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[0002] The present invention relates to compositions comprising a mixture of silane-functional polymers and/or prepolymers and use of same as water-hardening adhesives and sealants.

[0003] Water-hardening elastic adhesives and sealants are used in wide areas of industry and the trades. With an increase in substrates to be bonded and with increasing demands of the adhesive joints/seals, there have been increasingly frequent failures of known adhesive/sealant systems. The use of precoats (primers) and/or active cleaners as well as other methods of surface pretreatment such as corona treatment, plasma treatment, flame treatment, etc. can remedy the situation. Pretreatment of surfaces before the adhesive/sealing process is an additional working step, which is frequently complex, expensive or not even feasible. In addition to the polyurethane adhesives and sealants having free isocyanate groups and the traditional silicone adhesives and sealants based on dimethylpolysiloxanes, there has recently also been increased use of so-called modified silane adhesives and sealants. With the latter group, the main component of the polymer backbone is a polyether, and the reactive and crosslinkable end groups are alkoxysilyl groups. In comparison with the polyurethane adhesives and sealants, these silane-modified adhesives and sealants have the advantage being free of isocyanate groups, in particular monomeric diisocyanates. They are also characterized by a relatively broad spectrum of adhesion to a variety of substrates without a surface pretreatment by primers.

[0004] US 4,222,925 A and US 3,979,344 A describe room temperature-hardenable siloxane-terminated organic sealant compositions based on reaction products of isocyanate-terminated polyurethane prepolymers with 3-aminopropyltrimethoxysilane and/or 2-aminoethylmethoxysilane or 3-aminopropylmethoxysilane to form isocyanate-free siloxane-terminated prepolymers. However, adhesives and sealants based on these three polymers have unsatisfactory mechanical properties, in particular with respect to their elongation and tensile strength.

[0005] Additional synthesis processes and the use of silane-terminated prepolymers in adhesive/sealant applications are described, for example, in the following patents: US 3,971,751 A, EP 70475 A, DE 19849817 A, US 6,124,387 A, US 5,990,257 A, US 4,960,844 A, US 3,979,344 A,
5 US 3,632,557 A, DE 4029504 A, EP 601021 A or EP 370464 A.

[0006] WO 02/34838 A1 describes a method for synthesizing compounds having at least one urea group and at least one silyl group in which a compound having at least one amino group is reacted with a carbonate, wherein either the compound having at least one amino group or the
10 carbamate has a silyl group. The compounds synthesized in this way are suitable for producing surface coating agents, sealants, adhesives as well as mounting and insulation foams.

[0007] DE 10237271 A1 describes polymer compositions based on alkoxy-silane-terminated polymers with a controllable hardening rate. This discloses,
15 among other things, reaction of polypropylene glycols with isocyanates in a first step to form an OH-terminated polyurethane prepolymer and then mixing the latter with isocyanatomethyl-methyldimethoxysilane until no isocyanate band can be seen by IR spectroscopy. The polymer synthesized in this way should then be processed at room temperature with plasticizer, vinyltrimethoxysilane
20 and dried chalk to form a stable paste. After adding 3-(2-aminoethyl)aminopropyltrimethoxysilane as the catalyst, a rapidly hardening polymer composition is obtained. In addition, this document discloses the synthesis of a prepolymer containing isocyanate groups from a polypropylene glycol and a diisocyanate, whereby in a first step, a prepolymer
25 containing isocyanate groups is formed and then is to be mixed with vinyltrimethoxysilane as a reactive diluent and next reacted with N-phenylaminomethyltrimethoxysilane, so that no more isocyanate groups are detectable by IR spectroscopy. The prepolymer mixture prepared in this way should be compoundable with other components.

30 [0008] EP 1158026 A1 describes a hardenable composition comprising 100 parts by weight of a saturated hydrocarbon polymer having at least one

group containing silicon and bound by at least one hydroxyl group or hydrolyzable group to the silicon atom, so that this polymer is crosslinkable and forms siloxane bonds. In addition, the composition should contain 1 to 100 parts by weight of a compound having at least one epoxide group on its chain terminus. In addition, this composition contains 1 to 100 parts by weight mica and optionally a paraffinic hydrocarbon oil. Other conventional additives for sealant materials such as antiaging agents and fillers should optionally be mixed into the hardenable composition.

[0009] In view of this state of the art, the inventors have formulated the object of providing monocomponent compositions usable as elastic, water-hardening adhesives/sealants or coating agents and have very good adhesion to plastic substrates and painted substrates, even after storage in humidity, without pretreatment of the substrate surface.

[0010] The inventive approach to this object can be derived from the patent claims. It comprises essentially providing a monocomponent water-hardening adhesive/sealant composition containing at least one silane-functional polyoxyalkylene prepolymer and at least one silane-functional polyolefin, and at least one apolar plasticizer, wherein the at least one silane-functional polyoxyalkylene prepolymer is based on polyethers.

[0011] In other preferred embodiments, the inventive composition also comprises at least one paraffinic, naphthenic and/or aromatic petroleum oil and/or at least one catalyst plus optionally at least one filler and/or at least one adhesion promoter.

[0012] Another subject of the present invention is the use of the adhesive/sealant composition for bonding and/or coating and/or sealing plastic components or painted substrates without pretreatment of these substrates.

[0013] In the sense of this invention, "silane-functional polyoxyalkylene prepolymers" are prepolymers based on polyethers. These silane-terminated prepolymers based on polyethers can be synthesized in various ways in principle:

- hydroxy-functional polyethers are reacted with unsaturated chlorine compounds, e.g. allyl chloride, in an ether synthesis to form polyethers having terminal olefinic double bonds, which are in turn reacted with hydrosilane compounds having hydrolyzable groups, e.g. HSi(OCH₃)₃ in a hydrosilylation reaction under the catalytic influence of, for example, transition metal compounds of group 8 to form silane-terminated polyethers.
- In another process, the polyethers containing olefinically unsaturated groups are reacted with mercaptosilanes, e.g. 3-mercaptopropyl-trialkoxysilane.
- In another process, polyethers containing hydroxyl groups are first reacted with di- or polyisocyanates which are then in turn reacted with amino-functional silanes or mercapto-functional silanes to yield silane-terminated prepolymers.

[0014] Another possibility involves the reaction of hydroxy-functional polyethers with isocyanato-functional silanes. Silanes having isocyanate groups suitable for this reaction include, for example, methyldimethoxysilylmethyl isocyanate, trimethoxysilylmethyl isocyanate, diethylmethoxysilylmethyl isocyanate, ethyldimethoxysilylmethyl isocyanate, methyldiethoxysilylmethyl isocyanate, triethoxysilylmethyl isocyanate, ethyldiethoxysilylmethyl isocyanate, methyldimethoxysilylethyl isocyanate, trimethoxysilylethyl isocyanate, ethyldimethoxysilylethyl isocyanate, methyldiethoxysilylethyl isocyanate, triethoxysilylethyl isocyanate, ethyldiethoxysilylethyl isocyanate, methyldimethoxysilylpropyl isocyanate, trimethoxysilylpropyl isocyanate, ethyldimethoxysilylpropyl isocyanate, methyldiethoxysilylpropyl isocyanate, triethoxysilylpropyl isocyanate, ethyldiethoxysilylpropyl isocyanate, methyldimethoxysilylbutyl isocyanate, trimethoxysilylbutyl isocyanate, triethylsilylbutyl isocyanate, diethylmethoxysilylbutyl isocyanate, ethyldimethoxysilylbutyl isocyanate, methyldiethoxysilylbutyl isocyanate, triethoxysilylbutyl isocyanate, diethylethoxysilylbutyl isocyanate, ethyldiethoxysilylbutyl isocyanate, methyldimethoxysilylpentyl isocyanate, trimethoxysilylpentyl isocyanate, triethylsilylpentyl isocyanate, ethyldimethoxysilylpentyl isocyanate, methyl-

diethoxysilylpentyl isocyanate, triethoxysilylpentyl isocyanate, diethyl-ethoxysilylpentyl isocyanate, ethyldiethoxysilylpentyl isocyanate, methyl-dimethoxysilylhexyl isocyanate, trimethoxysilylhexyl isocyanate, ethyl-dimethoxysilylhexyl isocyanate, methyldiethoxysilylhexyl isocyanate,
 5 triethoxysilylhexyl isocyanate, ethyldiethoxysilylhexyl isocyanate, γ -trimethoxysiloxydimethylsilylpropyl isocyanate, γ -trimethylsiloxy-dimethoxysilylpropyl isocyanate, γ -triethoxysiloxydiethylpropyl isocyanate or γ -triethoxysiloxydiethoxysilylpropyl isocyanate. Instead of methoxysilanes, their ethoxy or propoxy analogs are preferred for occupational hygiene reasons.

10 **[0015]** Silane-functional poly- α -olefins, silane-functional polyisobutylenes or silane-functional partially crystalline polyolefin waxes may preferably be used as the "silane-functional polyolefin."

[0016] Largely amorphous poly- α -olefins include, for example, atactic polypropylene, atactic poly-1-butene, ethene-propene copolymers, ethene-
 15 1-butene copolymers, ethene-propene-1-butene copolymers, ethene-propene-1-hexene copolymers, ethene-propene-1-octene terpolymers, ethene-1-butene-1-hexene terpolymers, ethene-1-butene-1-octene terpolymers, ethene-1-hexene-1-octene terpolymers, propene-1-butene-1-hexene terpolymers, propene-1-butene-1-octene terpolymers or propene-1-hexene-
 20 1-octene terpolymers. These may be grafted to silane compounds according to the teaching of EP 940493 A1 to which end the silane that is to be grafted preferably has three alkoxy groups attached directly to the silicon. Such silane compounds which are suitable for grafting include, for example, vinyltrimethoxysilane, vinyltriethoxysilane, vinyltris(2-methoxyethoxy)silane,
 25 3-methacryloxypropyltrimethoxysilane, 3-methacryloxypropyltriethoxysilane, vinyldimethylmethoxysilane or vinylmethyldibutoxysilane. In this grafting the silane should usually be used in amounts between 0.1 and 10 wt%, based on the polyolefin.

[0017] Production of the silane-functional polyisobutylene and/or silane-
 30 functional polybutadienes to be used according to the invention is known in principle; isobutene (isobutylene) monomer and suitable comonomers are

typically reacted by ionic polymerization with the help of Lewis acids and are reacted with suitable silanes at the end of the polymerization, essentially forming telechelic silane-functional polyisobutylene homopolymers or copolymers. Production of these polymers, typically having a molecular weight
5 (M_n) between 1000 and 50,000, is described in DE 10209404 A1, EP 452875 A1, EP 537660 A1, EP 1134251 A1 and EP 856450 A1, for example.

[0018] Silane-functional partially crystalline polyolefin waxes to be used according to the invention are also known. The polyolefin waxes to be used are
10 preferably synthesized from propylene, ethylene using a metallocene catalyst and optionally additives of a C₄-C₁₀ 1-olefin and then are functionalized with an alkoxyvinylsilane in a grafting reaction. Such silane-modified partially crystalline polyolefin waxes naturally have the silane functionality distributed randomly along the polymer chain. Silane-modified polyolefin waxes to be used
15 according to the invention are described in EP 1508579 A1, for example.

[0019] The inventive adhesive/sealant compositions may also contain catalysts, adhesion promoters, fillers, pigments, antiaging agents and/or rheology agents in addition to the three binder components mentioned above.

[0020] In particular, aliphatic, aromatic or naphthenic petroleum oils such as
20 those known from WO 2004/009738 A1, for example, are also suitable as apolar plasticizers and/or extender oils. Such suitable extender oils or process oils have a pour point of -30°C to -50°C, for example, and the kinematic viscosity (DIN 51562) of 5 to 8 mm²/s at 40°C.

[0021] Organo-functional silanes such as hydroxy-functional, (meth)acryloxy-
25 functional, mercapto-functional, amino-functional or epoxy-functional silanes are preferably used as the adhesion promoters. Examples of mercapto-functional silanes include 3-mercaptopropyltrimethoxysilane or 3-mercaptopropyltrimethoxysilane or their alkyldimethoxy or alkyldiethoxy analogs. Examples of (meth)acryloxy-functional silanes include 3-acryloxypropyl-
30 trialkoxysilane, 3-methacryloxypropyltrialkoxysilane or their alkyldialkoxy

analogues, where the alkoxy groups are preferably methoxy or especially preferably ethoxy groups.

[0022] Examples of amino-functional silanes include: 3-aminopropyltrimethoxysilane (AMMO), 3-aminopropyltriethoxysilane (AMEO), 3-aminopropylmethyldimethoxysilane, 3-aminopropylmethyldiethoxysilane, N-(2-aminoethyl)-3-aminopropyltrimethoxysilane (DAMO), N-(2-aminoethyl)-3-aminopropyltriethoxysilane, N-(2-aminoethyl)-3-aminopropylmethyldimethoxysilane, N-(2-aminoethyl)-3-aminopropylmethyldiethoxysilane, N,N-di(2-aminoethyl)-3-aminopropyltrimethoxysilane, N,N-di(2-aminoethyl)-3-aminopropyltriethoxysilane, N,N-di(2-aminoethyl)-3-aminopropylmethyldimethoxysilane, N,N-di(2-aminoethyl)-3-aminopropylmethyldiethoxysilane, N-(2-aminoethyl)-N'-(2-aminoethyl)-3-aminopropyltrimethoxysilane, N-(2-aminoethyl)-N'-(2-aminoethyl)-3-aminopropyltriethoxysilane, N-(2-aminoethyl)-N'-(2-aminoethyl)-3-aminopropylmethyldimethoxysilane, N-(2-aminoethyl)-N'-(2-aminoethyl)-3-aminopropylmethyldiethoxysilane, bis(triethoxysilylpropyl)amine, bis(trimethoxysilylpropyl)amine, N-(2-aminobutyl)-3-aminopropyltriethoxysilane, N-(2-aminobutyl)-3-aminopropyltrimethoxysilane, N-(N-butyl)-3-aminopropyltrimethoxysilane, N-(N-butyl)-3-aminopropyltriethoxysilane, N-(N-butyl)-3-aminopropylalkoxydiethoxysilane or mixtures thereof as well as corresponding compounds having another alkyl group instead of the respective propyl group. Examples of this include vinylalkoxysilane, (N-cyclohexylaminomethyl)methyldiethoxysilane, N-cyclohexylaminomethyltriethoxysilane, N-phenylaminomethyl)methyldimethoxysilane, N-phenylaminomethyl)-trimethoxysilane.

[0023] Epoxy-functional silanes may also be selected from a plurality of compounds. Examples that may be mentioned include: 3-glycidyloxymethyltrimethoxysilane, 3-glycidyloxymethyltriethoxysilane, 3-glycidoxymethyltripropoxysilane, 3-glycidoxymethyltributoxysilane, 2-glycidoxyethyltrimethoxysilane, 2-glycidoxyethyltriethoxysilane, 2-glycidoxyethyltripropoxysilane, 2-glycidoxyethyltributoxysilane, 2-glycidoxyethyltrimethoxysilane, 1-glycidoxyethyltriethoxysilane, 1-glycidoxyethyltripropoxysilane, 1-glycidoxyethyltributoxysilane, 3-glycidoxypropyltrimethoxysilane,

3-glycidoxypropyltriethoxysilane, 3-glycidoxypropyltripropoxysilane, 3-glycid-
oxypropyltributoxysilane, 2-glycidoxypropyltrimethoxysilane, 2-glycidoxy-
propyltriethoxysilane, 2-glycidoxypropyltripropoxysilane, 2-glycidoxypropyl-
tributoxysilane, 1-glycidoxypropyltrimethoxysilane, 1-glycidoxypropyltriethoxy-
5 silane, 1-glycidoxypropyltripropoxysilane, 1-glycidoxypropyltributoxysilane,
3-glycidoxybutyltrimethoxysilane, 4-glycidoxybutyltriethoxysilane, 4-glycid-
oxybutyltripropoxysilane, 4-glycidoxybutyltributoxysilane, 4-glycidoxybutyl-
trimethoxysilane, 3-glycidoxybutyltriethoxysilane, 3-glycidoxybutyltripropoxy-
silane, 3-propoxybutyltributoxysilane, 4-glycidoxybutyltrimethoxysilane,
10 4-glycidoxybutyltriethoxysilane, 4-glycidoxybutyltripropoxysilane, 1-glycid-
oxybutyltrimethoxysilane, 1-glycidoxybutyltriethoxysilane, 1-glycidoxybutyl-
tripropoxysilane, 1-glycidoxybutyltributoxysilane, (3,4-epoxycyclohexyl)methyl-
trimethoxysilane, (3,4-epoxycyclohexyl)methyltriethoxysilane, (3,4-epoxycyclo-
hexyl)methyltripropoxysilane, (3,4-epoxycyclohexyl)methyltributoxysilane,
15 (3,4-epoxycyclohexyl)ethyltrimethoxysilane, (3,4-epoxycyclohexyl)ethyl-
triethoxysilane, (3,4-epoxycyclohexyl)ethyltripropoxysilane, (3,4-epoxycyclo-
hexyl)ethyltributoxysilane, (3,4-epoxycyclohexyl)propyltrimethoxysilane,
(3,4-epoxycyclohexyl)propyltriethoxysilane, (3,4-epoxycyclohexyl)propyl-
tripropoxysilane, (3,4-epoxycyclohexyl)propyltributoxysilane, (3,4-epoxycyclo-
20 hexyl)butyltrimethoxysilane, (3,4-epoxycyclohexyl)butyltriethoxysilane,
(3,4-epoxycyclohexyl)butyltripropoxysilane, (3,4-epoxycyclohexyl)butyl-
tributoxysilane. Instead of or together with the aforementioned trialkoxysilanes,
the corresponding alkyl dialkoxysilanes may also be used. In addition,
condensates or cocondensates of the aforementioned aminosilanes may also
25 be used as the adhesion promoter compound. The condensates or
cocondensates may also be used as partial hydrolyzates. Examples here
include DYNASYLAN™ 1146 and 1148 or the cocondensates disclosed in the
documents EP 518057 A1, EP 814110 A1 and DE 10212523 A.

[0024] The aforementioned adhesion promoters are preferably used in the
30 binder composition in amounts between 0.1 and 10 wt%, preferably between
0.5 and 5 wt%, especially preferably between 0.5 and 2 wt%.

[0025] However, so-called tackifiers such as hydrocarbon resins, phenolic resins, terpene-phenol resins, resorcinol resins or derivatives thereof, modified or unmodified resinic acids and/or esters (abietic acid derivatives), polyamines, polyaminoamides, anhydrides and anhydride-containing copolymers are also suitable as adhesion promoters. Addition of polyethoxy resins in small amounts may also improve adhesion with many substrates. Solid epoxy resins having a molecular weight of more than 700 are preferably used in finely ground form. If tackifiers are used as adhesion promoters, the type and amount will depend on the adhesive/sealant composition as well as the substrate to which it is applied. Typical tackifying resins (tackifiers), e.g. terpene-phenol resins or resinic acid derivatives are used in concentrations between 5 wt% and 20 wt%; typical adhesion promoters such as polyamines, polyaminoamides or phenolic resins or resorcinol derivatives are used in the range between 0.1 and 10 wt%.

[0026] All known compounds capable of catalyzing hydrolytic cleavage of the hydrolyzable groups of the silane grouping as well as the subsequent condensation of the Si-OH group to form siloxane groupings (crosslinking reaction and/or adhesion promoter function) may be used as catalysts. Examples include titanates such as tetrabutyl titanate and tetrapropyl titanate; tin carboxylates such as dibutyltin dilaurate, dibutyltin diacetate, dibutyltin diethyl hexanoate, dibutyltin dioctate, dibutyltin dimethyl maleate, dibutyltin diethyl maleate, dibutyltin dibutyl maleate, dibutyltin diisooctyl maleate, dibutyltin dtridecyl maleate, dibutyltin dibenzyl maleate, dibutyltin maleate, dibutyltin diacetate, tin octoate, dioctyltin distearate, dioctyltin dilaurate, dioctyltin diethyl maleate, dioctyltin diisooctyl maleate, dioctyltin diacetate and tin naphthenoate; tin alkoxides such as dibutyltin dimethoxide, dibutyltin diphenoxide and dibutyltin diisopropoxide; tin oxides such as dibutyltin oxide and dioctyltin oxide; reaction products between dibutyltin oxides and phthalic acid esters, dibutyltin bisacetylacetonate; organoaluminum compounds such as aluminum trisacetylacetonate, aluminum triethylacetoacetate and diisopropoxyaluminum ethylacetoacetate; chelate compounds such as zirconium tetraacetylacetonate and titanium tetraacetylacetonate; lead octanoate; amine compounds or salts thereof with carboxylic acids such as butylamine,

octylamine, laurylamine, dibutylamines, monoethanolamines, diethanolamines, triethanolamine, diethylenetriamine, triethylenetetramine, oleylamine, cyclohexylamine, benzylamine, diethylaminopropylamine, xylylenediamine, triethylenediamine, guanidine, diphenylguanidine, 2,4,6-tris(dimethylaminomethyl)phenol, morpholine, N-methylmorpholine, 2-ethyl-4-methylimidazole and 1,8-diazabicyclo-(5,4,0)-undecene-7 (DBU), a low-molecular polyamide resin obtained from an excess of a polyamine and a polybasic acid, adducts of a polyamine in excess with an epoxide, silane adhesion promoters with amino groups such as 3-aminopropyltrimethoxysilane and N-(β -aminoethyl)aminopropylmethyldimethoxysilane.

[0027] The fillers may be selected from a plurality of materials, which are to be mentioned here in particular: chalks, natural or ground calcium carbonates, calcium magnesium carbonates, silicates, talc, heavy spar and carbon black. It may optionally be expedient for at least a portion of the fillers to be surface pretreated; with the various calcium carbonates and/or chalks in particular, a coating with stearic acid has proven to be expedient to reduce the water input and to reduce the water sensitivity of the hardened composition. The total filler content in the formulation may vary between 0 and 60 wt%, the preferred range being between 30 and 60 wt%.

[0028] Conventional stabilizers or antiaging agents may be used against thermal, thermooxidative or ozone degradation of the inventive compositions, including, for example, sterically hindered phenols (e.g. 2,2-methylenebis-(4-methyl-6-tert-butylphenol)) and/or thioethers and/or substituted benzotriazoles or the sterically hindered amines of the HALS type (hindered amine light stabilizers), typical quantity ranges for these stabilizers being from 0 to 2.5 wt%.

[0029] Although the rheology of the inventive compositions can also be brought into the desired range through the choice of fillers and the quantity ratio of prepolymers, conventional rheology aids, e.g. pyrogenic silicas, bentonites or fibrillated or pulp short fibers or hydrogenated castor oil derivatives are known, e.g. by the brand names Rilanit (Cognis) and may be used in the range

between 0.1 and 7 wt%, preferably between 1 and 3 wt%. In addition, other conventional additives and auxiliary agents may be used in the inventive compositions, e.g. pigments such as titanium dioxide, carbon black, iron oxides or other inorganic colored pigments.

5 **[0030]** Typical inventive adhesive/sealant compositions contain:

- 5 to 30 wt% of a branched polypropylene glycol with methyldialkoxysilyl groups,
 - 5 to 30 wt% of a linear polypropylene glycol with methyldialkoxysilyl groups,
 - 10 1 to 10 wt% of an amorphous poly- α -olefin, polyisobutylene or a modified polyolefin wax with methyldialkoxysilyl groups and/or trialkoxysilyl groups,
 - 1 to 15 wt% of a paraffinic, naphthenic and/or aromatic petroleum oil,
 - 0.1 to 5 wt% of one or more adhesion promoters,
 - 15 0 to 60 wt%, preferably 30 to 60 wt% of one or more fillers,
 - 0 to 2 wt%, preferably 0.05 to 1.5 wt% of a catalyst,
- whereby the sum of the components yields 100 wt%.

[0031] The inventive compositions may be prepared in mixing equipment having a high shearing action in a known way, including, e.g. kneaders, planetary mixers, planetary dissolvers, internal mixers, so-called Banbury mixers, twin-screw extruders and similar mixing equipment with which those skilled in the art are familiar.

[0032] The inventive compositions are suitable for use as monocomponent, water-hardening, elastic adhesives/sealants or coating substances which have a very good adhesion to plastic substrates, painted components and plastic coatings without a complex substrate pretreatment and retain this adhesion even after water storage.

[0033] In addition, these monocomponent adhesives/sealants may also be made to harden with a second component that contains water.

30 **[0034]** In the following exemplary embodiments, the invention will be explained in greater detail but the selection of examples should not constitute a restriction on the scope of the inventive subject.

Examples

[0035] The inventive compositions listed in Table 1 below were mixed in a vacuum in an evacuable planetary mixer until they were homogeneous. Unless otherwise indicated, all parts in the examples are given as parts by weight.

5 **[0036]** For adhesion testing, adhesive beads were applied to various substrates and then allowed to harden for 7 days in a standard climate (23°C/50% relative atmospheric humidity) and then subjected to a peel test. In addition, hardened beads were tested for adhesion after the condensation water test. The condensation water test ("SW") includes 7 days of storage at 40°C and 98%
10 relative atmospheric humidity, followed by 1 day of storage in a standard climate ("NC"). Another aging test was performed according to the so-called "cataplasm test" ("CP") in accordance with DIN-EN 29142.

[0037] In the peel test, the adhesion was graded as follows:

1. Adhesion okay, greater than 95% cohesive fracture,
- 15 2. Adhesion still okay, 95% to greater than 75% cohesive fracture,
3. Adhesion not okay, 75% to greater than 25% cohesive fracture,
4. Adhesion not okay, less than 25% cohesive fracture.

[0038] To be able to compare the entire adhesion spectrum on different substrates, the individual adhesion grades were added up. The lower this total
20 sum, the wider is the adhesion spectrum of the composition.

[0039] Table 2 shows the good mechanical values of the hardened compositions of the inventive Examples 1 to 5.

[0040] As shown by the adhesion tests in Tables 3, 4 and 5, the adhesion behavior of the inventive compositions (Examples 1 to 5) is significantly better
25 than with comparable adhesives based on silane-functional polyoxyalkylene prepolymers of the known state of the art, in particular after storage in humidity and/or after the cataplasm test.

[0041] Table 1. Examples 1 to 5 (inventive)

Example	1	2	3	4	5
Silane-functional polyoxyalkylene prepolymer ¹⁾	14.000	14.000	14.000	14.000	14.000
Silane-functional polyoxyalkylene prepolymer ²⁾	10.000	14.500	14.500	14.500	14.500
Silane-functional polyolefin ³⁾	6.794	1.290	2.580	3.870	4.859
Apolar plasticizer/extender oil ⁴⁾	9.006	1.710	3.420	5.130	6.441
Antioxidant solution in alkyl sulfonate ester plasticizer	1.200	1.200	1.200	1.200	1.200
Chalk, ground, coated ⁵⁾	47.000	47.000	47.000	47.000	47.000
Thixotropy agent, Rilanit	2.000	2.000	2.000	2.000	2.000
Titanium dioxide, rutile type	6.200	6.200	6.200	6.200	6.200
DINP ⁶⁾	0.000	8.300	5.300	2.300	0.000
3-Glycidoxypropyltrimethoxysilane	0.500	0.500	0.500	0.500	0.500
Silane cocondensate	0.500	0.500	0.500	0.500	0.500
Silane AMMO	2.000	2.000	2.000	2.000	2.000
Catalyst solution ⁷⁾	0.800	0.800	0.800	0.800	0.800
Total	100.000	100.000	100.000	100.000	100.000

Notes

- 1) Bis[3-(methyldimethoxysilyl)propyl]polyoxypropylene, functionality >2
- 5 2) Bis[3-(methyldimethoxysilyl)propyl]polyoxypropylene, functionality approx. 2
- 3) Poly- α -olefin with methyldialkoxysilyl groups or trialkoxysilyl groups
- 4) Paraffinic petroleum oil of C₁₈-C₂₁ alkanes
- 5) Average particle size 5 μ m
- 6) Solution of dibutyltin dibutylate (58.3 parts), dioctyl phthalate (34.7 parts),
- 10 toluylsulfonfyl isocyanate (6.9 parts) and alkyl sulfonate ester of phenol (40 parts)

[0042] Table 2. Mechanical values of the hardened compositions

Example	1	2	3	4	5
Skin-forming time (min)	6	15	20	20	15
Shore A hardness after					
1 day NC	12	16	17	17	19
7 days NC	39	39	42	45	46
Thorough hardening of bead after					
1 day standard climate (mm)	1.8	2.4	2.3	2.3	2.2
Tensile test ¹⁾					
10% modulus N/mm ² 1 day NC	0.080	0.150	0.120	0.130	0.140
25% modulus N/mm ² 1 day NC	0.240	0.310	0.290	0.290	0.300
50% modulus N/mm ² 1 day NC	0.440	0.480	0.500	0.510	0.510
100% modulus N/mm ² 1 day NC	0.590	0.620	0.660	0.680	0.670
Tensile strength N/mm ² 1 day NC	0.700	0.720	0.840	0.850	0.780
Elongation % 1 day NC	193	169	210	196	159
Tensile test ¹⁾					
10% modulus N/mm ² 7 days NC	0.120	0.060	0.110	0.180	0.150
25% modulus N/mm ² 7 days NC	0.320	0.220	0.320	0.370	0.380
50% modulus N/mm ² 7 days NC	0.540	0.390	0.560	0.600	0.640
100% modulus N/mm ² 7 days NC	0.700	0.710	0.800	0.840	0.850
Tensile strength N/mm ² 7 days NC	0.780	0.920	0.930	0.990	1.000
Elongation % 7 day NC	164	210	165	183	184

1) According to DIN 53504 on S2 rods

[0043] Table 3

Bead adhesions

Substrate	Example 1		Comparative Example 1 (commercial product)		Comparative Example 2 (commercial product)	
	NC	SW	NC	SW	NC	SW
ABS	1	1	1	2	1	1
Soft PVC	1	1	4	4	1	1
Powder enamel SW 262 D (Akzo Nobel)	1	1	1	4	4	4
Powder enamel SW 206 D (Akzo Nobel)	1	1	1	4	3	4
Powder enamel with effect pigment	1	1	1	4	4	4
Polystyrene	1	1	1	1	1	1
	6	6	9	19	6	15

NC = 7 days 23°C/50% rh (relative humidity)

SW = 7 days 23°C/50% rh + 7 days 40°C/98% rh + 1 day 23°C/50% rh

[0044] Table 4

Cataplasm test in accordance with DIN-EN 29142

Bead adhesion Substrate	Example 1		Comparative Example 3 (commercial product)	
	NC	CP	NC	CP
Al elox E 6 EV 1	1	1	1	4
Steel plate, crude	1	1	1	3
Steel plate, hot-dip galvanized	1	1	1	4
Steel plate, electro- galvanized	1	1	3	4
V2A 4301	1	1	1	4
Aluminum 99.5	1	1	1	4
Hard PVC	1	1	1	2
Glass fiber-reinforced plastic	1	3	2	4
Glass	1	1	1	3
Total	9	11	12	32

NC storage = 7 days

5 CP storage = 7 days NC + cataplasm (7 days 70°C, 1 day -20°C, 1 day NC)

NC = 7 days 23°C/50% rh

SW = 7 days 23°C/50% rh + 7 days 70°C/100% rh + 1 day -20°C + 1 day 23°C/50% rh

[0045] Table 5. Adhesion test

Example	1		2		3		4		5	
	NC	SW	NC	SW	NC	SW	NC	SW	NC	SW
Al Mg Si 0.5	4	1	4	1	4	1	4	1	4	1
Al Mg Si 1	1	1	1	1	1	1	1	1	1	1
Al Mg 3	1	1	1	1	1	1	1	1	1	1
Al Mg 4.5 Mn	1	1		1	1	1	1	1	1	1
Al Cu Mg 1	1	1	1	1	1	1	1	1	1	1
Al Zn Mg Cu 1.5	1	1	1	1		1	1	1	1	1
Al elox E 6 EV 1	1	1	1	1				1	1	1
Copper SF Cu hh	1	1	1	1	1	1	1	1	1	1
Brass MS/58, polished	1	1	1	1	1	1	1	1	1	1
Steel plate, crude 1203	1	1	1	1	1	1	1	1	1	1
Steel plate, hot-dip galvanized	1	1	1	1	1	1	1	1	1	1
Steel plate, electro- galvanized	1	1	1	1	1	1	1	1	1	1
V2A 4301	1	1	1	1	1	1	1	1	1	1
Aluminum 99.5	1	1	1	1	1	1	1	1	1	1
SUBTOTAL	17	14	17	13	17	13	17	13	17	13
PA 6.6 natural, Röschling	1	1	1	1	1	1	1	1	1	1
Makrolon, Bayer	1	1	1	1	1	1	1	1	1	1
Polystyrene. Metzeler	1	1								
Hard PVC gray, Simona	1	1	1	1	1	1	1	1	1	1
Epoxy resin glass fibers	1	1	1	1	1	1	1	1	1	1
Glass	1	1	1	1	1	1	1	1	1	1
SUBTOTAL	5	5	5	5	5	5	5	5	5	5
TOTAL	22	19	22	18	22	18	22	18	22	18

NC storage = 7 days

SW storage = 7 days NC + 7 days SW

Patentkrav

1. Fugthærdende adhæsions/forseglingsmonokomponentsammensætning indeholdende
- 5
- (a) mindst én silanfunktional polyoxyalkylenpræpolymer, og
- (b) mindst én silanfunktional polyolefin, og
- (c) mindst én apolær blødgører, hvorved den mindst ene silanfunktionelle polyoxyalkylenpræpolymer er på basis af polyethere.
- 10
2. Fugthærdende adhæsions/forseglingsmonokomponentsammensætning ifølge krav 1 indeholdende som apolær blødgører mindst énallifatisk, naphthalen- eller aromatisk petroleumsolie.
- 15
3. Fugthærdende adhæsions/forseglingsmonokomponentsammensætning ifølge krav 1 eller 2, som yderligere indeholder mindste én katalysator.
4. Fugthærdende adhæsions/forseglingsmonokomponentsammensætning ifølge kravene 1 til 3, som yderligere indeholder mindst ét fyldstof og/eller
- 20
- mindst én adhæsionsfremmer.
5. Fugthærdende adhæsions/forseglingsmonokomponentsammensætning ifølge kravene 1 til 4, **kendetegnet ved**, at den silanfunktionelle polyoxyalkylenpræpolymer er valgt blandt lineære eller forgrenede polypropylenglycoler
- 25
- med methylalkoxysilylgrupper og/eller trialkoxysilylgrupper eller blandinger heraf.
6. Fugthærdende adhæsions/forseglingsmonokomponentsammensætning ifølge kravene 1 til 5, **kendetegnet ved**, at den silanfunktionelle polyolefin er en
- 30
- amorf poly- α -olefin, en polyisobutylene eller en modificeret polyolefinvoks med methylalkoxysilylgrupper og/eller trialkoxysilylgrupper.

7. Fugthærdende adhæsions/forseglingsmonokomponentsammensætning ifølge kravene 1 til 6, **kendetegnet ved**, at afhæsionspromotoren er valgt blandt 3-glycidoxypropylalkoxysilan, 3-mercaptopropylalkoxysilan, 3-methacryloxypropylalkoxysilan, 3-aminopropylalkoxysilan, N-(2-aminoethyl)-3-aminopropylalkoxysilan, N-(2-aminoethyl)-N'-(2-aminoethyl)-3-aminopropylmethyldiethoxysilan, bis-(triethoxysilylpropyl)amin, bis-(trimethoxysilylpropyl)-amin, vinylalkoxysilan, co-kondensater af amino-funktionelle silaner eller blandinger af de førnævnte silaner.
- 10 8. Fugthærdende adhæsions/forseglingsmonokomponentsammensætning ifølge kravene 1 til 7 indeholdende
- (a) 5 til 30 vægt% forgrenet polypropylenglycol med methyldialkoxysilylgrupper,
 - (b) 5 til 30 vægt% lineær polypropylenglycol med methyldialkoxysilylgrupper,
 - 15 (c) 1 til 10 vægt% amorf poly- α -olefin med methyldialkoxysilylgrupper og/eller trialkoxysilylgrupper,
 - (d) 1 til 15 vægt% paraffin-, naphthen- og/eller aromatisk jordolie,
 - (e) 0,1 til 5 vægt% af én eller flere adhæsionsfremmere,
 - (f) 0 til 60 vægt%, fortrinsvis 30 til 60 vægt% af ét eller flere fyldstoffer,
 - 20 (g) 0 til 2 vægt%, fortrinsvis 0,05 til 1,5 vægt% katalysator,
- hvor summen af de indgåede dele er 100%.
9. Anvendelse af adhæsions/forseglingssammensætningen ifølge kravene 1 til 8 til adhæsiv binding og/eller overtræk og/eller forsegling af plastdele eller 25 malede substrater uden forbehandling af substratet.