

Stabilizers for improving the storage stability of building material dry formulations containing polymer powder

The invention relates to the use of stabilizers for improving the storage stability of building material dry formulations containing polymer powder, to building material dry formulations containing stabilizers and to polymer compositions containing stabilizers and also to the use thereof, for example in adhesives or coating compositions, in particular tile adhesives, levelling compositions, screeds or reinforcing compositions for thermal insulation composite systems.

Building material dry formulations usually contain hydraulic binders such as cement or hydraulic lime and also fillers, polymers in the form of water-redispersible powders and optionally further additives. Before application, the building material dry formulations are mixed with water. The expression polymers in the form of water-redispersible powders refers to powder compositions which are obtainable by drying of the corresponding aqueous polymer dispersions in the presence of protective colloids. Owing to this production process, the finely divided polymer resin of the dispersion is enveloped in a sufficient amount of a water-soluble protective colloid. During drying, the protective colloid acts as a jacket which prevents the particles from sticking together. On redispersion of the polymer powders in water, the protective colloid dissolves in water again and an aqueous dispersion of the original polymer particles is obtained (Schulze J. in TIZ, No. 9, 1985).

However, providing building material dry formulations which contain polymer powder and are sufficiently storage-stable under, in particular, humid, hot or hot-humid conditions, e.g. tropical conditions, and redispersing the polymers very completely after addition of water and thus setting them free presents a problem. This problem occurs particularly when the hydraulic binders of the building material dry formulations

containing polymer powder comprise considerable proportions of cement or hydraulic lime. When no or only small proportions of cement or hydraulic lime are used as hydraulic binders, this problem does not occur or does not occur to a relevant extent, so that such building material dry formulations can give no hint for improving the storage stability of building material dry formulations according to the invention. During storage, such building material dry formulations should not take for a very long time and their powder flow should not suffer any impairment. Incompletely redispersed polymers give fresh mortars or cured building products which do not have the required use properties, for example levelling, stickiness, malleability or air pore content of the fresh mortars or impact strength, cohesion or adhesion of the cured building products. The problems mentioned also occur in temperate climatic zones in which humid and/or hot-humid conditions can sometimes also prevail with the change of seasons.

Such problems are particularly pronounced in the customary storage and transportation of building material dry formulations in perforated sacks. Perforations are holes produced in sacks and have, for example, diameters in the millimeter range. Perforations simplify the dispensing of building material dry formulations into sacks. During the dispensing operation, the building material dry formulations are usually mixed with air in order to convert them into a fluid state and thus be able to dispense them easily into sacks. The air escapes from the sacks through the perforations. However, the building material dry formulations are also brought into contact with the ambient air and subjected to a corresponding mass transfer during storage or during transport as a result of the perforations, which is, particularly at a high atmospheric humidity at warm temperatures, fatal to the property profile of the building material dry formulations containing polymer powder.

To solve such problems, the addition of organic additives to cement-containing dry mortars is frequently taught in the

prior art. For example, WO-A 2012/019908 recommends polymer powder compositions containing fatty acid (derivatives) or organosilicon compounds for this purpose. GB 826,316 proposes adding additives such as pentachlorophenol/chlorocresolic acid mixtures or mixtures with oleic acid to the cement. GB 841,304 proposes the addition of lubricating oil and/or wax and oleic acid to the cement. Adding long-chain amines to the cement in order to improve the storage stability is known from GB 1,188,713. In the process of GB 1,012,182, Portland cement is milled with an additive, in particular from the group of the fatty acids. In US 7,074,269 B2, adipic acid or a mixture containing adipic acid is added in order to improve the storage stability of cement. EP 1260490 A1 recommends the addition of antioxidants in order to improve the storage stability of dry mortar formulations. The approaches known hitherto for improving the storage stability of dry mortars containing cement or hydraulic lime frequently have the disadvantage that comilling of the additives with the hydraulic binder is frequently necessary. A further disadvantage is that modification of dry mortars with corresponding additives changes the property profile of fresh mortars and cured building products produced therefrom.

CN 203143402 recommends silos which are equipped with an anticondensation device for the storage of cement in order to prevent the deposition of cement on the silo walls. The anticondensation device contains silica gel. CA 1132784 describes quick-setting dry mixtures based on cement, lime, alabaster and optionally silica gel. WO 2015/062749 teaches gypsum-based binding compositions which contain cement and zeolite as additive and recommends the use of these in building chemical products which can optionally contain water-redispersible polymer powders in addition to fillers. EP 1381643 recommends polymer powder compositions which can contain a variety of inorganic fillers.

CN 1792975 is concerned with aqueous coating compositions containing inorganic binders, copolymers, polyvinyl alcohol

and also silica and can thus not make any contribution to improving the storage of building material dry formulations. CN 102249604, too, describes aqueous coating compositions based on polymer dispersions, silica sol and fillers.

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In the light of this background, it was an object of the invention to provide measures for improving the storage stability of building material dry formulations which contain water-redispersible polymer powders and a considerable proportion of cement and hydraulic lime as hydraulic binders. In particular, the storage stability of the building material dry formulations under humid or hot, preferably humid and hot, conditions, e.g. tropical conditions, should be improved. For example, such building material dry formulations should preferably not take during storage over a prolonged period of time and their powder flow should not suffer any impairment. If possible, the building material dry formulations should retain their use properties during storage and after storage give, for example, fresh mortars or cured building products which have the desired property profile in respect of levelling, stickiness, malleability, air pore content or impact strength, cohesion or adhesion. This set of objectives is particularly relevant for building material dry formulations containing polymer powder which are stored in perforated sacks.

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The object has surprisingly been able to be achieved by use of silica gel or zeolites as stabilizer. In a preferred embodiment, the stabilizers are constituents of the building material dry formulations. In an alternative embodiment, the stabilizers and the building material dry formulations are spatially separated from one another but are in contact with one another via air exchange.

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Conventional additives as are customarily used as anticaking agents for water-redispersible polymer powders, e.g. carbonates or silicates customary for this purpose, have been found to be unsatisfactory for achieving the object. Polymer

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powders containing anticaking agents such as silicas or aluminum silicates are described, for example, in DE-A 2214410 or GB 929704. DE-A 3101413 recommends hydrophobic silicas for the analogous purpose.

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The invention provides for the use of one or more stabilizers for improving the storage stability of building material dry formulations, which comprise

one or more hydraulic binders,

10 one or more polymers in the form of water-redispersible powders,

optionally one or more fillers and optionally one or more additives, characterized in that

15 one or more stabilizers are selected from the group consisting of silica gel and zeolites,

where the stabilizers

a) are constituents of the building material dry formulations; or

20 b) are spatially separated from the building material dry formulations but are in contact with the building material dry formulations via air exchange, and

at least 40% by weight of the hydraulic binders is cement and/or hydraulic lime, based on the total weight of the hydraulic binders.

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The building material dry formulations are preferably stored in the manner according to the invention for more than one day, more preferably for more than one week, even more preferably for more than one month, particularly preferably

30 for more than six months and most preferably for more than twelve months. The temperatures during storage can, for example, be in the range from -50°C to 60°C, preferably from

15°C to 50°C, particularly preferably from 25°C to 45°C and most preferably from 30 to 40°C. The relative atmospheric

35 humidities are, for example, from 20 to 100%, preferably from 50 to 95%, more preferably from 60 to 90%, particularly preferably from 70 to 90% and most preferably from 80 to 90%.

The storage of the building material dry formulations according to alternative a) or b) can be carried out in air-permeable containers. The air-permeable containers are based, for example, on cellulosic materials such as paper or paperboard, or plastics such as polystyrene, in particular polyethylene or polypropylene. As an alternative, plastic-coated cellulosic materials or cellulosic materials laminated with one or more plastic films, for example, are also suitable. The air-permeable containers can, for example, consist entirely or at least in part of porous materials. Porous materials are air-permeable. As an alternative, the air-permeable containers can also be perforated, i.e. be provided with holes. A perforation is a hole through the container. A perforation has a diameter of preferably ≤ 2 mm, particularly preferably ≤ 1 mm and most preferably ≤ 0.5 mm. A perforation is preferably ≥ 0.1 mm and more preferably ≥ 0.5 mm. The perforations can be introduced in any form, i.e. in disordered or ordered form, for example can form one or more lines or a lozenge or grid pattern or else have been applied in an irregular manner.

Air exchange or air permeability here also encompasses exchange or permeability of/for water vapor or gaseous water. The air exchange is generally made possible by the building material dry formulations and the stabilizers being exposed to the same air medium.

In the spatially separate use according to alternative b), the building material dry formulations and the stabilizers can each be present in a separate air-permeable container, in particular packaging, for example a sack, a bag or a pouch. In an alternative embodiment, an air-permeable container contains at least two air-permeable chambers, with at least one air-permeable chamber containing a building material dry formulation but no stabilizer and at least one air-permeable chamber containing stabilizers but no building material dry formulation. Finally, one of the two abovementioned components can, as an alternative, be present in an air-permeable

container which is in direct or indirect contact with the other component. In the case of direct contact, the air-permeable container and the other component touch one another. In the case of indirect contact, the air-permeable container and the other component are present in the same space without touching one another. The spatially separated building material dry formulations and the stabilizers can, for example, be present within a container, for example a shipping container, or a building, for example a warehouse.

The spatially separated use according to alternative b) has the advantage that the building material dry formulations and the stabilizers can be easily separated after storage and the stabilizers can be reused for the storage of building material dry formulations or for other purposes. The stabilizers can thus be recycled. The stabilizers are preferably regenerated, for example by heating, preferably to a temperature in the range from 50 to 500°C, particularly preferably from 60 to 350°C and most preferably from 70 to 200°C, before further use.

The use according to the invention of the stabilizers according to alternative a), where the stabilizers are present in the building material dry formulations, is preferred.

The invention further provides building material dry formulations comprising one or more hydraulic binders, one or more polymers in the form of water-redispersible powders, optionally one or more fillers and optionally one or more additives, characterized in that one or more stabilizers selected from the group consisting of silica gel and zeolites are additionally present and at least 40% by weight of the hydraulic binders is cement and/or hydraulic lime, based on the total weight of the hydraulic binders.

The stabilizers are generally used in the form of powders. The stabilizers have particle sizes of preferably from 0.1 μm to 10 mm, more preferably from 1 μm to 5 mm, even more preferably from 10 μm to 3 mm, particularly preferably from 100 μm to 1 mm and most preferably from 200 to 500 μm (determined by means of transmission electron microscopy using the Libra 120 instrument from Zeiss).

The amount of stabilizers is preferably from 0.1 to 30% by weight, particularly preferably from 0.5 to 20% by weight and most preferably from 1 to 10% by weight, based on the total weight of the building material dry formulations.

Silica gel is preferred as stabilizer. Silica gel is, as is known, an amorphous silicon dioxide. Silica gel is generally water-insoluble or sediments in water.

At 40% relative atmospheric humidity and 23°C, silica gel has an adsorption capacity for water of preferably $\leq 30\%$ by weight and particularly preferably $\leq 25\%$ by weight, based on the dry weight of the silica gel. At 80% relative atmospheric humidity and 23°C, the silica gel has an adsorption capacity for water of preferably $\geq 26\%$ by weight, particularly preferably $\geq 30\%$ by weight and most preferably $\geq 32\%$ by weight, based on the dry weight of the silica gel. The figures indicated are preferably based on 1 atm or 1 bar, or generally on ambient pressure. The dry weight referred to here is the mass of the silica gel after drying to constant weight at 150°C. The determination of the adsorption capacity is carried out gravimetrically. The adsorption behavior of the silica gel is particularly advantageous for achieving the object of the invention, in particular when the building material dry formulations are exposed to changing climatic conditions.

The silica gel used has a residual water content of preferably $\leq 15\%$ by weight, particularly preferably $\leq 11\%$ by weight and

most preferably $\leq 6\%$ by weight, based on the total weight of the silica gel (determined at 150°C in an IR dryer).

The silica gel has a BET surface area of preferably from 300 to 500 m²/g and particularly preferably from 350 to 450 m²/g (determination in accordance with DIN 66131 (using nitrogen)).

The production of silica gel is generally known. Silica gel is generally produced by reaction of water glass, for example water-soluble alkali metal silicates, in particular potassium or sodium silicates, with acid, in particular mineral acids such as hydrochloric acid or sulfuric acid, and subsequent drying. Water glass is, as is known, obtainable by, for example, fusion of silica sand with alkali metal carbonates at from 1400°C to 1500°C and subsequent conversion into an aqueous solution. Both silica gel and water glass are commercially available.

Zeolites belong, as is known, to the class of aluminosilicates, in particular crystalline aluminosilicates. Zeolites are generally made up of units of AlO₄ tetrahedra and SiO₄ tetrahedra which are joined to one another by oxygen atoms. Zeolites are known to have secondary structures for which pores and/or channels are characteristic. Zeolites represent a very small selection from among the large class of aluminosilicates.

It is possible to use synthetically produced zeolites, modified zeolites or preferably natural zeolites. Examples of zeolites are fibrous zeolites (in particular natrolite, laumontite, mordenite, thomsonite), flaky zeolites (in particular heulandite, stilbite, phillipsite, harmotome, yugawaralite) and cubic zeolites (in particular faujasite, melinite, chabasite, offretite, levyne). Particular preference is given to flaky zeolites.

The zeolites have a pore width of preferably from 1 to 10 Å, particularly preferably from 2 to 8 Å and most preferably from 2 to 5 Å.

5 Suitable hydraulic binders are, for example, cements, in particular Portland cement, aluminous cement, trass cement, slag cement, magnesia cement, phosphate cement or blast furnace cement, and also mixed cements, filler cements, fly ash, hydraulic lime or even plaster of Paris. Preference is
10 given to cements such as Portland cement, aluminous cement, slag cement, mixed cements and filler cements, or hydraulic lime.

15 The hydraulic binders comprise cement and/or hydraulic lime in an amount of preferably $\geq 50\%$ by weight, particularly preferably $\geq 60\%$ by weight, even more preferably $\geq 70\%$ by weight and most preferably $\geq 90\%$ by weight, based on the total weight of the hydraulic binders. The greatest preference is
20 given to exclusively hydraulic lime, preferably cement, being present as hydraulic binders.

25 In general, the building material dry formulations contain from 1 to 70% by weight, preferably from 5 to 60% by weight, more preferably from 8 to 50% by weight, even more preferably from 10 to 40% by weight, particularly preferably from 10 to 30% by weight and most preferably from 10 to 20% by weight, of hydraulic binders, in each case based on the total weight of the building material dry formulations.

30 Furthermore, the building material dry formulations can contain one or more pozzolanas. Preferred pozzolanas are selected from the group consisting of kaolin, microsilica, diatomaceous earth, fly ash, ground trass, ground blast furnace slag, glass flour, precipitated silica and pyrogenic
35 silica. Particularly preferred pozzolanas are kaolin, microsilica, fly ash, ground blast furnace slag, in particular metakaolin. In the interest of clarity, it may be pointed out

that pozzolanas do not encompass any zeolites and in particular not any silica gel.

The building material dry formulations can, for example, contain from 0.1 to 20% by weight, preferably from 1 to 10% by weight and particularly preferably from 1 to 5% by weight, of pozzolanas, based on the total weight of the building material dry formulations.

Examples of suitable fillers are silica sand, quartz flour, calcium carbonate, dolomite, clay, chalk, white hydrated lime, talc or mica, or else lightweight fillers such as pumice, foamed glass, gas concrete, perlites, vermiculites, carbon nanotubes (CNT). It is also possible to use any mixtures of the fillers mentioned. Preference is given to silica sand, quartz flour, calcium carbonate, chalk or white hydrated lime. In the interest of clarity, it may be pointed out that fillers do not encompass any zeolites and in particular not any silica gel.

The building material dry formulations generally contain from 5 to 95% by weight, preferably from 30 to 90% by weight and particularly preferably from 40 to 85% by weight, of fillers, in each case based on the total weight of the building material dry formulations.

Further customary additives for the building material dry formulations are thickeners, for example polysaccharides such as cellulose ethers and modified cellulose ethers, starch ethers, guar gum, xanthan gum, sheet silicates, polycarboxylic acids such as polyacrylic acids and partial esters thereof, and also polyvinyl alcohols which can optionally be acetalized or hydrophobically modified, casein and associative thickeners. Customary additives also include retarders such as hydroxycarboxylic acids or dicarboxylic acids or salts thereof, saccharides, oxalic acid, succinic acid, tartaric acid, gluconic acid, citric acid, sucrose, glucose, fructose, sorbitol, pentaerythritol. Further customary additives are

setting accelerators, for example alkali metal or alkaline earth metal salts of inorganic or organic acids. Further additives which may be mentioned are: hydrophobicizing agents, preservatives, film formers, dispersants, foam stabilizers, antifoams and flame retardants (e.g. aluminum hydroxide). In the interest of clarity, it may be mentioned that additives do not encompass any zeolites and in particular not any silica gel.

Additives are present in the building material dry formulations in an amount of preferably from 0 to 20% by weight, particularly preferably from 0.1 to 10% by weight, based on the total weight of the building material dry formulations.

The building material dry formulations generally contain from 0.1 to 90% by weight, preferably from 0.5 to 60% by weight, more preferably from 1 to 50% by weight, even more preferably from 2 to 45% by weight, particularly preferably from 5 to 40.0% by weight and most preferably from 10 to 35% by weight, of polymers of ethylenically unsaturated monomers, in each case based on the total weight of the building material dry formulations.

Suitable polymers of ethylenically unsaturated monomers are, for example, those based on one or more monomers from the group consisting of vinyl esters, (meth)acrylic esters, vinylaromatics, olefins, 1,3-dienes and vinyl halides and optionally further monomers which are copolymerizable therewith. The polymers are preferably not crosslinked.

Suitable vinyl esters are those of carboxylic acids having from 1 to 15 carbon atoms. Preference is given to vinyl acetate, vinyl propionate, vinyl butyrate, vinyl 2-ethylhexanoate, vinyl laurate, 1-methylvinyl acetate, vinyl pivalate and vinyl esters of α -branched monocarboxylic acids having from 9 to 11 carbon atoms, for example VeoVa9^R or

Veova10^R (trade names of Resolution). Particular preference is given to vinyl acetate.

Suitable monomers from the group of acrylic esters or methacrylic esters are esters of unbranched or branched alcohols having from 1 to 15 carbon atoms. Preferred methacrylic esters or acrylic esters are methyl acrylate, methyl methacrylate, ethyl acrylate, ethyl methacrylate, propyl acrylate, propyl methacrylate, n-butyl acrylate, n-butyl methacrylate, t-butyl acrylate, t-butyl methacrylate, 2-ethylhexyl acrylate. Particular preference is given to methyl acrylate, methyl methacrylate, n-butyl acrylate, t-butyl acrylate and 2-ethylhexyl acrylate.

As vinylaromatics, preference is given to styrene, methyl styrene and vinyltoluene. A preferred vinyl halide is vinyl chloride. The preferred olefins are ethylene, propylene and the preferred dienes are 1,3-butadiene and isoprene.

From 0.1 to 5% by weight, based on the total weight of the monomer mixture, of auxiliary monomers can optionally be copolymerized. Preference is given to using from 0.5 to 2.5% by weight of auxiliary monomers. Examples of auxiliary monomers are ethylenically unsaturated monocarboxylic and dicarboxylic acids, preferably acrylic acid, methacrylic acid, fumaric acid and maleic acid; ethylenically unsaturated carboxamides and carboxylic nitriles, preferably acrylamide and acrylonitrile; monoesters and diesters of fumaric acid and maleic acid, e.g. the diethyl and diisopropyl esters, and also maleic anhydride; ethylenically unsaturated sulfonic acids or salts thereof, preferably vinylsulfonic acid, 2-acrylamido-2-methylpropanesulfonic acid. Further examples are precrosslinking comonomers such as multiply ethylenically unsaturated comonomers, for example diallyl phthalate, divinyl adipate, diallyl maleate, allyl methacrylate or triallyl cyanurate, or post-crosslinking comonomers, for example acrylamidoglycolic acid (AGA), methyl methylacrylamidoglycolate (MAGME), N-methylolacrylamide (NMA),

N-methylolmethacrylamide, N-methylolallyl carbamate, alkyl ethers such as the isobutoxy ether or ester of N-methylolacrylamide, of N-methylolmethacrylamide and of N-methylolallyl carbamate. Epoxide-functional comonomers such as glycidyl methacrylate and glycidyl acrylate are also suitable. Further examples are silicon-functional comonomers such as acryloxypropyltri(alkoxy)silanes and methacryloxypropyltri(alkoxy)silanes, vinyltrialkoxysilanes and vinylmethyldialkoxysilanes, with, for example, ethoxy and ethoxypropylene glycol ether radicals being able to be present as alkoxy groups. Mention may also be made of monomers having hydroxy or CO groups, for example hydroxyalkyl methacrylates and hydroxyalkyl acrylates, e.g. hydroxyethyl, hydroxypropyl or hydroxybutyl acrylate or methacrylate, and also compounds such as diacetoneacrylamide and acetylacetoxyethyl acrylate or methacrylate.

The selection of monomers and the selection of the parts by weight of the comonomers is carried out in such a way that a glass transition temperature T_g of from -25°C to $+25^{\circ}\text{C}$, preferably from -10°C to $+10^{\circ}\text{C}$, particularly preferably from -10°C to 0°C results. The glass transition temperature T_g of the polymers can be determined in a known manner by means of differential scanning calorimetry (DSC). The T_g can also be calculated approximately beforehand by means of the Fox equation. According to Fox T. G., Bull. Am. Physics Soc. 1, 3, page 123 (1956): $1/T_g = x_1/T_{g1} + x_2/T_{g2} + \dots + x_n/T_{gn}$, where x_n is the mass fraction (% by weight/100) of the monomer n and T_{gn} is the glass transition temperature in kelvin of the homopolymer of the monomer n . T_g values for homopolymers are reported in Polymer Handbook 2nd Edition, J. Wiley & Sons, New York (1975).

Preference is given to copolymers of vinyl acetate with from 1 to 50% by weight of ethylene; copolymers of vinyl acetate with from 1 to 50% by weight of ethylene and from 1 to 50% by weight of one or more further comonomers from the group consisting of vinyl esters having from 1 to 12 carbon atoms in

the carboxylic acid radical, e.g. vinyl propionate, vinyl laurate, vinyl esters of alpha-branched carboxylic acids having from 9 to 13 carbon atoms, e.g. VeoVa9, VeoVa10, VeoVa11; copolymers of vinyl acetate, from 1 to 50% by weight of ethylene and preferably from 1 to 60% by weight of (meth)acrylic esters of unbranched or branched alcohols having from 1 to 15 carbon atoms, in particular n-butyl acrylate or 2-ethylhexyl acrylate; and copolymers comprising from 30 to 75% by weight of vinyl acetate, from 1 to 30% by weight of vinyl laurate or vinyl esters of an alpha-branched carboxylic acid having from 9 to 11 carbon atoms and also from 1 to 30% by weight of (meth)acrylic esters of unbranched or branched alcohols having from 1 to 15 carbon atoms, in particular n-butyl acrylate or 2-ethylhexyl acrylate, which additionally contain from 1 to 40% by weight of ethylene; copolymers comprising vinyl acetate, from 1 to 50% by weight of ethylene and from 1 to 60% by weight of vinyl chloride; where the polymers can additionally contain the abovementioned auxiliary monomers in the abovementioned amounts and the figures in % by weight add up to 100% by weight in each case.

Preference is also given to (meth)acrylic ester polymers, for example copolymers of n-butyl acrylate or 2-ethylhexyl acrylate or copolymers of methyl methacrylate with n-butyl acrylate and/or 2-ethylhexyl acrylate; styrene-acrylic ester copolymers comprising one or more monomers from the group consisting of methyl acrylate, ethyl acrylate, propyl acrylate, n-butyl acrylate, 2-ethylhexyl acrylate; vinyl acetate-acrylic ester copolymers comprising one or more monomers from the group consisting of methyl acrylate, ethyl acrylate, propyl acrylate, n-butyl acrylate, 2-ethylhexyl acrylate and optionally ethylene; styrene-1,3-butadiene copolymers; where the polymers can additionally contain the abovementioned auxiliary monomers in the abovementioned amounts and the figures in % by weight add up to 100% by weight in each case.

Greater preference is given to copolymers comprising vinyl acetate and from 5 to 50% by weight of ethylene, or copolymers comprising vinyl acetate, from 1 to 50% by weight of ethylene and from 1 to 50% by weight of a vinyl ester of α -branched monocarboxylic acids having from 9 to 11 carbon atoms, or copolymers comprising from 30 to 75% by weight of vinyl acetate, from 1 to 30% by weight of vinyl laurate or vinyl esters of an α -branched carboxylic acid having from 9 to 11 carbon atoms and also from 1 to 30% by weight of (meth)acrylic esters of unbranched or branched alcohols having from 1 to 15 carbon atoms, which additionally contain from 1 to 40% by weight of ethylene, or copolymers comprising vinyl acetate, from 5 to 50% by weight of ethylene and from 1 to 60% by weight of vinyl chloride.

The polymers are generally prepared in an aqueous medium and preferably by the suspension process or in particular by the emulsion polymerization process, as described, for example, in DE-A 102008043988. The polymers are obtained here in the form of aqueous dispersions. In the polymerization, it is possible to use the customary emulsifiers and/or preferably protective colloids, as described in DE-A 102008043988. Preference is thus given to polymers in the form of aqueous dispersions stabilized by protective colloid. The protective colloids can be anionic or preferably cationic or nonionic. Preference is also given to combinations of cationic and nonionic protective colloids. Preferred nonionic protective colloids are polyvinyl alcohols. Preferred cationic protective colloids are polymers bearing one or more cationic charges, as described, for example, in E. W. Flick, Water Soluble Resins - an Industrial Guide, Noyes Publications, Park Ridge, N.J., 1991. Preferred protective colloids are polyvinyl alcohols, in particular partially hydrolyzed or fully hydrolyzed polyvinyl alcohols having a degree of hydrolysis of from 80 to 100 mol%. Particular preference is given to partially hydrolyzed polyvinyl alcohols having a degree of hydrolysis of from 80 to 94 mol% and a Höppler viscosity in 4% strength aqueous solution of from 1 to 30 mPas (Höppler method at 20°C,

DIN 53015). The protective colloids mentioned are obtainable by means of processes known to those skilled in the art and are generally added in a total amount of from 1 to 20% by weight, based on the total weight of the monomers, in the polymerization.

The polymers in the form of aqueous dispersions can, as described, for example, in DE-A 102008043988 be converted into corresponding water-redispersible powders. Here, a drying aid is generally used in a total amount of from 3 to 30% by weight, preferably from 5 to 20% by weight, based on the polymeric constituents of the dispersion. As drying aids, preference is given to the abovementioned polyvinyl alcohols. Preference is thus given to polymers in the form of water-redispersible powders stabilized by protective colloid.

The drying of the dispersions can, for example, be carried out by means of fluidized-bed drying, freeze drying or spray drying. The dispersions are preferably spray dried. Spray drying is carried out in conventional spray drying plants, with atomization being able to be effected by means of one-fluid, two-fluid or multifluid nozzles or by means of a rotating disk. The exit temperature is generally selected in the range from 45°C to 120°C, preferably from 60°C to 90°C, depending on the plant, the Tg of the resin and the desired degree of drying. The viscosity of the feed to be atomized is set via the solids content so that a value of < 500 mPas (Brookfield viscosity at 20 revolutions and 23°C), preferably < 250 mPas, is obtained. The solids content of the dispersion to be atomized is preferably from 30 to 75% by weight and particularly preferably from 50 to 60% by weight.

In carrying out the atomization, a content of up to 1.5% by weight of antifoam, based on the polymer, has frequently been found to be useful. To increase the storability by improving the caking stability, in particular in the case of polymer powders having a low glass transition temperature, the polymer powder obtained can be provided with one or more anticaking

agents (antiblocking agents), preferably from 1 to 30% by weight, based on the total weight of polymeric constituents. Examples of anticaking agents are Ca carbonate or Mg carbonate, talc, gypsum, silica, kaolins such as metakaolin, silicates having particle sizes which are preferably in the range from 10 nm to 10 μ m. The anticaking agents are different from the stabilizers according to the invention. The anticaking agents can be used in addition to the stabilizers according to the invention.

To improve the use properties, additives such as pigments, fillers, foam stabilizers, hydrophobicizing agents or cement plasticizers can be additionally added for drying.

The invention further provides processes for producing building material dry formulations, in which one or more hydraulic binders, one or more polymers in the form of water-redispersible powders, optionally one or more fillers and optionally one or more additives are mixed, characterized in that

one or more stabilizers selected from the group consisting of silica gel and zeolites are additionally mixed in and at least 40% by weight of the hydraulic binders is cement and/or hydraulic lime, based on the total weight of the hydraulic binders.

The production of the building material dry formulations is not tied to any particular procedure or mixing apparatus. Thus, building material dry formulations can, for example, be obtained by mixing and homogenizing the individual constituents of the building material formulations in conventional powder mixing apparatuses, for example by means of mortar mixers, concrete mixers or cleaning machines or stirrers.

The building material formulations of the invention are thus in the form of dry mixtures. The production of the building material dry formulations is generally carried out without

addition of water or in the absence of water. The amount of water required for use of the building material dry formulations is added in the generally known amounts before the formulations are applied.

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In an alternative process for producing the building material dry formulations, premixes of at least two constituents of the building material dry formulations are firstly produced and these are subsequently blended with one or more further constituents of the building material dry formulations.

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Preferred premixes contain one or more stabilizers and one or more polymers in the form of water-redispersible powders. The object of the invention can be achieved in a particularly advantageous way by means of such compositions.

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The invention further provides water-redispersible polymer compositions obtainable by mixing one or more polymers in the form of water-redispersible powders and one or more stabilizers selected from the group consisting of silica gel and zeolites.

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The polymer compositions preferably contain from 0.1 to 1000% by weight, particularly preferably from 1 to 700% by weight and most preferably from 5 to 500% by weight, of stabilizers, based on the total weight of the water-redispersible polymers.

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The polymer compositions preferably contain $\geq 50\%$ by weight, particularly preferably $\geq 80\%$ by weight and even more preferably $\geq 90\%$ by weight, of stabilizers and polymers in the form of water-redispersible powders, based on the total weight of the polymer compositions. The polymer compositions most preferably consist of stabilizers and polymers in the form of water-redispersible powders.

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The invention further provides processes for producing the water-redispersible polymer compositions, characterized in that

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one or more polymers in the form of water-redispersible powders and one or more stabilizers selected from the group consisting of silica gel and zeolites are mixed.

- 5 Mixing of the polymers and the stabilizers is not tied to any particular procedure or apparatus and can be carried out in conventional mixing vessels.

10 For example, polymers in the form of aqueous dispersions are converted by means of drying into water-redispersible powders, and stabilizers are subsequently added. The addition of the stabilizers is thus carried out after drying of the polymer dispersions. The stabilizers can optionally be introduced into the spray dryer after drying of the polymer dispersion has
15 occurred, optionally together with other additives which can be added in a conventional way, for example anticaking agents, antifoams, foam stabilizers, fillers, dyes, biocides, thickeners.

20 The building material dry formulations of the invention are suitable, for example, for producing reinforcing compositions for thermal insulation composite systems or for producing adhesives or coating compositions. Examples of adhesives are adhesives for thermal insulation boards and noise protection
25 boards, tile adhesives, jointing mortars and adhesives for adhesive bonding of wood and wood materials. Examples of coating compositions are mortars, levelling compositions, screeds, skim coat, sealing slurries, powder colors and plasters and renders.

30 Surprisingly, the storage stability of the building material dry formulations is improved by the procedure according to the invention, even under humid or hot or humid and hot, for example tropical, storage conditions. This also applies, in
35 particular, for storage of building material dry formulations in perforated sacks. Thus, the powder flow, for example, of building material dry formulations can be retained better using the procedure according to the invention and caking

thereof during storage can be countered. In addition, building material dry formulations according to the invention lead, compared to conventional building material dry formulations, to building products having improved use properties, for example levelling, stickiness, malleability or air pore content of fresh mortars or impact strength, cohesion or adhesion of cured building products after storage.

The following examples serve to illustrate the invention.

Polymer powder:

Polyvinyl alcohol-stabilized, water-redispersible polymer powder based on a copolymer of vinyl acetate, ethylene and VeoVa10, with calcium carbonate and kaolin as anticaking agents.

Production of the building material dry formulations:

Building material dry formulations were produced from the listed constituents of the following formulation as per the supplementary information in table 1 by intensive mixing at 23°C and 50% relative atmospheric humidity:

Portland cement	42.5	111.0 parts by weight
Hydrated lime		50.0 parts by weight
Silica sand		505.5 parts by weight
Polymer powder		333.5 parts by weight
Optionally silica gel		50.0 parts by weight

Testing of the storage stability of the building material dry formulations:

For storage, the respective sample of the respective building material dry formulation was placed in a plastic cup having a volume of 125 ml. The lid of the plastic cup had a hole having a diameter of 1 mm. Otherwise, the plastic cup provided with the lid was closed in an airtight manner.

Storage was carried out at 35°C and 75% relative atmospheric humidity. The storage stability of the samples was assessed after storage for one day, 7 days and 28 days with the aid of the following school grades system:

1 = free-flowing, no change during storage;

2 = free-flowing; small agglomerates present, but these can easily be deagglomerated by means of a spatula;

5 3 = entire sample solidified to form a body; easily deagglomerizable by means of a spatula;

4 = like 3 but sample more strongly solidified;

5 = entire sample strongly solidified, formed a single body and adhered to the plastic cup.

The results of testing are summarized in table 1.

10

Table 1: Storage stability of the building material dry formulation:

	CEx. 1	Ex. 2
Silica gel	-	+
Storage stability:		
1 day	1	1
7 days	4	1
28 days	5	1

15

Claims:

1. The use of one or more stabilizers for improving the storage stability of building material dry formulations, which comprise one or more hydraulic binders, one or more polymers in the form of water-redispersible powders, optionally one or more fillers and optionally one or more additives, characterized in that one or more stabilizers are selected from the group consisting of silica gel and zeolites, where the stabilizers
 - a) are constituents of the building material dry formulations; or
 - b) are spatially separated from the building material dry formulations but are in contact with the building material dry formulations via air exchange, and at least 40% by weight of the hydraulic binders is cement and/or hydraulic lime, based on the total weight of the hydraulic binders.
2. The use of stabilizers for improving the storage stability of building material dry formulations as claimed in claim 1, characterized in that the building material dry formulations are stored at temperatures in the range from 30 to 60°C and at relative atmospheric humidities of from 50 to 100%.
3. A building material dry formulation comprising one or more hydraulic binders, one or more polymers in the form of water-redispersible powders, optionally one or more fillers and optionally one or more additives, characterized in that one or more stabilizers selected from the group consisting of silica gel and zeolites are additionally present and at least 40% by weight of the hydraulic binders is cement and/or hydraulic lime, based on the total weight of the hydraulic binders.

4. The use of stabilizers for improving the storage stability of building material dry formulations as claimed in claim 1 or 2 or building material dry formulations as claimed in claim 3, characterized in that the silica gel
5 has an adsorption capacity for water at 40% relative atmospheric humidity and 23°C of $\leq 30\%$ by weight and/or has an adsorption capacity for water at 80% relative atmospheric humidity and 23°C of $\geq 26\%$ by weight, in each case based on the dry weight of the silica gel.
10
5. The use of stabilizers for improving the storage stability of building material dry formulations as claimed in claim 1 or 2 or building material dry formulations as claimed in claim 3, characterized in that
15 the polymers in the form of water-redispersible powders are stabilized by means of polyvinyl alcohol.
6. A process for producing building material dry formulations, in which one or more hydraulic binders, one
20 or more polymers in the form of water-redispersible powders, optionally one or more fillers and optionally one or more additives are mixed, characterized in that one or more stabilizers selected from the group consisting of silica gel and zeolites are additionally mixed in and
25 at least 40% by weight of the hydraulic binders is cement and/or hydraulic lime, based on the total weight of the hydraulic binders.
7. A water-redispersible polymer composition obtainable by
30 mixing one or more polymers in the form of water-redispersible powders and one or more stabilizers selected from the group consisting of silica gel and zeolites.
8. The water-redispersible polymer composition as claimed in claim 7, characterized in that the polymer composition
35 contains $\geq 50\%$ by weight of stabilizers and polymers in the form of water-redispersible powders, based on the total weight of the polymer composition.

9. A process for producing water-redispersible polymer compositions, characterized in that one or more polymers in the form of water-redispersible powders and one or more stabilizers selected from the group consisting of silica gel and zeolites are mixed.
10. The use of the building material dry formulations as claimed in claim 3 for producing adhesives, coating compositions or reinforcing compositions for thermal insulation composite systems.