wt.-%, most preferably at least about 1 wt.-%, from about 0.01 wt.-% to about 40 wt.-%, preferably from about 0.02 wt.-% to about 35 wt.-%, more preferably from about 0.05 wt.-% to about 30 wt.-%, most preferably from about 1 wt.-% to about 25 wt.-% of said activator, based on the total weight of component B. In a particular preferred embodiment, the activator is comprised of water and lithium hydroxide. The water content comprised in component B is at least about 1 wt.-%, preferably at least about 5 wt.-%, more preferably at least about 10 wt.-%, most preferably at least about 20 wt.-%, from about 1 wt.-% to about 60 wt.-%, preferably from about 5 wt.-% to about 50 wt.-%, more preferably from about 10 wt.-% to about 40 wt.-%, most preferably from about 15 wt.-% to about 30 wt.-%, based on the total weight of component B. The lithium hydroxide content comprised in component B is at least about 0.1 wt.-%, preferably at least about 0.5 wt.-%, more preferably at least about 1.0 wt.-%, most preferably at least about 1.5 wt.-%, from about 0.1 wt.-% to about 5 wt.-%, preferably from about 0.5 wt.-% to about 4 wt.-%, more preferably from about 1.0 wt.-% to about 3 wt.-%, most preferably from about 1.5 wt.-% to about 2.5 wt.-%, based on the total weight of component B. In a most preferred embodiment, component B comprises from about 2.0 wt.-% to about 20 wt.-% of a 10% aqueous solution of lithium hydroxide, based on the total weight of component B.

The accelerator component is constituted of at least one alkali and/or earth alkaline metal salt selected from the group consisting of hydroxides, chlorides, sulfates, phosphates, monohydrogen phosphates, dihydrogen phosphates, nitrates, carbonates and mixtures thereof, preferably the accelerator component is an alkali or earth alkaline metal salt, still preferably is a water-soluble alkali or earth alkaline metal salt, more preferably is a calcium metal salt, such as calcium hydroxide, calcium sulfate, calcium carbonate, calcium chloride, calcium formate or calcium phosphate, a sodium metal salt, such as sodium hydroxide, sodium sulfate, sodium carbonate, sodium chloride, sodium formate or sodium phosphate, or a lithium metal salt, such as lithium hydroxide, lithium sulfate, lithium sulfate monohydrate, lithium carbonate, lithium chloride, lithium formate or lithium phosphate, most preferably is lithium sulfate or lithium sulfate monohydrate. Component B comprises at least about 0.01 wt.-%, preferably at least about 0.05 wt.-%, more preferably at least about 0.1 wt.-%, most preferably at least about 1.0 wt.-%, from about 0.01 wt.-% to about 25 wt.-%, preferably from about 0.05 wt.-% to about 20 wt.-%, more preferably from about 0.1 wt.-% to about 15 wt.-%, most preferably from about 1.0 wt.-% to about 10 wt.-% of said accelerator, based on the total weight of component B.

In a particular preferred embodiment of component B of the present invention, the ratio of 10% aqueous solution of lithium hydroxide/lithium sulfate or lithium sulfate monohydrate is 7/1 or 6/1.

The at least one retarder comprised in component B according to the present invention is selected from the group consisting of citric acid, tartaric acid, lactic acid, salicylic acid, gluconic acid and mixtures thereof, preferably is a mixture of citric acid and tartaric acid. Component B comprises at least about 0.1 wt.-%, preferably at least about 0.2 wt.-%, more preferably at least about 0.5 wt.-%, most preferably at least about 1.0 wt.-%, from about 0.1 wt.-% to about 25 wt.-%, preferably from about 0.2 wt.-% to about 15 wt.-%, more preferably from about 0.5 wt.-% to about 15 wt.-%, most preferably from about 1.0 wt.-% to about 10 wt.-% of said retarder, based on the total weight of component B.

In a particular preferred embodiment of component B of the present invention, the ratio of citric acid/tartaric acid is 1.6/1.

The at least one mineral filler comprised in component B according to the present invention is selected from the group consisting of limestone fillers, sand, crushed stones, gravels, pebbles and mixtures thereof, preferred are limestone fillers, such as various calcium carbonates. The at least one mineral filler is preferably selected from the group consisting of limestone fillers or quartz fillers, such as quartz powder Millisil W12 or W6 (Quarzwerke GmbH, Germany) and quartz sand. The at least one mineral filler of component B is most preferably a calcium carbonate or a mixture of calcium carbonates. Component B comprises at least about 30 wt.-%, preferably at least about 40 wt.-%, more preferably at least about 50 wt.-%, still more preferably at least about 60 wt.-%, most preferably at least about 70 wt.-%, from about 30 wt.-% to about 95 wt.-%, preferably from about 35 wt.-% to about 90 wt.-%, more preferably from about 40 wt.-% to about 85 wt.-%, still more preferably from about 45 wt.-% to about 80 wt.-%, most preferably from about 50 wt.-% to about 75 wt.-% of at least one mineral filler, based on the total weight of component B. The at least one mineral filler is chosen to obtain a particle size complementary to that of the aluminous cement.

It is preferred that the at least one mineral filler has an average particle size of not more than 500 µm, more preferably of not more than 400 µm, most preferably not more than 350 µm.

In a particular preferred embodiment of the present invention, the at least one mineral filler comprised in component B is mixture of three different calcium carbonates, i.e. calcium carbonate fines, such as different Omyacarb® types (Omya International AG, Germany). Most preferably, the first calcium carbonate has an average particle size (d50%) of about 3.2 µm and a residue of 0.05% on a 45 µm sieve (determined according to ISO 787/7). The second calcium carbonate has an average particle size (d50%) of about 7.3 µm and a residue of 0.5% on a 140 µm sieve (determined according to ISO 787/7). The third calcium carbonate has an average particle size (d50%) of about 83 µm and a residue of 1.0% on a 315 µm sieve (determined according to ISO 787/7). In a particular preferred embodiment of component B of the present invention, the ratio of first calcium carbonate/second calcium carbonate/third calcium carbonate is 1/1.5/2 or 1/1.4/2.2.

In a particular preferred alternative embodiment of the present invention, the at least one mineral filler comprised in component B is mixture of three different quartz fillers. Most preferably, the first quartz filler is a quartz sand having an average particle size (d50%) of about 240 µm. The second quartz filler is a quartz powder having an average grain size (d50%) of about 40 µm. The third quartz filler is a quartz powder having an average grain size (d50%) of about 15 µm. In a particular preferred embodiment of component B of the present invention, the ratio of first quartz filler/second quartz filler/third quartz filler is 3/2/1.

In an advantageous embodiment, component B further comprises the following characteristics, taken alone or in combination.

Component B may additionally comprise a thickening agent. The thickening agent to be used in the present invention may be selected from the group consisting of bentonite, silicon dioxide, quartz, thickening agents based on acrylate, such as alkali-soluble or alkali-swellable emulsions, fumed silica, clay and titanate chelating agents. Exemplarily mentioned are polyvinyl alcohol (PVA), hydrophobically modified alkali soluble emulsions (HASE), hydrophobically modified ethylene oxide urethane polymers known in the art as HEUR, and cellulosic thickeners such as hydroxymethyl cellulose (HMC), hydroxyethyl cellulose (HEC), hydrophobically-modified hydroxy ethyl cellulose (HMHEC), sodium carboxymethyl cellulose (SCMC), sodium carboxymethyl 2-hydroxyethyl cellulose,2-hydroxypropyl methyl cellulose, 2-hydroxyethyl methyl cellulose, 2-hydroxybutyl methyl cellulose, 2-hydroxyethyl ethyl cellulose, 2-hydoxypropyl cellulose, attapulgite clay, and mixtures thereof. Suitable thickening agents are commercially available products, such as Optigel WX (BYK-Chemie GmbH, Germany), Rheolate 1 (Elementis GmbH, Germany) and Acrysol ASE-60 (The Dow Chemical Company). Component B comprises at least about 0.01 wt.-%, preferably at least about 0.05 wt.-%, more preferably at least about 0.1 wt.-%, most preferably at least about 0.3 wt.-%, from about 0.01 wt.-% to about 15 wt.-%, preferably from about 0.05 wt.-% to about 10 wt.-%, more preferably from about 0.1 wt.-% to about 5 wt.-%, most preferably from about 0.3 wt.-% to about 1 wt.-% of said thickening agent, based on the total weight of component B.

The presence of a retarder and thickening agent does not change the overall inorganic nature of the cementitious component B.

Component B comprising the initiator and retarder is present in aqueous-phase, preferably in form of a slurry or paste.

It is preferred that the pH-value of component B is above 10, more preferably above 11 and most preferably is above 12, in particular in the range between 10 and 14, preferably between 11 and 13.

It is particular preferred that the proportions of water in the two components, namely component A and component B, are chosen so that the water to aluminous cement ratio (W/CAC) or water to calcium sulfoaluminate cement (W/CAS), in the product obtained by mixing components A and B is lower than 1.5, preferably between 0.3 and 1.2, most preferably between 0.4 and 1.0.

Moreover, it is particular preferred that the proportion of lithium in component B is chosen so that the lithium to aluminous cement ratio (Li/CAC) and lithium to calcium sulfoaluminate cement (Li/CAS), in the product obtained by mixing components A and

B is lower than 0.05, preferably between 0.001 and 0.05, most preferably between 0.005 and 0.01.

Moreover, it is particular preferred that the proportion of retarder in component B is chosen so that the citric acid/tartaric acid to aluminous cement ratio and citric acid/tartaric acid to calcium sulfoaluminate cement, in the product obtained by mixing components A and B is lower than 0.5 preferably between 0.01 and 0.4, most preferably between 0.1 and 0.2.

In a most preferred embodiment, component A comprises or consists of the following components:
70 to 80 wt.-% of aluminous cement, alternatively 40 to 60 wt.-% aluminous cement and 15 to 25 wt.-% calcium sulfate,
0.5 to 1.5 wt.-% of phosphoric acid,
0.5 to 1.5 wt.-% of plasticizer,
0.001 to 0.05 wt.-% of an antimicrobial or biocidal agent,
optionally 5 to 20 wt.-% of mineral fillers, and
15 to 25 wt.-% of water.

In a preferred embodiment, component B comprises or consists of the following components:
0.1 wt.-% to 4 wt.-% of lithium hydroxide,
0.1 wt.-% to 5 wt.-% of lithium sulfate or lithium sulfate monohydrate,
0.05 wt.-% to 5 wt.-% of citric acid,
0.05 wt.-% to 4 wt.-% of tartaric acid,
35 wt.-% to 45 wt.-% of a first mineral filler,
15 wt.-% to 25 wt.-% of a second mineral filler,
10 wt.-% to 20 wt.-% of a third mineral filler,
0.01 wt.-% to 0.5 wt.-% of a thickening agent, and
15 wt.-% to 25 wt.-% of water.

In a most preferred embodiment, component B comprises or consists of the following components:
1.5 wt.-% to 2.5 wt.-% of lithium hydroxide,
1 wt.-% to 4 wt.-% of lithium sulfate or lithium sulfate monohydrate,

1 wt.-% to 3 wt.-% of citric acid,
0.5 wt.-% to 2 wt.-% of tartaric acid,
35 wt.-% to 45 wt.-% of a first mineral filler,
15 wt.-% to 25 wt.-% of a second mineral filler,
10 wt.-% to 20 wt.-% of a third mineral filler,
0.01 wt.-% to 0.5 wt.-% of a thickening agent, and
15 wt.-% to 25 wt.-% of water.

In a most preferred alternative embodiment, component B comprises or consists of the following components:
3 wt.-% to 4 wt.-% of lithium hydroxide,
1 wt.-% to 10 wt.-% of lithium sulfate or lithium sulfate monohydrate,
1 wt.-% to 5 wt.-% of citric acid,
1 wt.-% to 3 wt.-% of tartaric acid,
25 wt.-% to 35 wt.-% of a first mineral filler,
15 wt.-% to 25 wt.-% of a second mineral filler,
10 wt.-% to 20 wt.-% of a third mineral filler,
0.01 wt.-% to 0.5 wt.-% of a thickening agent, and
30 wt.-% to 40 wt.-% of water.

In another most preferred embodiment, component B comprises or consists of the following components:
0.2 wt.-% to 1.5 wt.-% of lithium hydroxide,
0.1 wt.-% to 1.0 wt.-% of lithium sulfate or lithium sulfate monohydrate,
0.1 wt.-% to 1.0 wt.-% of citric acid,
0.1 wt.-% to 0.5 wt.-% of tartaric acid,
35 wt.-% to 45 wt.-% of a first mineral filler,
15 wt.-% to 25 wt.-% of a second mineral filler,
10 wt.-% to 20 wt.-% of a third mineral filler,
0.01 wt.-% to 0.5 wt.-% of a thickening agent, and
15 wt.-% to 25 wt.-% of water.

Component A of the present invention may be prepared as follows: The phosphor-containing blocking agent is mixed with water, so that the pH-value of the resulting mixture is about 2. Plasticizer is added and the mixture homogenized. Aluminous cement, optionally calcium sulfate, and optionally mineral filler are premixed and added stepwise to the mixture whilst increasing the stirring speed, so that the pH-value of the resulting mixture is about 4. Finally, thickening agent and antibacterial/biocidal agent are added and mixed until complete homogenization of the mixture.

Component B of the present invention may be prepared as follows: The accelerator is dissolved in an aqueous solution of an activator, followed by subsequent addition of retarder and homogenization of the mixture. The filler(s) is/are added stepwise whilst increasing the stirring speed until the mixture homogenizes. Finally, the thickening agent is added until complete homogenization of the mixture.

Component A and B are present in aqueous phase, preferably in form of a slurry or paste. In particular, components A and B have a pasty to fluid aspect according to their respective compositions. In one preferred embodiment, component A and component B are in paste form thereby preventing sagging at the time of mixing the two components.

The weight ratio between component A and component B (A/B) is preferentially comprised between 7/1 and 1/3, preferably is 3/1. Preferably, the composition of the mixture comprises 75 wt.-% of component A and 25 wt.-% of component B. In an alternative embodiment, the composition of the mixture comprises 25 wt.-% of component A and 75 wt.-% of component B.

The fire-resistant two-component system is of mineral nature, which is not affected by the presences of additional thickening agents of other agents.

The shelf life of the fire-resistant two-component system depends on the individual shelf life of each of the respective components, in particular component A as well as component B has a shelf life of at least six months at ambient temperature so as to protect the system from the storing and supply delays. Most preferably, component A and B are individually stable for at least six months. The component A and B were stored in tightly closed containers to avoid evaporation of water at 40°C and checked for any changes in fluidity, homogeneity, whether sedimentation occurs, and pH-value after several time intervals. The properties of all components remained unaffected after 6 months, thus the shelf life is at least 6 months at 40°C.

It is preferred that the fire-resistant two-component mortar system has an initial set-time of at least 5 min, preferably of at least 10 min, more preferably of at least 15 min, most preferably of at least 20 min, in particular in the range of from about 5 to 25 min, preferably in the range of about 10 to 20 min, after mixing of the two components A and B.

In the fire-resistant multi-component mortar system, especially the fire-resistant two-component mortar system, the volume ratio of cementitious component A to initiator component B is 1:1 to 7:1, preferably is 3:1. In an alternative embodiment, the volume ratio of cementitious component A to initiator component B is 1:3 to 1:2.

After being produced separately, component A and component B are introduced into separate containers, from which they are ejected by means of mechanical devices and are guided through a mixing device. The fire-resistant two-component mortar system of the present invention is preferably a ready-for-use system, whereby component A and B are separately arranged from each other in a multi-chamber device, such as a multi-chamber cartridge and/or a multi-chamber cylinder or in two-component capsules, preferably in a two-chamber cartridge or in two-component capsules. The multi-chamber system preferably includes two or more foil bags for separating curable component A and initiator component B. The contents of the chambers or bags which are mixed together by a mixing device, preferably via a static mixer, can be injected into a borehole. The assembly in multiple chamber cartridges or pails or sets of buckets is also possible.

The hardening aluminous cement composition existing from the static mixer is inserted directly into the borehole, which is required accordingly for fastening the anchors and post-installed reinforcing bars, and has been initially introduced into the mineral surface, during the chemical fastening of anchors and post-installed reinforcing bars, whereupon the construction element to be fastened, such as an anchor or post-installed reinforcing bar, is inserted and adjusted, whereupon the mortar composition sets and hardens. In particular, the fire-resistant two-component system of the present invention is to be considered as a fire-resistant chemical anchor for fastening anchors and post-installed reinforcing bars.

Without being bound by theory, the blocking agent present in component A inhibits the solubilization of the calcium aluminate(s) in water, thereby stopping cement hydration which leads to the curing of the mixture. Upon adding the initiator component B, the pH-value is changed and the cementitious component A is unblocked and hydration reaction of the calcium aluminate(s) is released. As this hydration reaction is catalyzed and accelerated by the presence of alkali metals salts, in particular lithium salts, it has an initial set-time of shorter than 5 min. In order to retard the fast curing time (initial-set time), it is preferred that the at least one retarder comprised in component B according to the present invention is so chosen to obtain an initial set-time of at least 5 min, preferably of at least 10 min, more preferably of at least 15 min, most preferably of at least 20 min, in particular in the range of from about 5 to 25 min, preferably in the range of about 10 to 20 min, after mixing of the two components A and B.

The role of mineral fillers, in particular in component B, is to adjust the final performance with regard to mechanical strength and performance as well as long term durability. By optimizing the fillers, it is possible to optimize the water/aluminous cement ratio which allows for an efficient and fast hydration of the aluminous cement.

The fire-resistant two-component mortar system of the present invention can be used for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars into mineral surfaces, such as structures made of brickwork, concrete, pervious concrete or natural stone. In particular, the fire-resistant two-component mortar system of the present invention can be used for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars in boreholes. It can be used for anchoring purposes encompassing an increase in the load capacity at elevated temperatures, such as 250℃. An increased temperature resistance results in a better operational capability for anchoring purposes at higher temperatures, such as temperatures being present in the area of a borehole of facade anchorages, which are exposed to strong sunlight or otherwise elevated temperatures, such as fire. In particular, the fire-resistant two-component mortar system of the present invention has load values that do not decrease at higher temperatures, they even increase at higher temperatures such as 250℃ when compared to the known systems, to guarantee a sufficient anchoring at elevated temperatures which is necessary when fastening anchors and post-installed reinforcing bars.

Moreover, the fire-resistant two-component mortar system of the present invention may be used for the fire-resistant attachment of fibers, scrims, fabrics or composites, in particular of high-modulus fibers, preferably of carbon fibers, in particular for the reinforcement of building structures, for example walls or ceilings or floors, or further for mounting components, such as plates or blocks, e.g. made of stone, glass or plastic, on buildings or structural elements. However, in particular it is used for a fire-resistant fastening of anchors and post-installed reinforcing bars into recesses, such as boreholes, in mineral surfaces, such as structures made of brickwork, concrete, pervious concrete or natural stone, whereby the components of the fire-resistant two-component mortar system of the present invention are prior mixed, for example by means of a static mixer or by destroying a cartridge or a plastic bag, or by mixing components of a multi-chamber pails or sets of buckets.

The following example illustrates the invention without thereby limiting it.

EXAMPLES

1. Preparation of the comparative inorganic mortar systems

1.1 Comparative example 1 - inorganic mortar system "Cemeforce"

The commercially available one-component cartridge Cemeforce (Sumitomo Osaka Cement Co. Ltd., Japan) containing the binder as dry powder is opened and its contents mixed with a separate bottle of water according to the instructions ready for introducing into the borehole using a dispenser.

1.2 Comparative examples 2a and 2b - inorganic mortar system "Ambex capsules"

The commercially available one-component Ambex Anchoring Capsules AAC (comparative example 2a) and ARC-E (comparative example 2b) (Ambex Concrete Repair Solutions, Canada) ware immersed into water according to the instructions ready for manually insertion into the borehole.

2. Preparation of the inventive inorganic mortar system (inventive example 3)

The cementitious component A as well as the initiator component B of the inventive example 3 are initially produced by mixing the constituents specified in Tables 1 and 2, respectively. The proportions that are given are expressed in wt.-%.

A typical mixing protocol for component A is as follows: weighting out the necessary quantity of water, introducing the water into a mixing bowl and slowly adding phosphoric acid thereto under stirring until a pH-value of about 2 is obtained; adding plasticizer and homogenizing at 100 to 200 rpm for 2 minutes; pre-mixing Ternal White® and filler in a big bucket and adding this mixture step by step whilst slowly stirring at 200 rpm to avoid lump formation, increasing stirring speed to 4000 rpm; pH-value obtained should be about 4; adding slowly thickening agent and finally antibacterial or biocidal agent and homogenizing at 5000 rpm it for 5 min.

Table 1: Composition of component A.

Compound	Function	A
Deionized water		19.995
Phosphoric acid 85%	blocking agent	0.910
Ternal White	aluminate cement	77.981
Ethacryl™ G	plasticizer	0.600
Xanthan Gum	thickening agent	0.500
Nuosept OB 03	biocidal agent	0.015

Phosphoric acid 85% marketed by Sigma-Aldrich Chemie GmbH, Germany
Ternal White® marketed by Kerneos S.A., France
Ethacryl™ G marketed by Coatex, Arkema Group, France
Xanthan Gum marketed by Colltec GmbH & CO. KG, Germany
Nuosept OB 03 marketed by Ashland Nederland B.V., The Netherlands

A typical mixing protocol for component B is as follows: dissolving lithium sulfate monohydrate together with water in a 10% aqueous solution of lithium hydroxide followed by dissolving the carboxylic acids in this mixture and fully homogenizing it at 500 rpm for at least for 30 min; adding stepwise filler or filler mixture while increasing stirring speed to 2000 rpm over a time period of 5 min and continuing homogenizing it at 2000 rpm for about 10 min; finally adding thickening agent whilst stirring, and increasing stirring speed to 2500 rpm over a time period of 3 min; finally continuing homogenizing for 5 min.

Table 2: Composition of component B.

Compound	Function	B
Water		0.426
LiOH 10% (water)	activator	18.412
$Li_2SO_4 \cdot H_2O$	accelerator	3.217
Citric acid	retarder	2.108
Tartaric acid	retarder	1.317
Filler 1	filler	35.429[1]
Filler 2	filler	22.312[2]
Filler 3	filler	16.383[3]
Optigel WX	thickening agent	0.396

LiOH 10% (water) marketed by Bern Kraft GmbH, Germany
$Li_2SO_4 \cdot H_2O$ marketed by Sigma-Aldrich Chemie GmbH, Germany
Citric acid marketed by Sigma-Aldrich Chemie GmbH, Germany
Tartaric acid marketed by Sigma-Aldrich Chemie GmbH, Germany
[1] Omyacarb 130-AI marketed by Omya International AG, Germany
[2] Omyacarb 15-H AI marketed by Omya International AG, Germany
[3] Omyacarb 2-AI marketed by Omya International AG, Germany
Optigel WX marketed by Rockwood Clay Additives GmbH, Germany

3. Determination of mechanical performance at 250°C – Resistance to fire

The tests were performed in uncracked concrete C20/25. The concrete used for testing complies with EN 206 and meets the requirements of ETAG 001 Annex A. For installation purposes the borehole was drilled (borehole diameter 16 mm) and cleaned, the mortar injected and the reinforcement bar injected at normal ambient temperature in accordance with the MPII. Comparative example 1 was introduced into the borehole using a dispenser. Comparative examples 2a and 2b were manually inserted into the borehole. After being produced separately, the cementitious component A and initiator component B of the inventive example was mixed in a speed mixer in a volume ratio of 3:1 and were introduced into the borehole.

The diameter of the rebar was equal to 10 mm. The embedment depth of the rebar was equal to 120 mm. In the test, the curing time of the samples at room temperature was 24 hours and then the concrete block with the reinforcement bars was placed in an oven and heated to 250°C. Pull-out tests were performed at 250°C after 3 days of maintaining said temperature.

The average failure load is determined by centrally pulling out the rebar with tight support using high-strength steel rods using a hydraulic tool. Three reinforcement bars are doweled in place in each case and their load values are determined after curing for 3 days at 250 ℃ as mean value. Ultimate failure loads are calculated as bond strengths and given in N/mm^2 in Table 3.

Table 3: Bond strengths in N/mm^2.

	Comparative example 1	**Comparative example 2a**	**Comparative example 2b**	**Inventive example 3 (mixture of component A and B)**
250 ℃ in service temperature	10.2	5.9	1.9	13.7

As it can be seen from Table 3, the inventive system shows considerable bond strengths after 3 days at 250 ℃. Further, all three prior art one-component systems show a reduced bond strength at 250 ℃ of about 2-4 N/mm^2 when compared to the bond strength achieved after 24 h at ambient temperature. The inventive system exhibits an increased bond strength at 250 ℃ of 2 N/mm^2 when compared to the bond strength achieved after 24 h at ambient temperature indicating a desired post-cure effect instead of weakening the binder matrix by the elevated temperature. Furthermore, this variant has been tested for fire performance according to EAD (EAD # 330087-00-0601, European Assessment Document von EOTA, 2015) in a temperature range of from 23 ℃ to 450 ℃ (bond strength value of 14.5 N/mm^2).

Further, in comparison to injection mortars based on organic resins, their bond strength at elevated temperatures show significant, non-acceptable decrease in load values, at 250 ℃ sometimes close to zero in the organic systems, whereas the inventive examples increase in their bond strengths. As it has been shown above, the fire-resistant two-component mortar system of the present invention provides mechanical strength comparable to those of the organic systems, but the essentially mineral composition thereof makes it far less toxic and very little polluting for the environment as well as allows for a more cost-effective production than of the known system of the prior art.

Further, it has been shown, that the fire-resistant multiple-component system, in particular a fire-resistant two-component mortar system, overcomes the disadvantages of the prior art systems. In particular, the fire-resistant two-component mortar system that is ready-for-use, is handled easily and is eco-friendly, can be stably stored for a certain period of time prior to use, exhibits a good balance between setting and hardening and still has an excellent mechanical performance when it comes to a fire-resistant chemical fastening of anchors and post-installed reinforcing bars, even under the influence of elevated temperatures, such as fire. Moreover, fire-resistant multiple-component anchoring system has load values that increase at higher temperatures such as 250℃ to guarantee a sufficient anchoring at elevated temperatures which is necessary when fastening anchors and post-installed reinforcing bars.

CLAIMS

1. Fire-resistant two-component mortar system comprising a curable aqueous-phase aluminous cement component A and an initiator component B in aqueous-phase for initiating the curing process, component A further comprising at least one blocking agent selected from the group consisting of phosphoric acid, metaphosphoric acid, phosphorous acid and phosphonic acids, at least one plasticizer and water, and component B comprising an initiator, at least one retarder, at least one mineral filler and water,

   characterized in that

   i) the initiator comprises a mixture of alkali and/or alkaline earth metal salts,

   ii) the at least one retarder is selected from the group consisting of citric acid, tartaric acid, lactic acid, salicylic acid, gluconic acid and mixtures thereof, and

   iii) the at least one mineral filler is selected from the group consisting of limestone fillers, sand, corundum, dolomite, alkaline-resistant glass, crushed stones, gravels, pebbles and mixtures thereof;

   for a fire-resistant chemical fastening of anchors and post-installed reinforcing bars.

2. Fire-resistant two-component mortar system according to claim 1, **characterized in that**

   the initiator comprises a mixture of lithium metal salts.

3. Fire-resistant two-component mortar system according to claim 1 or 2, **characterized in that** the at least one retarder is citric acid, tartaric acid or a mixture thereof.

4. Fire-resistant two-component mortar system according to anyone of the preceding claims, **characterized in that**

   least one mineral filler has an average particle size of not more than 500 µm.

5. Fire-resistant two-component mortar system according to anyone of the preceding claims, **characterized in that**

   the at least one mineral filler is a limestone filler or a mixture of limestone fillers.

6. Fire-resistant two-component mortar system according to anyone of the preceding claims, **characterized in that** the water to aluminous cement ratio (W/CAC) or water to calcium sulfoaluminate cement (W/CAS), in the product obtained by mixing components A and B is lower than 1.5.

7. Fire-resistant two-component mortar system according to anyone of the preceding claims, **characterized in that** component A and component B are in form of a slurry or paste.

8. Fire-resistant two-component mortar system according to anyone of the preceding claims, **characterized in that** the pH-value of component B is above 10.

9. Fire-resistant two-component mortar system according to anyone of the preceding claims, **characterized in that** component B comprises
0.1 wt.-% to 4 wt.-% of lithium hydroxide,
0.1 wt.-% to 5 wt.-% of lithium sulfate or lithium sulfate monohydrate,
0.05 wt.-% to 5 wt.-% of citric acid,
0.05 wt.-% to 4 wt.-% of tartaric acid,
35 wt.-% to 45 wt.-% of a first mineral filler,
15 wt.-% to 25 wt.-% of a second mineral filler,
10 wt.-% to 20 wt.-% of a third mineral filler,
0.01 wt.-% to 0.5 wt.-% of a thickening agent, and
15 wt.-% to 25 wt.-% of water.

10. Fire-resistant two-component mortar system according to claim 9, **characterized in that** the first mineral filler, the second mineral filler and the third mineral filler are three different calcium carbonate fines.

11. Method for a fire-resistant chemical fastening of anchors and post-installed reinforcement bars comprising applying the fire-resistant two-component mortar

system according to any one of the preceding claims into a recess in a mineral surface followed by insertion of the anchor or post-installed reinforcement bar.

12. Method according to claim 11, wherein the recess is a borehole.

13. Use of the fire-resistant two-component mortar system according to anyone of the preceding claims for a fire-resistant chemical fastening of anchors and post-installed reinforcement bars in mineral surfaces.

14. Use according to claim 13, wherein the reinforcement bars are steel reinforcement bars.

15. Use according to claim 13 or 14, wherein the mineral surfaces are structures made of brickwork, concrete, pervious concrete or natural stone.