

**WATER-DILUTABLE TWO-COMPONENT COATING COMPOSITION BASED
ON EXTERNALLY EMULSIFIED ALKYD RESINS, A PROCESS FOR ITS
PREPARATION, AND THE USE THEREOF**

5 The invention relates to an aqueous coating composition,
especially a two-component aqueous coating composition,
to a process for its preparation and to its use in
single-coat and multicoat systems.

On the basis of their outstanding properties, prior art
10 two-component polyurethane coating materials are of great
importance in the coatings sector. A disadvantage,
however, is that relatively large quantities of organic
solvents are required for processing, which must be
removed by, for example, incineration. In many areas of
15 application, especially outside industry, such incinera-
tion is impracticable, so that there is increased demand
here for high-solids yet, in particular, water-dilutable
coatings in order to minimize the emission of solvent and
the associated environmental pollution.

20 The use of water as liquid phase in two-component poly-
urethane coating materials having free isocyanate groups
is in general not readily possible, since isocyanate
groups react not only with alcoholic hydroxyl groups but
also with water to form N-substituted polyurea compounds,
25 giving off carbon dioxide as they do so. Because of this,
in general, the service life, pot life and quality of the
coatings are reduced to levels incompatible with their
practical use. Nevertheless, much effort has recently
been expended in attempting to overcome these disadvan-
30 tages.

For instance, DE-A 42 26 243 describes an aqueous two-
component coating composition based on polyisocyanates
and on self-emulsifying, fatty acid-modified polyesters

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and polyurethanes. European Patent Application EP-A
0 496 205, as well, describes aqueous binder combinations
based on polyisocyanates and self-emulsifying polyester
resins which possess urethane, carboxyl and hydroxyl
5 groups. DE-C 31 22 030 describes coating compositions
comprising polyisocyanate and water-dilutable alkyd,
melamine and acrylic resins, which compositions also
comprise water-miscible solvents.

Disadvantages of the above-described water-dilutable two-
10 component binders is the low achievable solids content,
the relatively low boil limit and the short pot life.

It has surprisingly now been found that selected, extern-
ally emulsified alkyd resins, which are described in more
detail below, are particularly suitable, outstandingly
15 emulsifying partners for combination with nonblocked
polyisocyanate curing agents, and are distinguished by
high solids contents, good pot lives and high boil
limits.

The invention therefore provides a water-dilutable two-
20 component coating composition comprising
a) a polyisocyanate component having a viscosity at
23°C of from 50 to 10,000 mPa·s, consisting of one
or more organic polyfunctional isocyanates, and
b) an alkyd resin emulsion whose solid component com-
25 prises in each case a proportion by mass of
b1) from 60 to 98% of one or more alkyd resins and
b2) from 2 to 40% of one or more hydroxy-functional
emulsifiers; and which comprises
b3) if desired, up to 15%, based on the mass of
30 emulsion, of organic solvents, and also
b4) water.

The invention also provides a process for the preparation
of coating compositions composed of an aqueous binder
combination with or without auxiliaries and additives
35 which are known from coatings technology, which comprises

first transferring the alkyd resin to the aqueous phase with the aid of emulsifiers and then emulsifying into the aqueous emulsion of the alkyd resin a polyisocyanate component having a viscosity at 23°C of from 50 to 10,000 mPa·s consisting of at least one organic polyisocyanate. In this process, the proportions of the two components are chosen such that the ratio of the number of isocyanate groups in the polyisocyanate component to the number of hydroxyl groups in the alkyd resin is from 0.3:1 to 5:1. The auxiliaries and additives used if desired are incorporated into the externally emulsified alkyd resin emulsion prior to the addition of the polyisocyanate component.

Finally, the invention additionally provides for the use of the novel binder combinations as binders for paints, coating compositions and sealing compounds.

The polyisocyanate component a) comprises any desired organic polyisocyanates which are liquid at room temperature and whose isocyanate groups are in each case bonded to an aliphatic, cycloaliphatic, araliphatic or aromatic carbon atom. In general the polyisocyanate component a) has a viscosity of from 50 to 10,000 mPa·s, preferably from 50 to 1000 mPa·s, at 23°C. It is particularly preferably a polyisocyanate or polyisocyanate mixture containing only aliphatically and/or cycloaliphatically bonded isocyanate groups and having a (mean) NCO functionality of between 2.2 and 5.0 and a viscosity at 23°C of from 50 to 500 mPa·s.

The polyisocyanates can if required be used as a blend with small quantities of inert solvents, in order to reduce the viscosity to a value within the stated ranges. However, the quantity of such solvents is preferably calculated such that, in the novel coating compositions ultimately obtained, the mass of solvents is not more than 20% of the mass of water, this calculation including any solvents which may still be present in the alkyd

resin emulsion. Examples of solvents suitable for addition to the polyisocyanates are aromatic or aliphatic hydrocarbons, such as, for example, "Isopar H", ketones, esters or aprotic water-miscible solvents, for example N-methylpyrrolidone.

Polyisocyanates particularly suitable as component a) are the so-called paint polyisocyanates having aromatically or (cyclo)aliphatically bonded isocyanate groups; in this context, the latter aliphatic polyisocyanates are, as already mentioned, particularly preferred. It is preferred to employ only isocyanates derived from aliphatic polyfunctional isocyanates.

Highly suitable examples are paint polyisocyanates derived from hexamethylene diisocyanate, 1-isocyanato-3,3,5-trimethyl-4-isocyanatomethylcyclohexane (IPDI) and bis(isocyanatocyclohexyl)methane, especially hexamethylene diisocyanate. "Paint polyisocyanates" based on these diisocyanates are to be understood as being the derivatives of these diisocyanates which are known per se, comprise biuret, urethane, uretdione and/or isocyanurate groups and, following their preparation, have been freed in a known manner, preferably by distillation, from excess initial diisocyanate down to a residual content of less than 0.5% by mass. Particularly preferred paint polyisocyanates are those which are completely free of monomer fractions. Preferred aliphatic polyisocyanates to be used in accordance with the invention include the hexamethylene diisocyanate-based, biuret-containing polyisocyanates which meet the above criteria, as can be obtained, for example, by the processes of US Patents 3 124 605, 3 358 610, 3 903 126, 3 903 127 and 3 976 622, which comprise mixtures of N,N,N-tris(6-isocyanatohexyl)-biuret with minor amounts of its higher homologs, and the cyclic hexamethylene diisocyanate trimers which meet the above criteria, as can be obtained in accordance with US-A 4 324 879, which essentially comprise N,N,N-tris(6-isocyanatohexyl) isocyanurate in a mixture with minor

amounts of its higher homologs. Particular preference is given to mixtures which meet the criteria specified and comprise hexamethylene diisocyanate-based polyisocyanates containing uretdione and/or isocyanurate groups, as are
5 formed by the catalytic oligomerization of hexamethylene diisocyanate using trialkylphosphines. Among these latter mixtures, particular preference is given to those having a viscosity at 23°C of from 50 to 500 mPa·s and a mean NCO functionality of between 2.2 and 5.0.

10 The aromatic polyisocyanates, which are likewise suitable in accordance with the invention but are less preferred, are in particular paint polyisocyanates based on 2,4-diisocyanatotoluene or its technical-grade mixtures with
15 2,6-diisocyanatotoluene or based on 4,4-diisocyanatodiphenylmethane or its mixtures with its isomers and/or higher homologs. Examples of aromatic paint polyisocyanates of this type are the isocyanates containing urethane groups, as are obtained by reaction of excess quantities
20 of 2,4-diisocyanatotoluene with polyhydric alcohols such as trimethylolpropane and subsequent distillative removal of the unreacted diisocyanate excess. Examples of further aromatic paint polyisocyanates are the trimers of the monomeric diisocyanates mentioned by way of example, i.e. the corresponding isocyanatoisocyanurates, which, follow-
25 ing their preparation, are likewise freed from excess monomeric diisocyanates, preferably by distillation.

Also preferred are those polyfunctional isocyanates which, in order to facilitate dispersion in the aqueous phase, are modified at least in part with polyoxyalkylene
30 glycols, such as polyoxyethylene glycol and polyoxypropylene glycol, or with ionic groups. With particular preference, the proportion by mass of polyfunctional isocyanates which have been hydrophilically modified in this way is at least 5% of the overall mass of the
35 isocyanate component. Such isocyanates are obtainable by reacting diisocyanates with hydrophilic compounds containing at least two isocyanate-reactive groups and at

least one group selected from polyoxyethylene and polyoxypropylene groups and also ionic or ionogenic groups.

For use according to the invention as component a), particular preference is given to sterically hindered polyisocyanates having 4 to 25, preferably 4 to 16, carbon atoms, which contain in position 2 relative to the NCO group one or two linear, branched or cyclic alkyl groups having 1 to 12, preferably 1 to 4, carbon atoms. Examples thereof are 1,1,6,6-tetramethylhexamethylene diisocyanate, 1,5-dibutylpentamethylene diisocyanate, and p- or m-tetramethylxylylene diisocyanate (TMXDI).

It is of course also possible in principle to use unmodified polyisocyanates of the type mentioned by way of example, provided they conform to the statements made regarding viscosity.

The polyisocyanate component a) may in addition comprise any desired mixture of the polyisocyanates mentioned.

The alkyd resins b1), which are suitable in accordance with the invention, are polyesters modified with fatty acids. They are prepared from saturated and/or unsaturated fatty acids or oils, polyalcohols and polycarboxylic acids. The fatty acids can be replaced at least in part by other monocarboxylic acids.

The term fatty acids refers in general to linear or branched monocarboxylic acids having 6 to 35 carbon atoms. The fatty acids may be non-drying or drying. Examples of suitable non-drying fatty acids are, preferably, saturated and monounsaturated linear or branched aliphatic monocarboxylic acids, with a number of carbon atoms which is preferably from 6 to 18.

Examples of suitable drying fatty acids are unsaturated fatty acids or fatty acid mixtures which comprise at least one monocarboxylic acid having at least two iso-

lated or conjugated double bonds and an iodine number of more than 125 g/(100 g). Preference is given to unsaturated fatty acids having a linear carbon chain of from 16 to 18 carbon atoms.

5 Specific examples of suitable nondrying fatty acids are 2-ethylhexanoic acid, isononanoic acid, Versatic acid or coconut fatty acid and also oleic acid. Preferred examples of what are understood to be drying fatty acids are unsaturated monocarboxylic acids having an iodine
10 number of more than 125 g (100 g) and 18 carbon atoms. These include, in particular, unsaturated fatty acids having two or three isolated double bonds and various steric configurations, or corresponding polyunsaturated fatty acids with conjugated double bonds. Such fatty
15 acids are present, for example, in natural oils, such as linseed oil, soya oil, safflower oil, cottonseed oil or castor oil, sunflower oil, groundnut oil, wood oil and dehydrated castor oil. The unsaturated fatty acids obtained therefrom are linseed oil fatty acid, safflower
20 oil fatty acid, tall oil fatty acid, cottonseed fatty acid, groundnut oil fatty acid, wood oil fatty acid, ricinenic fatty acid or sunflower oil fatty acid.

In order to incorporate the fatty acids into the alkyd resins it is possible on the one hand to esterify the
25 fatty acids with the alcohol components or, on the other hand, to introduce them into the alkyd resin by transesterification reactions of the oils.

It is also possible to employ so-called technical-grade oils as fatty acids, these oils generally being mixtures
30 of cis-linolenic acid, linoleic acid, oleic acid and stearic acid. The technical-grade oils or fatty acids can be employed as such or are incorporated into the alkyd resin through transesterification reactions or after dehydration reactions (ricinenic fatty acid).

Where polyunsaturated fatty acids are used, particular preference is given to employing mixtures of fatty acids containing isolated and conjugated unsaturation, for example having a proportion by mass of from 10 to 80% of
5 fatty acids containing conjugated unsaturation.

The proportion by mass of saturated and unsaturated fatty acids incorporated, based on the mass of the solid resin, is from 10 to 80%, preferably from 20 to 70%. Of the mass of saturated and unsaturated fatty acids, with particular
10 preference from 10 to 60% is accounted for by unsaturated fatty acids containing conjugated double bonds. For non-yellowing resins, saturated monocarboxylic acids or fatty acids containing one or two isolated double bonds are preferred. The fatty acids obtained can be chemically
15 optimized by means of fractional distillation, isomerization or conjugation. In order to modify the properties of the alkyd resin, up to 15% by mass of the unsaturated fatty acids may be replaced by other monocarboxylic acids, such as benzoic acid, tert-butylbenzoic acid,
20 hexahydrobenzoic acid, ethylhexanoic acid or abietic acid.

The monocarboxylic acids which can be used together, at least in part, with the fatty acids are understood as being, for example, alicyclic or aromatic monocarboxylic
25 acids having 6 to 35 carbon atoms. They may, if desired, be substituted.

Suitable polycarboxylic acids contain, for example, two or more carboxyl groups on a hydrocarbon structure having, for example, from 4 to 36 carbon atoms. It is
30 also possible to employ the esterifiable derivatives of the polycarboxylic acids, such as anhydrides or methyl esters. The dicarboxylic acids which are preferably employed are linear or branched aliphatic, alicyclic or aromatic in structure.

Suitable examples of dicarboxylic acids and derivatives thereof are phthalic anhydride, isophthalic acid, lower alkyl(C₁-C₆-alkyl)-substituted isophthalic acid, dimethyl terephthalate, tetrahydro- and hexahydrophthalic anhydride, succinic anhydride, methyltetrahydrophthalic anhydride, fumaric acid, maleic anhydride, adipic acid, 2,2,4-trimethyladipic acid, azelaic acid, sebacic acid, dimerized fatty acids, cyclopentanedicarboxylic acid, 1,3- and 1,4-cyclohexanedicarboxylic acids, norbornene-
10 dicarboxylic acid, endoethylenecyclohexanedicarboxylic acid or halogenated dicarboxylic acids, such as chlorophthalic anhydride and hexachloroendomethylenetetrahydrophthalic anhydride, or mixtures thereof. Polycarboxylic acids of higher functionality, and their derivatives,
15 such as trimellitic anhydride, pyromellitic anhydride or bisanhydrides, can be incorporated proportionately; preferably, up to 10% of the dicarboxylic acids can be replaced by polycarboxylic acids or derivatives thereof. An appropriate tricarboxylic acid can also be obtained by
20 substituted addition or Diels-Alder reaction of maleic anhydride or (meth)acrylic acid with an unsaturated fatty acid.

Alcohols preferred for the synthesis of the alkyd resins are aliphatic, cycloaliphatic and araliphatic alcohols
25 having 2 to 6 hydroxyl groups and 2 to 24 carbon atoms per molecule and a molecular mass of from 62 to 434 g/mol. The alcohols may have primary, secondary and tertiary hydroxyl groups. The linear or branched, substituted or unsubstituted carbon chain can be interrupted if
30 desired by ether or ester groups.

Examples of the compounds employed as diols are glycols, such as ethylene glycol, propylene glycol, 1,4-butanediol, 1,6-pentanediol, 1,6-hexanediol, 1,2-decanediol, 2,2-ethylbutyl-1,3-propanediol, 2,2-dimethyl-1,3-propane-
35 diol, cyclohexanedimethanol, 1,1-isopropylidenebis(p-phenoxy)di-1-ethanol, 1,1-isopropylidenebis(p-phenoxy)di-2-propanol, di(hydroxyethyl)-5,5-dimethylhydantoin, and

the hydrogenated bisphenols A and F. As ether alcohols use is made, for example, of diethylene glycol, triethylene glycol, dipropylene glycol or tripropylene glycol, and ethoxylated or propoxylated bisphenol A or F products.

Examples of higher-functional polyols are glycerol, trimethylolethane, trimethylolpropane, trimethylolhexane, ditrimethylolpropane, 2,2-dimethylolbutan-3-ol, 2,2-bis(hydroxymethyl)butan-1-ol, pentaerythritol, dipentaerythritol, tripentaerythritol, tris(2-hydroxyethyl) isocyanurate, and also ethoxylated or propoxylated polyhydric alcohols such as trimethylolpropane, pentaerythritol, and sugar alcohols, such as mannitol or sorbitol, and mixtures thereof.

Primary monoalcohols having a chain-terminating action, such as isodecanol, cyclohexanol, benzyl alcohol or fatty alcohols, can be incorporated by condensation in certain proportions, preferably when carboxylic acids having a basicity of more than two are used.

The alkyd resins can be prepared by polycondensation in accordance with known methods, as are described, for example, in S. Paul, Surface Coatings, pp. 70 to 139, John Wiley & Sons, New York, 1985.

The polycondensation can be carried out by heating in the melt or by an azeotropic method, with elimination of water. The desired number of hydroxyl and acid groups can be introduced by an appropriate choice of the ratios of equivalents, a suitable reaction regime and, if desired, by working in steps. The appropriate process conditions and solution criteria are familiar to the person skilled in the art.

Suitable hydroxy-functional emulsifiers are alkylphenols and alkylphenol ethoxylates, alkyl ethoxylates, alkyl glycosides, as described for example in DE 34 04 558,

alkyl polysaccharides, sorbitol mono- and diesters, ethoxylated sorbitol esters, sorbitol hexaesters, propylene oxide-ethylene oxide copolymers, polyvinyl alcohols or partially hydrolyzed polyvinyl acetates, and
5 water-soluble hydroxy-functional polymers formed by addition polymerization, condensation polymerization or polyaddition.

Suitable hydroxy-functional polyesters are water-soluble polyesters whose solubility in water derives from the
10 fact that polyethylene glycol has been used as hydrophilic component and/or from the high acid number.

Particular preference is given to hydroxyl-containing polyurethanes or polyurethane-polyureas which can be prepared by reacting polyfunctional isocyanates with,
15 inter alia, hydroxy-functional polyesters or polyethers as hydrophobic component, the polyesters being obtained by condensation from the polycarboxylic acids and polyols already described above, and polyethylene glycol and/or dihydroxy acids, for example dimethylolpropionic acid, as
20 hydrophilic components, with or without chain extension using polyamines. These polyurethanes or polyurethane-ureas are prepared, for example, in bulk or in inert solvents by adding diisocyanates to the hydroxy components or by chain extension of isocyanate-functional
25 prepolymers in the aqueous phase, using polyamines.

In order to prepare the alkyd resin emulsions, these alkyd resins are first of all mixed with the above-described emulsifiers or emulsifier dispersions, in the presence or absence of the inert solvents described
30 above.

The mixtures comprise from 40 to 97, preferably from 50 to 95, parts by weight of the hydrophobic alkyd resins mentioned in a blend with from 3 to 60, preferably from 5 to 50, parts by weight of the specified emulsifiers or
35 emulsifier dispersions. However, it is important to

select the nature and proportions of the individual components, within the scope of the comments made, such that the proportion by mass of ethylene oxide originating from component b2) in the water-dispersible mixtures is
5 not more than 20%, preferably not more than 15%, of the mass of the solid (b1 + b2).

The mixtures can be prepared simply by blending the synthetic resins with the emulsifiers or aqueous emulsifier dispersions, with or without the presence of further
10 solvents, for example hydrocarbons, alcohols, ketones, glycol ethers or N-methylpyrrolidone.

The aqueous synthetic-resin dispersions according to the invention are prepared by dispersing the novel mixtures in water, which can be done either simply by stirring
15 water into the initially introduced mixture of the synthetic resins with the emulsifier, using customary dissolvers or stirrers, or else by pouring the mixture into water, with vigorous stirring. If desired, it is possible first to add part of the water to the above-
20 described mixture and then to pour this mixture, with stirring, into the remaining quantity of water. In this way, stable oil-in-water emulsions can be obtained.

To prepare the alkyd resin emulsion, it is also possible first to prepare an aqueous solution of the emulsifier,
25 into which the alkyd resin is then stirred under heavy shearing.

The ready-to-use coating compositions are obtained by emulsifying the polyisocyanate component a) in the aqueous emulsion of the alkyd resin b), the alkyd resin
30 emulsion taking over the function of an emulsifier for the added polyisocyanate a). As polyisocyanate component a) it is possible, but not preferable, to use hydrophilically modified polyisocyanates which, because of the incorporated ionic or nonionic hydrophilic centers, are
35 autodispersible.

Thorough mixing can be achieved simply by stirring at room temperature. In this context, the quantity of polyisocyanate component is calculated such that the resulting ratio of the number of isocyanate groups of component a) to the number of alcoholic hydroxyl groups of component b) is from 0.3:1 to 5:1, preferably from 0.5:1 to 4:1 and, with particular preference, from 0.8:1 to 3:1.

Prior to the addition of the polyisocyanate component a) it is possible to incorporate into the externally emulsified alkyd resin emulsion b) the auxiliaries and additives which are customary in coating technology. These auxiliaries and additives may also be present in the polyisocyanate component a).

If desired, the dispersions according to the invention can be modified, prior to, during or after their preparation, by the addition of other polymers, for example polyacrylates, polyurethanes, hard resins or polyesters in solution or dispersion form. If the additional binders carry reactive groups, for example hydroxyl groups, then these groups must be taken into account in connection with the mixing ratio of components a) and b).

The coating compositions according to the invention consist of the above-described hydroxyl-containing water-dispersible binders and the isocyanates. As auxiliaries and additives they can comprise, for example, pigments, fillers, coatings additives, emulsifiers which are preferably incorporated into the network via reactive double bonds or hydroxyl groups during film formation, especially nonionic emulsifiers, leveling agents, anti-foams, rheological auxiliaries, catalysts, siccatives and further binders. The purpose of the additives is to influence coatings properties such as, for example, curing times and surface quality, or to influence applications-related properties, for example the viscosity.

In order to achieve ready dispersibility of the polyisocyanates it is possible to establish a suitable, low viscosity. This goal is also served by dissolving highly viscous or solid polyisocyanates in water-miscible organic solvents which react slowly or not at all with isocyanates. Examples of unreactive solvents are glycol dialkyl ethers, such as glycol dimethyl ether, esters, such as ethylglycol acetate, ketones, such as acetone, cyclic ethers, such as dioxane, or lactams, such as N-methylpyrrolidone. Preference is given to alcohols containing sterically hindered alcohol groups, ketone alcohols or alkoxy alcohols, such as butoxyethanol, butyldiglycol, methoxyisopropanol or diacetone alcohol. They are used, shortly before processing and without heating, to prepare a polyisocyanate content which has a solids content of more than 40% by mass, preferably from 50 to 95% by mass, with a viscosity of from 0.5 to 2000 mPa·s, preferably from 1 to 20 mPa·s.

Suitable pigments are the customary pigments, for example those described in DIN 55 944: preferably carbon black, titanium dioxide, finely disperse silica, aluminum silicate, metal powders or flakes, organic and inorganic color pigments, anticorrosion pigments, such as lead compounds and chromate compounds, and metal-effect pigments. In addition to the pigments and fillers it is possible if desired to employ customary organic dyes. It is likewise possible to add proportions of crosslinked organic microparticles.

The methods for preparing the coating compositions from the individual components are known. For example, it is possible to disperse the pigments in a particularly appropriate grinding resin and, if desired, to mill them to the required particle size. Another procedure envisages milling the pigments in the aqueous dispersion of the binder component b).

- In this context care should be taken to ensure that the stability of the aqueous dispersion remains unaffected during the milling process. Following the dispersion of the pigments it is possible to add further binder components. These may comprise the externally emulsified alkyd resins of the invention and, if desired, other binders of those described above. If desired, further coatings auxiliaries can be added in order to influence properties such as, for example, dispersibility.
- 10 In accordance with another preferred procedure, the externally emulsified alkyd resins or, if desired, other customary paint resins are first of all mixed with a little water, with or without the addition of fillers, pigments, colorants and the like, and this mixture is
15 dispersed on a roller bed or in a ball mill, to form pastes. These pastes can then be diluted with water and, if desired, admixed with further resin emulsion and additives to prepare the ready-to-use coating formulations.
- 20 If desired, pigments or coatings auxiliaries may also be present in component a). This coatings component is generally nonaqueous. However, it is dispersible in the aqueous alkyd resin emulsion. It may if desired contain
25 small proportions of organic solvents in order to establish an appropriate viscosity for dispersion. Care should be taken to ensure that the additives are unable to react with the isocyanate component. The brief mixing of isocyanates with alcohols, such as butoxyethanol or diacetone alcohol, is possible.
- 30 The coating compositions according to the invention can be applied to the materials to be coated using customary techniques, for example dipping, spraying or rolling. The applied film subsequently crosslinks.
- 35 Crosslinking can be effected at temperatures of, for example, from 0°C to 150°C. The coating compositions

according to the invention can advantageously be cured at relatively low temperatures, for example at temperatures between 10°C and 80°C, especially below 60°C. If appropriate, a flash-off time can be allowed to elapse before crosslinking.

The thicknesses of the coats applied depend on the intended use of the coating composition. For example, clearcoats have a thickness of up to 60 μm , pigmented basecoats or topcoats a thickness of from 10 to 50 μm , coatings as fillers or stone-chip resistance coats a thickness of from 30 to 100 μm , and anticorrosion primer coatings a thickness of from 20 to 70 μm .

The coating composition according to the invention is suitable for single-coat finishes, topcoats and primers.

Any desired substrates are suitable, examples being metal substrates such as iron, aluminum or zinc, nonmetallic substrates, such as mineral substrates (e.g. concrete, glass), wood, plastics substrates, such as polyolefins, polycarbonates and polyurethanes, and, if desired, substrates provided with a preliminary coating. Application can be made to a dried or crosslinked coated substrate. It is also possible to operate by the "wet-on-wet" method. For this purpose the coating composition of the invention can be applied, if desired after a short flash-off phase, to a substrate provided with a noncross-linked coating composition. It is also possible to apply a further coating composition to the novel coating composition, without drying or crosslinking beforehand and, if desired, after a short flash-off phase. The further coating composition may comprise a coating composition on the basis of the present invention or another coating composition. Subsequently, the coating films are crosslinked together.

The coating composition according to the invention is particularly suitable for use in multi-coat finishing,

with at least one coat being prepared using a novel coating composition. In this context it is possible, depending on the pigmentation, to produce, for example, clearcoat compositions, basecoat or topcoat compositions and also stone-chip resistance compositions, fillers or primers. A preferred use is that as clearcoat compositions applied to a basecoat which is based on an aqueous solvent-containing coating composition. The coatings thus obtained are distinguished by high mar resistance, a high gloss retention capacity and enhanced resistance properties.

The examples which follow illustrate the invention. All contents, parts and numerical percentages below are proportions by mass unless otherwise specified.

15 **Examples**

Hydroxy-functional emulsifier E1

26.8 g of dimethylolpropionic acid are suspended at about 80°C in 100 g of polyethylene glycol 1000 (mean molecular mass M_n about 1000 g/mol). Then, after heating to 70°C, 51 g of tetramethylxylylene diisocyanate (TMXDI) and 36.6 g of tolylene diisocyanate (TDI) are added dropwise at a rate such that the temperature does not exceed 70°C (about 30 min). Once all of the isocyanate has been added, the admixture is stirred at the temperature for one hour and the reaction temperature is then raised to 90°C. The temperature is maintained until the isocyanate content has fallen to 3.8%. Then 30 g of *Genapol O-100 (ethoxylated fatty alcohol) and 60 g of a polyester made from isophthalic acid, adipic acid, neopentylglycol and trimethylolpropane (OH number 107 mg/g, acid number 3 mg/g) are added and the mixture is stirred at 90°C until the NCO content has fallen to 1.4%. Then, with vigorous stirring, 400 g of heated deionized water are added over the course of 10 minutes. This is followed directly by the rapid (about 5 min) dropwise addition of 3.75 g of

triethylenetetramine dissolved in 37.5 g of deionized water. Following the addition of 4.5 g of triethylamine and a reaction time of 3 hours at 80°C, a further 4.4 g of triethylamine and 1000 g of deionized water are added and the mixture is then cooled. A pastelike dispersion is obtained.

Alkyd resin emulsion A1

220 g of the above-described emulsifier emulsion E1 are added to 200 g of a commercial alkyd resin having an oil content of 34% (e.g. *Alftalat AF 342 100%) and the mixture is stirred at 70°C for about 60 min until it is homogeneous.

After adding 1 ml of ammonia water (25%), 70 g of deionized water heated at 70°C are added dropwise very slowly with vigorous stirring (about 2 hours). A milky, pseudoplastic dispersion is obtained.

Alkyd resin emulsion A2

40 g of *Genapol O-100 (ethoxylated fatty alcohol) and 10 g of butylglycol are added to 200 g of a commercial alkyd resin having an oil content of 42% (e.g. *Alftalat AM 424 100%) and the mixture is stirred at 70°C for about 60 min until it is homogeneous.

After adding 2 ml of ammonia water (25%), 230 g of deionized water heated at 70°C are added dropwise very slowly with vigorous stirring (about 4 hours). A milky dispersion is obtained.

Coating composition

19.5 g of the externally emulsified alkyd resin emulsion A1 are diluted with 2 g of methoxypropyl acetate and mixed with 6 g of a polyisocyanate (*Bayhydur LS 2980). The pot life of this mixture is more than 4 hours. The films, cured at room temperature, were free from tack, clear and crosslinked and exhibited good evenness. After

drying at 80°C for 30 minutes and at 60°C for 16 hours, pendulum hardnesses of more than 100 s were measured, which rose to more than 150 s after a further week at room temperature. The solvent resistance (xylene, 5
5 minutes) of the films cured in this way was excellent. Similar results are obtained with the alkyd resin emulsion A2.



Patent Claims

1. A water-dilutable two-component coating composition comprising
 - 5 a) an isocyanate component having a viscosity at 23°C of from 50 to 10,000 mPa·s, consisting of one or more organic polyfunctional isocyanates, and
 - b) an alkyd resin emulsion whose solid component
10 comprises in each case a proportion by mass of
 - b1) from 60 to 98% of one or more alkyd resins and
 - b2) from 2 to 40% of one or more hydroxy-functional emulsifiers, and which com-
15 prises
 - b3) if desired, up to 15%, based on the mass of emulsion, of organic solvents, and also
 - b4) water.
- 20 2. A water-dilutable two-component coating composition as claimed in claim 1, wherein the isocyanate component a) has a mean isocyanate functionality of from 2.2 to 5.
- 25 3. A water-dilutable two-component coating composition as claimed in claim 1, wherein the ratio of the number of isocyanate groups in component a) to the number of hydroxyl groups in the alkyd resin b1) is from 0.3:1 to 5:1.
- 30 4. A water-dilutable two-component coating composition as claimed in claim 1, wherein the isocyanate component a) employed comprises diisocyanate derivatives with structures selected from biuret, urethane, uretdione and isocyanurate structures.



5. A water-dilutable two-component coating composition as claimed in claim 1, wherein the polyfunctional isocyanates contain only aliphatic structures.
- 5 6. A water-dilutable two-component coating composition as claimed in claim 1, wherein the isocyanate component a) contains less than 0.5% of monomeric diisocyanates.
- 10 7. A water-dilutable two-component coating composition as claimed in claim 1, wherein the isocyanate component contains at least 5% of a polyfunctional isocyanate which is obtainable by reacting a diisocyanate with a hydrophilic component containing at least two isocyanate-reactive groups and at least one group selected from polyoxyethylene and polyoxypropylene groups and ionic or ionogenic groups.
- 15 8. A water-dilutable two-component coating composition as claimed in claim 4, wherein the polyfunctional isocyanates are obtained by reacting sterically hindered diisocyanates having 4 to 25 carbon atoms.
- 20 9. A water-dilutable two-component coating composition as claimed in claim 1, wherein the proportion by mass of saturated and unsaturated fatty acids in the alkyd resin component b1) is from 10 to 80%.
- 25 10. A water-dilutable two-component coating composition as claimed in claim 1, wherein the proportion by mass of saturated and unsaturated fatty acids in the alkyd resin component b1) is from 20 to 70%.
- 30 11. A water-dilutable two-component coating composition as claimed in claim 7, wherein the proportion by mass of polyoxyalkylene groups in the solid component of the alkyd resin emulsion (b1) + b2)) is not more than 20%.



12. A water-dilutable two-component coating composition as claimed in claim 1, wherein the emulsifier component b2) is a hydroxy-functional polyurethane-polyurea dispersion.
- 5 13. A water-dilutable two-component coating composition as claimed in claim 1, wherein the emulsifier component b2) is obtained by chain extension of a polyethylene glycol-containing, isocyanate-functional prepolymer in the aqueous phase, using poly-
10 amines.
14. A process for the preparation of coating compositions, which comprises in a first step transferring alkyd resins to the aqueous phase with the aid of hydroxy-functional emulsifiers, and then emulsifying
15 a polyisocyanate component in this emulsion.
15. A process for the preparation of coatings using an aqueous two-component coating composition as claimed in claim 1.
16. A process for the preparation of multilayer coat-
20 ings, in which at least one of the coating compositions employed comprises a two-component coating composition as claimed in claim 1.
17. The use of a coating composition as claimed in claim 1 for preparing single-coat finishes or topcoats.
- 25 18. The use of a coating composition as claimed in claim 1 for producing primers.