

DRY MORTAR COMPOSITION, IN PARTICULAR MORTAR-GLUE FOR TILING ADHESIVE

[0001] The invention relates to the field of mortars based on hydraulic binder
5 and on aggregates. "Hydraulic binder" is intended to mean, where appropriate,
collectively, a mixture of several hydraulic binders.

[0002] These mortars are in the form of a dry composition, ready to mix with
water. Dry mortar composition (or dry mortar) is intended to mean a pulverulent
10 mixture wherein the hydraulic binder, the aggregates and optional additives
are in the form of powder and grains. After mixing with water, in what is referred
to as the mixing step, a paste or wet mortar is obtained, which can be
deposited on a substrate.

15 [0003] The invention relates more particularly to mortar-glues for tiling
adhesives. In this case, the wet mortar is deposited on a substrate in order to
provide attachment of the tiling to said substrate.

[0004] Mortar-glues for tiling adhesives must meet a certain number of
20 requirements relating both to ease of use during the laying of the tiling and to
the properties of the hardened mortar after laying. Standard EN 12004
requires, for example, a pull-off adhesion of at least 0.5 N/mm² (class C1
mortar-glue) or even of at least 1 N/mm² (class C2 mortar-glue), even after
submersion in water, the action of heat or else the action of freezing and
25 thawing. The open time, which is the maximum time between coating the
substrate with glue and laying the tiles while retaining adhesion of at least 0.5
N/mm², must be at least 20 minutes, preferably at least 30 minutes for a
mortar-glue with extended open time, denoted "E". The transverse
deformation, according to standard EN 12004, is preferably at least 2.5 mm
30 (deformability S1) or even at least 5 mm (deformability S2). The setting and
cure time, the practicability of implementation, the consistency of the wet

mortar, the effort required for the application, are also parameters to be taken into account.

5 [0005] An adhesive composition based on perlite and optionally on cement, the apparent density of which is 500 kg/m^3 , is known from documents US 2017/0297959 and EP2 910 535.

10 [0006] The aim of the invention is to propose a dry mortar-glue composition that meets the most demanding of the various abovementioned criteria, and more particularly preferably at least of class C2E S1, while providing as low consumption as possible. Consumption is intended to mean the mass of dry composition required to satisfactorily attach 1 m^2 of tiling to a support, while meeting the various criteria mentioned above. Another aim of the invention is to propose a mortar-glue having a pleasant texture for the applicators and
15 requiring little effort during laying.

[0007] More generally, another aim of the invention is to propose a dry mortar composition providing low consumption and pleasant application.

20 [0008] These various aims are achieved by a dry mortar composition, in particular mortar-glue for tiling adhesive, comprising a hydraulic binder and aggregates, said hydraulic binder comprising ground granulated blast furnace slag and a cement selected from Portland cements, aluminous cements and sulfo-aluminous cements, said composition having an apparent density of
25 between 0.40 and 0.69 kg.dm^{-3} . The apparent density (sometimes also referred to as bulk density) is measured according to standard EN 459-2 :2012. Typically, in the present text, any reference to a density must be understood as relating to an apparent density or bulk density. Further, the apparent density is that of the dry mortar composition, therefore of the pulverulent mixture, and
30 not the density of the cured mortar, after mixing and curing.

[0009] Another subject of the invention is a method for attaching a tiling to a substrate, comprising, successively, mixing the dry mortar-glue composition for tiling adhesive according to the invention with water so as to obtain a wet mortar, applying the wet mortar to the substrate, and applying tiles of said tiling to said substrate.

[0010] The composition according to the invention is preferably a dry mortar-glue composition for tiling adhesive.

[0011] The composition according to the invention may also be a masonry mortar composition, a mortar composition for facade rendering, a bonding mortar composition for external insulation systems, or an undercoat mortar composition for external insulation systems.

[0012] External thermal insulation systems are also referred to as ETICS (*External Thermal Insulation Composite System*). They conventionally comprise, starting from the facade to be insulated externally, an insulating panel (for example of mineral wool or expanded polystyrene) bonded using a mortar-glue or mechanically attached to the facade, then an undercoat (also referred to as base coat) incorporating a reinforcing lattice (for example a mesh of glass fibers), then a facade rendering (or decorative rendering).

[0013] The inventors were able to demonstrate that a dry composition of very low density made it possible to drastically reduce consumption while retaining the properties required for application as tiling adhesive. By way of example, it is possible, with a composition according to the invention, to cover 1 m² of support with 1.9 kg of dry composition as opposed to 3.4 kg for a standard mortar-glue.

[0014] The compositions further make it possible to produce, after mixing, a wet mortar which is particularly pleasant and easy to lay for the applier,

requiring little effort, particularly due to its smooth, creamy and slightly foamy texture.

5 [0015] Unless specified otherwise, the contents indicated in the present text are contents by weight, relative to the amount of dry composition.

[0016] The apparent density of the dry composition is preferably at least 0.45 kg.dm⁻³, in particular at least 0.47 kg.dm⁻³, or even at least 0.50 kg.dm⁻³. It is advantageously at most 0.65 kg.dm⁻³, or even at most 0.62 kg.dm⁻³, and even
10 at most 0.60 kg.dm⁻³.

[0017] Preferably, the hydraulic binder consists of ground granulated blast furnace slag and a cement selected from Portland cements, aluminous cements and sulfo-aluminous cements.

15 [0018] The cement is preferably Portland cement. The hydraulic binder thus comprises Portland cement and ground granulated blast furnace slag. The hydraulic binder even advantageously consists of Portland cement and ground granulated blast furnace slag.

20 [0019] The total content by weight of hydraulic binder, particularly when the hydraulic binder is a preferred binder defined above, is preferably at least 45%, preferably at least 50%, or even at least 55%. It is normally at most 90%, or even at most 85%, and even at most 80% or at most 70%.

25 [0020] Advantageously, particularly when the hydraulic binder consists of Portland cement and ground granulated blast furnace slag, the dry composition comprises 25 to 60%, in particular 30 to 50% by weight of Portland cement and 15 to 50%, in particular 18 to 40% by weight of ground granulated
30 blast furnace slag.

[0021] The presence of ground granulated blast furnace slag makes it possible to improve the texture and smoothness of the wet mortar, and to reduce the effort required by the applier. It also makes it possible to improve the pull-off adhesion after submersion in water and after freezing/thawing, as well as the open time and the transverse deformation.

[0022] The hydraulic binder may also contain metakaolin in order to improve the pull-off adhesion after submersion in water and after freezing/thawing.

[0023] The dry composition preferably comprises a hydraulic binder and lightweight aggregates. For the purposes of the present invention, lightweight aggregate is intended to mean an aggregate having an apparent density of at most 600 kg/m³. The apparent density of the lightweight aggregates is determined in accordance with standard EN 1097-3 :1998.

[0024] The dry composition preferably comprises at most 10%, in particular at most 8%, or even at most 5%, or at most 2% by weight of "heavyweight" aggregates, that is having an apparent density of greater than 600 kg/m³, such as siliceous sand or limestone fillers. According to one embodiment, the dry composition may even be devoid of such aggregates. Alternatively, the dry composition may comprise from 2 to 8% by weight of heavyweight aggregates, in particular of siliceous sand. Such an amount, which does not excessively affect the apparent density of the dry composition, makes it possible to improve internal cohesion and thus adhesion, as well as the ease of laying.

[0025] The composition preferably comprises at least 9% and even at least 12% or at least 15% by weight of lightweight aggregates. This content is preferably at most 40%, in particular at most 30%, or even at most 25%

[0026] The maximum size of the lightweight aggregates is preferably at most 0.400 mm, in particular at most 0.315 mm. The maximum size is determined

by screening. It is defined as being the smallest screen dimension through which all the material passes.

[0027] Highly advantageously, the lightweight aggregates comprise, or even
5 consist of, a mixture of hydrophobic expanded perlite, thermosetting polymer powder and hollow silicate particles. Such a combination of aggregates makes it possible to achieve low dry mortar densities, while giving the wet mortar a smooth and soft texture, guaranteeing an effortless application. The performance obtained by the combination of these lightweight aggregates is
10 better than that obtained using only one of these aggregates.

[0028] Expanded perlite is a siliceous sand of volcanic origin, expanded by heat treatment. The perlite must be hydrophobic, since standard perlite absorbs too much water. The hydrophobic nature is obtained, in a known way,
15 by applying a coating to the surface of the particles. The apparent density of the hydrophobic expanded perlite is preferably at most 150 kg/m³, in particular at most 100 kg/m³. The content by weight of hydrophobic expanded perlite in the dry composition is preferably between 3 and 10%, in particular from 3 to 7%.

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[0029] The hollow silicate particles are in particular selected from expanded glass beads and cenospheres. Cenospheres are hollow particles of aluminosilicate produced during the combustion of coal in thermal power plants. The apparent density of the cenospheres is preferably at most 400
25 kg/m³, in particular at most 350 kg/m³. The maximum size thereof is preferably at most 0.315 mm. The apparent density of the expanded glass beads is preferably at most 500 kg/m³. The maximum size thereof is preferably at most 0.100 mm. The content by weight of hollow particles of silicate in the dry composition is preferably between 2 and 20%, in particular between 3 and
30 15%.

[0030] The thermosetting polymer powder is preferably present at a content by weight ranging from 2 to 20%, in particular from 3 to 15%, or even from 4 to 9%. The maximum size thereof is preferably at most 0.200 mm, in particular at most 0.150 mm. The D50 (based on a distribution by weight) is preferably at most 0.100 mm. The apparent density of the thermosetting polymer is preferably at most 500 kg/m³. The thermosetting polymer powder is preferably a micronized rubber powder, comprising in particular a vulcanized elastomer. It is preferably obtained by grinding used tires. The presence of thermosetting polymer powder in the preferred contents and sizes makes it possible to considerably improve the texture of the wet mortar and to reduce the application effort. Since the thermosetting polymer powder is part of the lightweight aggregates, it is not a water-redispersible powder. Indeed, a redispersible powder is not an aggregate, since it disintegrates in the mixing water. The optional and preferred presence of redispersible powder is described below in the text.

[0031] The dry composition preferably comprises at least one additive selected from wetting agents (in particular at a content of between 0.05 and 0.2%; for example chemically modified alkyl sulfonates), redispersible polymer powders (in particular at a content of between 0.5 and 20%, preferentially between 2 and 10%, and even between 3 and 8%), curing accelerators (in particular at a content of between 0.1 and 1%, for example calcium formate), thickeners such as cellulose ethers and starch ethers (in particular at a content of between 0.2 and 0.7%).

[0032] Redispersible polymer powders are powders which make it possible to obtain a polymeric dispersion after addition of water. The polymer is preferably based on one or more monomers selected from vinyl esters (in particular vinyl esters of C1-C15 carboxylic acids), (meth)acrylates (in particular of C1-C10 alcohols), vinyl aromatics, alkenes (for example ethylene), dienes and vinyl halides. It has been observed that the dry composition according to the invention made it possible to obtain a high transverse deformation for lower

contents of redispersible polymer powders than are used conventionally. A content of redispersible polymer powder of between 2 and 5% makes it possible in particular to achieve a transverse deformation of at least 2.5 mm, and a content of between 5 and 10% makes it possible to achieve a transverse deformation of at least 5 mm.

[0033] The various preferred features presented above can of course be combined in any possible combination, the different combinations not being listed for the sake of brevity.

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[0034] A particularly preferred combination is a dry mortar-glue composition for tiling adhesive comprising a hydraulic binder consisting of Portland cement (preferably 25 to 60%) and ground granulated blast furnace slag (preferably 15 to 50%), at most 10% by weight of heavyweight aggregates (optionally 2 to 8%), lightweight aggregates consisting of a mixture of hydrophobic expanded perlite (preferably 3 to 10%), micronized rubber powder (2.5 to 10%) and cenospheres or expanded glass beads (3 to 10%), and a redispersible polymer powder (0.5 to 20%). The contents indicated are contents by weight relative to the weight of dry composition.

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[0035] The weight ratio of water to dry composition, also referred to as “mixing ratio”, is preferably between 0.45 and 0.55. Such a ratio makes it possible to obtain a particularly pleasant texture.

25 [0036] The substrate is typically a wall or a partition, or a floor, for example a screed.

[0037] The tiles or tiling slabs may be made of various materials, such as ceramics, sandstone, cement, stone, marble, etc. The wet mortar may for example be applied to the substrate and optionally to the tiles or slabs by means of a glue comb, float, trowel or notched spatula.

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[0038] The following examples illustrate the invention in a non-limiting manner.

[0039] Different compositions of mortar-glue for tiling adhesive were formulated then tested.

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[0040] Tables 1 and 2 present the compositions studied, the content of each component being expressed as percentage by weight relative to the amount of dry composition.

10 [0041] Mortar-glues C1 to C6 are comparative examples of standard mortar-glues (C1, C2), light mortar-glues (C3 to C5) or mortar-glues devoid of blast furnace slag (C6). Mortar-glues 1 to 5 are mortar-glues according to the invention.

15 [Table 1]

	C1	C2	C3	C4	C5
Portland cement	30	30	50	50	40
Slag	0	0	0	0	10
Silica sand	58.85	13.85	28.4	18.9	23.4
Limestone filler	5	50	5	15	5
Hydrophobic perlite	0	0	0	5	0
Expanded glass	0	0	10	0	0
Cenospheres	0	0	0	4.5	15
Redispersible powder	5	5	5	5	5
Cellulose ether	0.3	0.3	0.45	0.45	0.45
Bentonite	0.3	0.3	0.3	0.3	0.3
Starch ether	0.05	0.05	0.05	0.05	0.05
Accelerator	0.5	0.5	0.8	0.8	0.8

[Table 2]

	1	2	3	4	5	C6
Portland cement	42	42	42	42	42	60
Slag	21	26	26	21	21	0
Metakaolin	5	0	0	5	5	5
Silica sand	4.77	7.27	2.27	4.77	4.77	7.77
Hydrophobic perlite	5	5	5	5	5	5
Rubber powder 1	7.5	7.5	7.5	0	7.5	7.5
Rubber powder 2	0	0	0	7.5	0	0
Expanded glass	0	7.5	7.5	0	7.5	0
Cenospheres	7.5	0	0	7.5	0	7.5
Redispersible powder	5	2.5	7.5	5	5	5
Cellulose ether	0.45	0.45	0.45	0.45	0.45	0.45
Bentonite	0.5	0.5	0.5	0.5	0.5	0.5
Starch ether	0.18	0.18	0.18	0.18	0.18	0.18
Accelerator	1	1	1	1	1	1
Wetting agent	0.1	0.1	0.1	0.1	0.1	0.1

[0042] The slag is a blast furnace slag having a Blaine fineness of 7500. The silica sand has a maximum size of 0.6 mm and the limestone filler has a maximum size of 0.25 mm. The hydrophobic perlite has a maximum size of 0.04 mm and an apparent density of less than 100 kg/m³. Rubber powder 1 has a maximum size of 0.150 mm and an apparent density of less than 500 kg/m³. Rubber powder 2 has a maximum size of 0.500 mm and an apparent density of less than 450 kg/m³. The expanded glass powder has a maximum size of 0.100 mm and an apparent density of less than 500 kg/m³. The cenospheres have a maximum size of 0.315 mm and an apparent density of less than 350 kg/m³. The accelerator is calcium formate.

[0043] Tables 3 and 4 present the properties described below for each of the examples.

[0044] The apparent density of the dry composition in the pulverulent state was measured in accordance with standard EN 459-2 :2012.

5 [0045] The pull-off adhesion (initial, after submersion in water, after heat action and after freezing/thawing action), the open time and the transverse deformation were measured in accordance with standard EN 12004-2 :2017.

[0046] The tables also present a qualitative measurement of the assessment of smoothness of the wet mortar and the effort employed when laying the tiling.
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[0047] Finally, the tables indicate the consumption, expressed as weight of dry composition required to bond 1 m² of tiling.

[0048] The latter assessments and measurements were performed by panels
15 of 5 to 10 people. The grades given are an average of the grades, ranging from 0 to 10, attributed by each member of the panel and relating to the smoothness (velvetiness, creaminess) of the wet mortar and the lack of effort during use thereof, the latter criterion taking into account both the effort to remove the wet mortar from the bucket and the effort to apply it to the substrate using a notched
20 trowel. Consumption is also a mean of the consumption measured by the members of the panel. The mixing ratios were 0.5 for the examples according to the invention.

[Table 3]

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	C1	C2	C3	C4	C5
Apparent density (kg/dm ³)	1.42	1.35	1.01	0.82	0.85
<i>Adhesion (MPa)</i>					
Initial	1.4	1.3	1.5	1.4	1.4
After submersion in water	1.0	1.0	1.0	1.0	1.1
After freezing/thawing	1.2	1.0	1.1	1.1	1.1

After heat action	1.5	1.1	1.4	1.2	1.3
<i>Open time (MPa)</i>					
20 minutes	1.2	0.9	1.5	1.1	0.9
30 minutes	0.8	0.5	1.0	0.7	0.7
Transverse deformation (mm)	2.5	2.5	2.6	2.5	2.5
Force (N)	6.5	6.0	5.8	5.1	4.8
Smoothness (/10)	5.2	6.8	7.2	7.2	6.7
Lack of effort (/10)	4.5	6.5	7.5	7.5	7.2
Consumption (kg/m ²)	3.4	3.4	2.9	2.7	2.7

[Table 4]

	1	2	3	4	5	C6
Apparent density (kg/dm ³)	0.60	0.64	0.56	0.59	0.62	0.56
<i>Adhesion (MPa)</i>						
Initial	1.3	1.1	1.8		1.5	1.5
After submersion in water	1.2	1.2	1.5		1.0	0.9
After freezing/thawing	1.4	1.1	1.6		1.2	1.2
After heat action	1.4	1.0	1.9		1.4	1.4
<i>Open time (MPa)</i>						
20 minutes	1.3	1.1	1.6		1.2	1.0
30 minutes	0.9	1.0	1.3		0.8	0.6
Transverse deformation (mm)	3.2	2.6	5.0		2.9	2.7
Force (N)	4.0	6.0	3.0		4.5	5.2
Smoothness (/10)	8.5	8.5	8.5	6.5	8.5	8.0
Lack of effort (/10)	8.8	8.8	8.8	8.8	8.8	8.0
Consumption (kg/m ²)	1.8	1.9	1.8	1.8	1.8	1.8

- 5 [0049] The examples according to the invention show that the consumption of mortar-glue is very significantly reduced for use properties (pull-off adhesion, open time, transverse deformation) which are at least as good as in the case

of the comparative mortar-glues. The mortar-glues are further improved in terms of texture and effort required for laying.

5 [0050] Comparison of examples 1 and 4 shows the impact of the particle size of the rubber powder on the soft and smooth nature of the wet mortar-glue, with a finer powder being preferred.

10 [0051] Comparison of examples 1 and C6 shows that the addition of blast furnace slag makes it possible to improve the pull-off adhesion after submersion in water and after freezing/thawing, the open time, the transverse deformation and the ease of laying. The presence of blast furnace slag makes it possible to improve the smoothness of the mortar-glue and to reduce the effort required.

15 [0052] Using a dedicated measurement instrument, the force of application of the mortar-glues C1 and 1 was compared. It is 5.2 kg for example C1 versus only 4.2 kg for example 1, that is a reduction of approximately 20%.

Claims

1. A dry mortar composition, in particular mortar-glue for tiling adhesive, comprising a hydraulic binder and aggregates, said hydraulic binder
5 comprising ground granulated blast furnace slag and a cement selected from Portland cements, aluminous cements and sulfo-aluminous cements, said composition having an apparent density of between 0.40 and 0.69 kg.dm⁻³.
2. The composition according to claim 1, the apparent density of which is
10 at least 0.45 kg.dm⁻³.
3. The composition according to one of the preceding claims, wherein the total content by weight of hydraulic binder is at least 45%, preferably at least 50%, and at most 70%.
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4. The composition according to one of the preceding claims, comprising 25 to 50% by weight of Portland cement and 20 to 50% by weight of ground granulated blast furnace slag.
- 20 5. The composition according to one of the preceding claims, comprising at least 9%, in particular at least 12%, and at most 40% by weight of lightweight aggregates, the apparent density of which is at most 600 kg/m³.
6. The composition according to the preceding claim, wherein the
25 maximum size of the lightweight aggregates is at most 0.400 mm, in particular at most 0.315 mm.
7. The composition according to the preceding claim, wherein the lightweight aggregates comprise a mixture of hydrophobic expanded perlite,
30 thermosetting polymer powder and hollow silicate particles.

8. The composition according to the preceding claim, wherein the hollow silicate particles are selected from the expanded glass beads and the cenospheres.
- 5 9. The composition according to one of claims 7 or 8, wherein the thermosetting polymer powder is present at a content by weight ranging from 2 to 20%, and the maximum size thereof is at most 0.150 mm.
- 10 10. The composition according to one of the preceding claims, comprising from 2 to 8% by weight of heavyweight aggregates, the apparent density of which is greater than 600 kg/m³.
- 15 11. The composition according to one of the preceding claims, further comprising a redispersible polymer powder at a content by weight of between 0.5 and 20%.
- 20 12. The composition according to one of the preceding claims, which is a masonry mortar composition, a mortar composition for facade rendering, a bonding mortar composition for external insulation systems, or an undercoat mortar composition for an external insulation system.
13. The composition according to one of claims 1 to 11, which is a dry mortar-glue composition for tiling adhesive.
- 25 14. A method for attaching a tiling to a substrate, comprising, successively, mixing the dry composition according to the preceding claim with water so as to obtain a wet mortar, applying the wet mortar to said substrate, and applying the tiles of said tiling to said substrate.
- 30 15. The method according to the preceding claim, such that the weight ratio of water to dry composition is between 0.45 and 0.55.