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(54) Title: PROCESS FOR JOINING TOGETHER COMPONENTS, IN PARTICULAR IN THE PRODUCTION OF SHOES

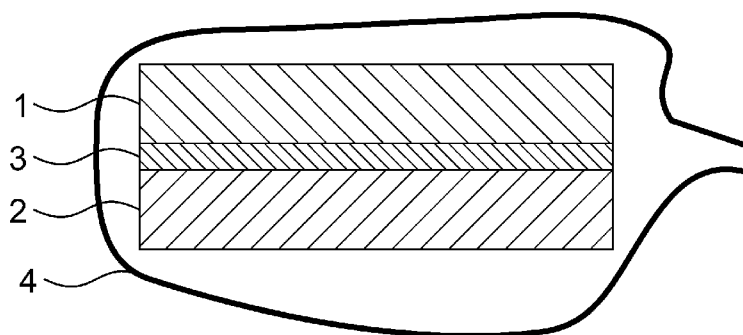


FIG. 4

(57) Abstract: Process for joining together components, in particular in the production of shoes The present invention relates to a process for joining together at least two components with the aid of an adhesive and an assembled component which has been produced by this process. The pressure is exerted such that a flexible casing (4) at least partly enclosing the first (1) and second component (2) is contracted by an external stimulus. The external stimulus is based on a heat treatment and/or on an evacuation of the enclosing flexible casing (4). In particular, the process is suitable in the production of shoes. It furthermore relates to a component which has been joined together with the process according to the invention.

Process for joining together components, in particular in the production of shoes

The present invention relates to a process for joining together at least two components with the aid of an adhesive and an assembled component which has been produced by this process. In particular, the process is suitable for the production of shoes. It furthermore relates to a component
5 which has been joined together with the process according to the invention.

When two components are joined together with the aid of an adhesive, the fixing of the components is of importance for the dimensional accuracy of the adhesive bond. In the case of adhesive bonds exposed to stress in particular, the bond should be pressed or held in position until the adhesive polymer has built up a sufficiently high cohesive strength. The cohesive strength can
10 be built up either by cooling a hot adhesive layer or by chemical crosslinking of the adhesive polymer.

In this context fixing of the components can be effected mechanically, for example by a press or screw clamp. After the mechanical fixing, the components still remain in the fixing for a certain period of time until the adhesive polymer has built up a sufficiently high cohesive strength. This
15 leads to a relatively high consumption of time during production. For example, the process described above is used in the production of footwear. The components which have been joined together furthermore require repackaging after the fixing in order to protect the components which have been joined together from environmental influences. The production costs are thereby likewise increased.

20 Irregularly shaped and flexible components which are to be glued are, for example, the sole and upper of a shoe. Thus, for example, DE 198 09 077 A1 describes a process for the production of a shoe with an upper, lining and sole, in which the upper and lining are each prefabricated separately from one another from appropriate individual parts to give an outer upper or an inner shoe, the outer upper is bonded to a finished sole to give an outer shoe and the inner shoe is inserted into the
25 outer shoe as a lining, wherein the individual parts of the outer upper and of the inner shoe forming the lining are bonded to one another by gluing and the outer upper and inner shoe in each case are shaped from a manually preformed outer shoe blank by pressing on a last by means of pressure cushions and by heating, to give the outer upper or the inner shoe.

As already mentioned, the disadvantage of such gluing processes is that after the fixing and curing,
30 the fixing must be detached and the glued article must be packaged in a separate step.

Packaging of irregularly shaped objects is effected in foodstuffs technology inter alia by means of vacuum packing. In this, the foodstuff is placed in a bag and the bag is evacuated. As a result of the

evacuation, the bag clings to the contours of the foodstuff. In this manner, the life of the foodstuff can be prolonged and the foodstuff can be protected from damage by freezing. This procedure is as yet unknown for fixing adhesive bonds.

Further processes for joining together at least two components by means of which time and costs
5 can be reduced during the joining together and the subsequent production steps, and a component which has been joined together which uses this process are therefore desirable.

A process for joining together at least two components is proposed according to the invention, comprising the steps:

- provision of a first and a second component;
- 10 application of an adhesive to the first and/or second component;
- joining together of the first and second component, the first and second component being at least partly bonded to one another by the adhesive;
- introduction of the first and second component into a flexible casing;
- 15 exertion of pressure on the first and second component, the pressure acting at least partly on the adhesive between the first and second component, and subsequent storage of the first and second component in the contracted flexible casing for a period of at least 1 minute;
- the pressure being exerted such that a flexible casing at least partly enclosing the first and second component is contracted by an external stimulus and
- 20 the external stimulus being based on a heat treatment and/or on an evacuation of the enclosing flexible casing

Preferably, the first and second component are stored for a period of at least 5 minutes, particularly preferably for a period of at least 10 minutes. Preferably, the first and second component are stored in a contracted flexible casing until a stable adhesive bond has formed between the first and second
25 component.

The process according to the invention has the advantage that irregularly shaped articles with an adhesive bond exposed to stress can be fixed to one another until a sufficient cohesive strength is reached, without a specific pressing tool having to be used for the entire operation. Rather, in principle after the flexible casing has been exposed to the external stimulus, the next arrangement

of components can already be worked. A further advantage is that the flexible casing can simultaneously serve as the packaging for the arrangement of components.

To exert pressure on the components which have been joined together, the flexible casing at least partly encloses the components. Preferably, the flexible casing encloses the components completely. In its simplest form the casing can be a tube which is open on one or both sides. "Flexible" here means that after the action of vacuum and/or heat, the casing is capable of at least partly fitting on to the outer contours of the components to be fixed. The casing here can also be elastic in construction.

After exposure to the external stimulus, the casing contracts around the components to be fixed and in this way exerts the desired pressure. The pressure prevailing on the components can also be influenced via the flexibility of the casing. If the external stimulus includes heat, a reactive adhesive can be simultaneously activated by this means.

The material of the casing is initially not specified further, and can expediently include a thermoplastic polymer, such as, for example, polyurethane, polyamide, polyethylene, polyolefins, PVDF, PVS, PTFE and/or a polymer composite film. The casing can preferably be provided with a non-stick finish.

When the flexible casing is evacuated around components, the entire air in the casing is advantageously removed. If this is not possible in the case of concavely shaped components, the final pressure within the casing can be, for example, ≤ 1 mbar or ≤ 0.1 mbar.

In the process according to the invention, the enclosing flexible casing is advantageously welded or closed mechanically by clips on at least one end after its contraction, so that the contracted enclosing flexible casing completely encloses the component which has been joined together. The component which has been joined together can then be barricaded off from the environment. This prevents environmental influences, for example air after the contraction or dirt particles, from entering into the contracted enclosing flexible casing to reach the component which has been joined together. Furthermore, the welding prevents the contracted enclosing casing from expanding again and as a result no longer exerting pressure on the adhesive area of the components which have been joined together.

In the process according to the invention, a one-part or multi-part enclosing flexible casing can be used to enclose the first and second component which have been joined together. A one-part enclosing flexible casing would be advantageous if the components which have been joined together are produced in relatively small piece numbers. As a result, the device which provides the enclosing flexible casing as a rule does not require a large space.

In the case of a large number of pieces, a multi-part enclosing flexible casing is advantageous. For example, the enclosing flexible casing can comprise two webs of film. One web of film lies on a conveyor belt on to which the components which have been joined together are laid. A second web of film runs over the components which have been joined together and this web of film lies over
5 the components which have been joined together. In a further step, the device welds the two webs of film to one another and thus produces an enclosing flexible casing, which contracts due to at least one external stimulus.

In one embodiment of the process according to the invention, the first component comprises a shoe sole and the second component comprises a shoe upper. Boot soles, boot uppers and the like are
10 also included here.

In a further embodiment of the process according to the invention, a vacuum packaging is used as the enclosing flexible casing. On placing of the components to be fixed into a vacuum packaging which is open on one side and by evacuation of the air in the vacuum packaging, the vacuum packaging contracts and encloses the component which has been joined together. As a result, the
15 vacuum packaging exerts a pressure on the adhesive area and thus fixes this. A vacuum laminator, for example, can be used for this.

In a further embodiment of the process according to the invention, a shrink film, shrink hood and/or a shrink tube is used as the enclosing flexible casing. These shells contract on heating. The components to be fixed can be, for example, wound into a shrink film or arranged in a shrink tube,
20 followed by heating and contraction of the casing.

Combinations of evacuation and heating can of course also be employed in the process according to the invention. It is conceivable, for example, for a thermoplastic vacuum bag to be made flexible by the action of heat, before an evacuation takes place.

In a further embodiment of the process according to the invention, the adhesive comprises an
25 aqueous polyurethane dispersion. Preferably, this is an aqueous polyurethane dispersion with polyurethanes (A) which are reaction products of the following components:

A1) polyisocyanates

A2) polymeric polyols and/or polyamines with average molecular weights of ≥ 400 g/mol to $\leq 8,000$ g/mol

30 A3) optionally mono- and/or polyalcohols or mono- and/or polyamines or amino alcohols with molecular weights of ≤ 400 g/mol,

and at least one compound chosen from

A4) compounds which have at least one ionic or potentially ionic group

and/or

A5) nonionically hydrophilized compounds.

- 5 A potentially ionic group is a group which is capable of the formation of an ionic group.

Preferably, the polyurethanes (A) are prepared from ≥ 7 % by weight to ≤ 45 % by weight of A1), ≥ 50 to ≤ 91 % by weight of A2), ≥ 0 to ≤ 15 % by weight of A5), ≥ 0 to ≤ 12 % by weight of ionic or potentially ionic compounds A4) and optionally ≥ 0 to ≤ 30 % by weight of compounds A3), wherein the sum of A4) and A5) is ≥ 0.1 to ≤ 27 % by weight and the sum of the components adds up to 100 % by weight.

Particularly preferably, the polyurethanes (A) are built up from ≥ 10 to ≤ 30 % by weight of A1), ≥ 65 to ≤ 90 % by weight of A2), ≥ 0 to ≤ 10 % by weight of A5), ≥ 3 to ≤ 9 % by weight of ionic or potentially ionic compounds A4) and optionally ≥ 0 to ≤ 10 % by weight of compounds A3), wherein the sum of A4) and A5) is ≥ 0.1 to ≤ 19 % by weight and the sum of the components adds up to 100 % by weight.

Very particularly preferably, the polyurethanes (A) are prepared from ≥ 8 to ≤ 27 % by weight of A1), ≥ 65 to ≤ 85 % by weight of A2), ≥ 0 to ≤ 8 % by weight of A5), ≥ 3 to ≤ 8 % by weight of ionic or potentially ionic compounds A4) and optionally ≥ 0 to ≤ 8 % by weight of compounds A3), wherein the sum of A4) and A5) is ≥ 0.1 to ≤ 16 % by weight and the sum of the components adds up to 100 % by weight.

Suitable polyisocyanates (A1) are aromatic, araliphatic, aliphatic or cycloaliphatic polyisocyanates. Mixtures of such polyisocyanates can also be employed. Examples of such suitable polyisocyanates are butylene-diisocyanate, hexamethylene-diisocyanate (HDI), isophorone-diisocyanate (IPDI), 2,2,4- and/or 2,4,4-trimethylhexamethylene-diisocyanate, the isomeric bis(4,4'-isocyanatocyclohexyl)methanes or mixtures thereof of any desired isomer content, isocyanatomethyl-1,8-octane-diisocyanate, 1,4-cyclohexylene-diisocyanate, 1,4-phenylene-diisocyanate, 2,4- and/or 2,6-toluylene-diisocyanate, 1,5-naphthylene-diisocyanate, 2,4'- or 4,4'-diphenylmethane-diisocyanate, triphenylmethane-4,4',4''-triisocyanate or derivatives thereof with a urethane, isocyanurate, allophanate, biuret, uretdione or iminooxadiazinedione structure and mixtures thereof. Hexamethylene-diisocyanate, isophorone-diisocyanate and the isomeric bis(4,4'-isocyanatocyclohexyl)methanes and mixtures thereof are preferred.

Polyisocyanates or polyisocyanate mixtures of the type mentioned with exclusively aliphatically and/or cycloaliphatically bonded isocyanate groups are preferred. Very particularly preferred starting components (A1) are polyisocyanates or polyisocyanate mixtures based on HDI, IPDI and/or 4,4'-diisocyanatodicyclohexylmethane.

- 5 Any desired polyisocyanates which are built up from at least two diisocyanates, are prepared by modification of simple aliphatic, cycloaliphatic, araliphatic and/or aromatic diisocyanates and have a uretdione, isocyanurate, urethane, allophanate, biuret, iminooxadiazinedione and/or oxadiazinetriene structure, such as are described, for example, in J. Prakt. Chem. 336 (1994) p. 185-200, are furthermore suitable as polyisocyanates (A1).
- 10 Suitable polymeric polyols or polyamines (A2) have an OH functionality of ≥ 1.5 to ≤ 4 , such as, for example, polyacrylates, polyesters, polylactones, polyethers, polycarbonates, polyester carbonates polyacetals, polyolefins and polysiloxanes. Polyols in a molecular weight range of from ≥ 600 g/mol to $\leq 2,500$ g/mol with an OH functionality of ≥ 2 to ≤ 3 are preferred.

- The possible polycarbonates containing hydroxyl groups are obtainable by reaction of carbonic acid derivatives, for example diphenyl carbonate, dimethyl carbonate or phosgene, with diols.
- 15 Possible such diols are, for example, ethylene glycol, 1,2- and 1,3-propanediol, 1,3- and 1,4-butanediol, 1,6-hexanediol, 1,8-octanediol, neopentyl glycol, 1,4-bishydroxymethylcyclohexane, 2-methyl-1,3-propanediol, 2,2,4-trimethylpentane-1,3-diol, dipropylene glycol, polypropylene glycols, dibutylene glycol polybutylene glycols, bisphenol A, tetrabromobisphenol A and also
- 20 lactone-modified diols. The diol component preferably contains ≥ 40 % by weight to ≤ 100 wt.% of hexanediol, preferably hexane-1,6-diol and/or hexanediol derivatives, preferably those which contain ether or ester groups in addition to terminal OH groups, for example products which have been obtained by reaction of 1 mol of hexanediol with at least 1 mol, preferably 1 to 2 mol of caprolactone in accordance with DE-A 1 770 245, or by etherification of hexanediol with itself to
- 25 give di- or trihexylene glycol. The preparation of such derivatives is known, for example, from DE-A 1 570 540. The polyether-polycarbonate diols described in DE-A 3 717 060 can also be employed.

- The hydroxypolycarbonates should preferably be linear. However, they can optionally be slightly branched by incorporation of polyfunctional components, in particular low molecular weight
- 30 polyols. Glycerol, trimethylolpropane, hexane-1,2,6-triol, butane-1,2,4-triol, trimethylolpropane, pentaerythritol, quinitol, mannitol, sorbitol, methyl glycoside and 1,3,4,6-dianhydrohexitols, for example, are suitable for this.

Suitable polyether polyols are the polytetramethylene glycol polyethers known per se in polyurethane chemistry, which can be prepared, for example, via polymerization of tetrahydrofuran by cationic ring-opening.

5 Polyether polyols which are moreover suitable are polyethers such as, for example, the polyols prepared using starter molecules, from styrene oxide, propylene oxide, butylene oxides or epichlorohydrin, in particular of propylene oxide.

10 Suitable polyester polyols are, for example, reaction products of polyfunctional, preferably difunctional and optionally additionally trifunctional alcohols with polyfunctional, preferably difunctional carboxylic acids. Instead of the free polycarboxylic acids, the corresponding polycarboxylic acid anhydrides or corresponding polycarboxylic acid esters of lower alcohols or mixtures thereof can also be used for preparation of the polyesters. The polycarboxylic acids can be aliphatic, cycloaliphatic, aromatic and/or heterocyclic in nature and can optionally be substituted, for example by halogen atoms, and/or unsaturated.

15 Components (A3) are suitable for termination of the polyurethane prepolymer. Monofunctional alcohols and monoamines are possible for this. Preferred monoalcohols are aliphatic monoalcohols having 1 to 18 C atoms, such as, for example, ethanol, n-butanol, ethylene glycol monobutyl ether, 2-ethylhexanol, 1-octanol, 1-dodecanol or 1-hexadecanol. Preferred monoamines are aliphatic monoamines, such as, for example, diethylamine, dibutylamine, ethanolamine, N-methylethanolamine or N,N-diethanolamine and amines of the Jeffamin® M series (Huntsman Corp. Europe, Belgium) or amino-functional polyethylene oxides and polypropylene oxides.

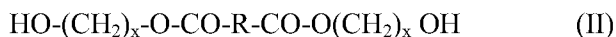
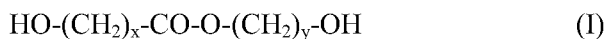
Polyols, aminopolyols or polyamines with a molecular weight below 400 g/mol, a large number of which are described in the appropriate literature, are likewise suitable as component (A3).

Preferred components (A3) are, for example:

25 a) alkanediols or -triols, such as ethanediol, 1,2- and 1,3-propanediol, 1,4- and 2,3-butanediol, 1,5-pentanediol, 1,3-dimethylpropanediol, 1,6-hexanediol, neopentyl glycol, 1,4-cyclohexanedimethanol, 2-methyl-1,3-propanediol, 2-ethyl-2-butylpropanediol, trimethylpentanediol, position isomeric diethyloctanediols, 1,2- and 1,4-cyclohexanediol, hydrogenated bisphenol A [2,2-bis(4-hydroxycyclohexyl)-propane], 2,2-dimethyl-3-hydroxypropionic acid (2,2-dimethyl-3-hydroxypropyl ester), trimethylolethane, 30 trimethylolpropane or glycerol,

b) ether diols, such as diethylene glycol, triethylene glycol, tetraethylene glycol, dipropylene glycol, tripropylene glycol, 1,3-butylene glycol or hydroquinone dihydroxyethyl ether,

c) ester diols of the general formulae (I) and (II),



in which

5 R is an alkylene or arylene radical having 1 to 10 C atoms, preferably 2 to 6 C atoms,

x is 2 to 6 and

y is 3 to 5,

such as, for example, [delta]-hydroxybutyl-[epsilon]-hydroxy-caproic acid ester, [omega]-hydroxyhexyl-[gamma]-hydroxybutyric acid ester, adipic acid ([beta]-hydroxyethyl) ester and
10 terephthalic acid bis([beta]-hydroxy-ethyl) ester, and

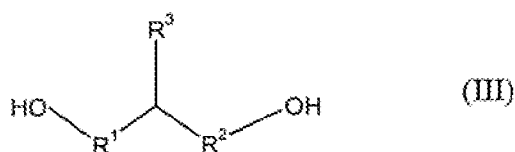
d) di- and polyamines, such as, for example, 1,2-diaminoethane, 1,3-diaminopropane, 1,6-diaminohexane, 1,3- and 1,4-phenylenediamine, 4,4'-diphenylmethanediamine, isophoronediamine, isomer mixture of 2,2,4- and 2,4,4-trimethylhexamethylenediamine, 2-methylpentamethylenediamine, diethylenetriamine, 1,3- and 1,4-xylylenediamine,
15 [alpha],[alpha],[alpha],[alpha]'-tetramethyl-1,3- and -1,4-xylylenediamine, 4,4-diaminodicyclohexylmethane, amino-functional polyethylene oxides or polypropylene oxides, which are obtainable under the name Jeffamin, D series (Huntsman Corp. Europe, Belgium), diethylenetriamine and triethylenetetramine. Diamines which are suitable in the context of the invention are also hydrazine, hydrazine hydrate and substituted hydrazines, such as, for example,
20 N-methylhydrazine, N,N'-dimethylhydrazine and homologues thereof, and acid dihydrazides, adipic acid, [beta]-methyladipic acid, sebacic acid, hydracrylic acid and terephthalic acid, semicarbazido-alkylene hydrazides, such as, for example, [beta]-semicarbazidopropionic acid hydrazide (for example described in DE-A 1 770 591), semicarbazidoalkylene carbazine esters,, such as, for example, 2-semicarbazidoethyl carbazine ester (for example described in DE-A 1 918
25 504) or also aminosemicarbazide compounds, such as, for example, [beta]-aminoethyl semicarbazido-carbonate (for example described in DE-A 1 902 931).

Component (A4) contains ionic groups, which can be either cationic or anionic in nature. Compounds having a cationic or anionic dispersing action are those which contain, for example, sulfonium, ammonium, phosphonium, carboxylate, sulfonate or phosphonate groups or groups
30 which can be converted into the abovementioned groups by salt formation (potentially ionic

groups) and can be incorporated into the macromolecules by the isocyanate-reactive groups present. Hydroxyl and amine groups are preferably suitable isocyanate-reactive groups.

Suitable ionic or potentially ionic compounds (A4) are, for example, mono- and dihydroxycarboxylic acids, mono- and diaminocarboxylic acids, mono- and dihydroxysulfonic acids, mono- and diaminosulfonic acids and mono- and dihydroxyphosphonic acids or mono- and diaminophosphonic acids and their salts, such as dimethylolpropionic acid, dimethylolbutyric acid, hydroxypivalic acid, N-(2-aminoethyl)-[beta]-alanine, 2-(2-amino-ethylamino)-ethanesulfonic acid, 1,2- or 1,3-propylenediamine-[beta]-ethylsulfonic acid, ethylenediamine-propyl- or -butylsulfonic acid, malic acid, citric acid, glycollic acid, lactic acid, glycine, alanine, taurine, lysine, 3,5-diaminobenzoic acid, an addition product of IPDI and acrylic acid (EP-A 0 916 647, Example 1) and alkali metal and/or ammonium salts thereof; the adduct of sodium bisulfite on but-2-ene-1,4-diol, polyether sulfonate, the propoxylated adduct of 2-butenediol and NaHSO₃, for example described in DE-A 2 446 440 (page 5-9, formula I-III) and units which can be converted into cationic groups, such as N-methyl-diethanolamine, as hydrophilic builder components. Preferred ionic or potentially ionic compounds are those which have carboxyl or carboxylate and/or sulfonate groups and/or ammonium groups. Particularly preferred ionic compounds are those which contain carboxyl and/or sulfonate groups as ionic or potentially ionic groups, such as the salts of N-(2-aminoethyl)-[beta]-alanine, of 2-(2-amino-ethylamino)ethanesulfonic acid or of the addition product of IPDI and acrylic acid (EP-A 0 916 647, Example 1) as well as of dimethylolpropionic acid.

Suitable compounds (A5) having a nonionic hydrophilizing action are, for example, polyoxyalkylene ethers which contain at least one hydroxyl or amino group. These polyethers contain a content of from 30 % by weight to 100 % by weight of units which are derived from ethylene oxide. Possible compounds are polyethers of linear structure having a functionality of between 1 and 3, and also compounds of the general formula (III)



in which

R¹ and R² independently of each other each denote a divalent aliphatic, cycloaliphatic or aromatic radical having 1 to 18 C atoms, which can be interrupted by oxygen and/or nitrogen atoms, and R³ represents an alkoxy-terminated polyethylene oxide radical.

Compounds having a nonionic hydrophilizing action are also, for example, monofunctional polyalkylene oxide polyether alcohols containing, as a statistical average, ≥ 5 to ≤ 70 , preferably ≥ 7 to ≤ 55 ethylene oxide units per molecule, such as are accessible in a manner known per se by alkoxylation of suitable starter molecules (for example in Ullmanns Encyclopädie der technischen
5 Chemie, 4th edition, volume 19, Verlag Chemie, Weinheim p. 31-38).

Suitable starter molecules are, for example, saturated monoalcohols, such as methanol, ethanol, n-propanol, isopropanol, n-butanol, isobutanol, sec-butanol, the isomeric pentanols, hexanols, octanols and nonanols, n-decanol, n-dodecanol, n-tetradecanol, n-hexadecanol, n-octadecanol, cyclohexanol, the isomeric methylcyclohexanols or hydroxymethylcyclohexane, 3-ethyl-3-
10 hydroxymethyloxetane or tetrahydrofurfuryl alcohol, diethylene glycol monoalkyl ethers, such as, for example, diethylene glycol monobutyl ether, unsaturated alcohols, such as allyl alcohol, 1,1-dimethylallyl alcohol or oleyl alcohol, aromatic alcohols, such as phenol, the isomeric cresols or methoxyphenols, araliphatic alcohols, such as benzyl alcohol, anisyl alcohol or cinnamyl alcohol, secondary monoamines, such as dimethylamine, diethylamine, dipropylamine, diisopropylamine,
15 dibutylamine, bis-(2-ethylhexyl)-amine, N-methyl- and N-ethylcyclohexylamine or dicyclohexylamine, and heterocyclic secondary amines, such as morpholine, pyrrolidine, piperidine or 1H-pyrazole. Preferred starter molecules are saturated monoalcohols. Diethylene glycol monobutyl ether is particularly preferably used as the starter molecule.

Alkylene oxides which are suitable for the alkoxylation reaction are, in particular, ethylene oxide
20 and propylene oxide, which can be employed in the alkoxylation reaction in any desired sequence or also in a mixture.

The polyalkylene oxide polyether alcohols are either pure polyethylene oxide polyethers or mixed polyalkylene oxide polyethers, the alkylene oxide units of which comprise ethylene oxide units to the extent of at least 30 mol%, preferably to the extent of at least 40 mol%. Preferred nonionic
25 compounds are monofunctional mixed polyalkylene oxide polyethers which contain at least 40 mol% of ethylene oxide units and not more than 60 mol% of propylene oxide units.

A combination of nonionic (A4) and ionic (A5) hydrophilizing agents is preferably used for the preparation of the polyurethane (A). Combinations of nonionic and anionic hydrophilizing agents are particularly preferred.

30 The preparation of the aqueous polyurethane (A) can be carried out in one or more stages in a homogenous or, in the case of a multi-stage reaction, partly in a disperse phase. After the polyaddition has been completely or partly carried out, a dispersing, emulsifying or dissolving step

is carried out. Thereafter, a further polyaddition or modification is optionally carried out in the disperse phase.

All the processes known from the prior art can be used for the preparation of the polyurethane (A), such as emulsifier-shearing force, acetone, prepolymer mixing, melt emulsification, ketimine and solid spontaneous dispersing processes or derivatives thereof. A summary of these methods is to be found in Methoden der organischen Chemie (Houben-Weyl, supplementary and follow-up volumes to the 4th edition, volume E20, H. Bartl and J. Falbe, Stuttgart, New York, Thieme 1987, p. 1671-1682). The melt emulsification, prepolymer mixing and the acetone process are preferred. The acetone process is particularly preferred.

10 For the preparation of a polyurethane prepolymer, all or portions of the constituents (A2) to (A5), which contain no primary or secondary amino groups, and a polyisocyanate (A1) are conventionally initially introduced into the reactor and the mixture is heated up to higher temperatures, preferably in the range of from 50 to 120 °C, optionally diluted with a solvent which is water-miscible but inert towards isocyanate groups, but preferably without a solvent.

15 Suitable solvents are, for example, acetone, butanone, tetrahydrofuran, dioxane, acetonitrile, dipropylene glycol dimethyl ether and 1-methyl-2-pyrrolidone, which can be added not only at the start of the preparation, but optionally in portions also later. Acetone and butanone are preferred. It is possible to carry out the reaction under normal pressure or increased pressure, e.g. above the normal pressure boiling temperature of a solvent, such as, for example, acetone.

20 The catalysts known for acceleration of the isocyanate addition reaction, such as, for example, triethylamine, 1,4-diazabicyclo-[2,2,2]-octane, dibutyltin oxide, tin dioctoate or dibutyltin dilaurate, tin bis-(2-ethylhexanoate) or other organometallic compounds, can furthermore be also initially introduced or metered in later. Dibutyltin dilaurate is preferred.

The constituents (A1), (A2), optionally (A3) and (A4) and/or (A5), which contain no primary or secondary amino groups, which optionally have not yet been added at the start of the reaction are then metered in. In the preparation of the polyurethane prepolymer, the ratio of the substance amounts of isocyanate groups to isocyanate-reactive groups is ≥ 0.90 to ≤ 3 , preferably ≥ 0.95 to ≤ 2.5 , particularly preferably ≥ 1.05 to ≤ 2.0 . The reaction of components (A1) to (A5) takes place partially or to completion, but preferably to completion, with respect to the total amount of isocyanate-reactive groups of the part of (A2) to (A5) which contains no primary or secondary amino groups. The degree of conversion is conventionally monitored by monitoring the NCO content of the reaction mixture. For this, either spectroscopic measurements, for example infrared or near infrared spectra, determinations of the refractive index or chemical analyses, such as

titrations of samples taken, can be carried out. Polyurethane prepolymers which contain free isocyanate groups are obtained in substance or in solution.

- After or during the preparation of the polyurethane prepolymers from (A1) and (A2) to (A5), partial or complete salt formation of the groups having an anionic and/or cationic dispersing action takes place, if this has not yet been carried out in the starting molecules. In the case of anionic groups, bases, such as ammonia, ammonium carbonate or ammonium bicarbonate, trimethylamine, triethylamine, tributylamine, diisopropylethylamine, dimethylethanolamine, diethylethanolamine, triethanolamine, potassium hydroxide or sodium carbonate, are employed for this, preferably triethylamine, triethanolamine, dimethylethanolamine or diisopropylethylamine. The substance amount of the bases is between 50 and 100 %, preferably between 60 and 90 % of the substance amount of the anionic groups. In the case of cationic groups, sulfuric acid dimethyl ester or succinic acid are employed. If only nonionically hydrophilized compounds (A5) with ether groups are used, the neutralization step is omitted. The neutralization can also be carried out at the same time as the dispersing, in that the dispersing water already contains the neutralizing agent.
- Possible aminic components are (A2), (A3) and (A4) with which still remaining isocyanate groups can optionally be reacted. This chain lengthening in this context can be carried out either in a solvent before the dispersing, during the dispersing or in water after the dispersing. If aminic components are employed as (A4), the chain lengthening is preferably carried out before the dispersing.
- The aminic components (A2), (A3) or (A4) can be added to the reaction mixture in a form diluted with organic solvents and/or with water. Preferably, ≥ 70 % by weight to ≤ 95 % by weight of solvent and/or water is employed. If several aminic components are present, the reaction can be carried out in succession in any desired sequence or simultaneously by addition of a mixture.

- For the purpose of preparation of the polyurethane dispersion (A), the polyurethane prepolymers are either introduced into the dispersing water, optionally under high shearing forces, such as, for example, vigorous stirring or using a jet disperser, or, conversely, the dispersing water is stirred into the prepolymer. The increase in molecular weight by reaction of isocyanate groups which may be present with components (A2), (A3) can then be carried out, if this has not yet taken place in the homogeneous phase. The amount of polyamine (A2), (A3) employed depends on the unreacted isocyanate groups still present. Preferably, ≥ 50 to ≤ 100 %, particularly preferably $\geq 75\%$ to ≤ 95 % of the substance amount of isocyanate groups are reacted with polyamines (A2), (A3).

The organic solvent can optionally be distilled off. The dispersions have a solids content of from ≥ 10 to ≤ 70 % by weight, preferably ≥ 25 to ≤ 65 % by weight and particularly preferably ≥ 30 to ≤ 60 % by weight.

5 The polyurethane dispersions can be employed by themselves or with known binders, auxiliary substances and additives, in particular light stabilizers, such as UV absorbers and sterically hindered amines (HALS), furthermore antioxidants, fillers and lacquer auxiliary substances, for example antisetling agents, defoaming and/or wetting agents, flow agents, reactive diluents, plasticizers, catalysts, auxiliary solvents and/or thickeners and additives, such as, for example, dispersions, pigments, dyestuffs or matting agents. In particular, combinations with polyurethane
10 dispersions or polyacrylate dispersions, which can optionally also be hydroxy-functional, are possible without problems. The additives can be added to the PU dispersions directly before processing. However, it is also possible to add at least a portion of the additives before or during the dispersing of the binder or binder/crosslinking agent mixture. The choice and the metering of these substances which can be added to the individual components and/or the total mixture, are
15 known to the person skilled in the art.

In a further embodiment of the process according to the invention, the adhesive comprises a polyurethane hot melt adhesive. Such adhesives are also called hot melts. They are preferably hot melt adhesive films or reactive hot melt adhesives. For reactive hot melt adhesives, linear polyesters and/or polyether polyols are preferably used in combination with an excess of
20 polyisocyanates, preferably diisocyanates.

The advantages of this product class lie above all in the absence of solvents, the possibility of applying the products hot with relatively low viscosities and nevertheless of obtaining high initial strengths and, because of the further reaction with moisture, of obtaining after a relatively short time adhesive bonds with a very high heat resistance far above the application temperatures and
25 excellent resistances to solvents. An example for a reactive hot melt adhesive comprises:

A') at least one aromatic, aliphatic, araliphatic and/or cycloaliphatic isocyanate, preferably with a content of free NCO groups of from 5 to 60 wt.% (based on A') and

B') a polyol or polyol mixture containing at least one polyester polyol.

30 The preparation of the compositions is preferably carried out, for example, by a procedure in which the polyols B') and the isocyanates A') are mixed, the ratio of A' to B' being chosen such that the molar ratio of NCO to OH is > 1 , preferably from ≥ 1.2 to ≤ 4.0 , particularly preferably from ≥ 1.3 to ≤ 3.0 , and the homogeneous mixture is filled into containers or is stirred until a constant NCO value is obtained and then filled into containers. ≥ 60 °C to ≤ 150 °C, preferably ≥ 80 °C to

$\leq 130^{\circ}\text{C}$ are chosen as the preferred reaction temperature. The preparation of the formulations can also be carried out continuously in a cascade of stirred tanks or in suitable mixing units, such as, for example, rapidly rotating mixers by the rotor-stator principle or a static mixer.

It is also possible to modify the polyols or polyol mixture B') or a part thereof with a deficit of A') and, when the reaction has ended, to react the polyols containing urethane groups with an excess of A') to give a composition containing isocyanate groups.

It is likewise possible to carry out the reaction of the polyols B') with the isocyanates A') in the presence of up to 5 % by weight of, for example, trimers of aliphatic and/or aromatic diisocyanates, such as, for example, HDI, or to add such trimers when the prepolymerization has ended.

In a further embodiment of the process according to the invention, the adhesive includes a moisture-curing 1C PU adhesive. It is likewise possible to formulate the prepolymer as a 2C PU adhesive together with a component containing OH groups.

Monomeric diisocyanates for the preparation of the prepolymers are those aromatic, aliphatic or cycloaliphatic di- or triisocyanates of which the molecular weight is less than 500 g/mol. Examples of suitable aromatic diisocyanates are all the isomers of toluylene-diisocyanate (TDI), either in the isomerically pure form or as a mixture of several isomers, naphthalene-1,5-diisocyanate (NDI), naphthalene-1,4-diisocyanate (NDI), diphenylmethane-4,4'-diisocyanate (MDI), diphenylmethane-2,4'-diisocyanate and mixtures of 4,4'-diphenylmethane-diisocyanate with the 2,4' isomer, xylylene-diisocyanate (XDI), 4,4'-diphenyldiethylmethane-diisocyanate, di- and tetraalkyl-diphenylmethane-diisocyanate, 4,4'-dibenzyl-diisocyanate, 1,3-phenylene-diisocyanate, 1,4-phenylene-diisocyanate. Examples of suitable cycloaliphatic diisocyanates are the hydrogenation products of the abovementioned aromatic diisocyanates, such as e.g. 4,4'-dicyclohexylmethane-diisocyanate, isophorone-diisocyanate, cyclohexane-1,4-diisocyanate, hydrogenated xylylene-diisocyanate (H6XDI), 1-methyl-2,4-diisocyanato-cyclohexane, m- or p-tetramethylxylylene-diisocyanate (m-TMXDI, p-TMXDI) and dimer fatty acid diisocyanate. Examples of aliphatic diisocyanates are tetramethoxybutane-1,4-diisocyanate, butane-1,4-diisocyanate, hexane-1,6-diisocyanate (HDI), 1,6-diisocyanato-2,2,4-trimethylhexane, 1,6-diisocyanato-2,4,4-trimethylhexane, lysine-diisocyanate and 1,12-dodecane-diisocyanate (C12 DI).

Polyisocyanates which are formed by trimerization or oligomerization of diisocyanates or by reaction of diisocyanates with polyfunctional low molecular weight compounds containing hydroxyl or amino groups are also suitable as isocyanates which are at least trifunctional. Commercially obtainable products are, for example, trimerization products of the isocyanates HDI, MDI or IPDI as a biuret, uretdione or carbodiimide.

In particular, isocyanates which contain isocyanate groups of different functionality can also be employed.

Examples of such aromatic asymmetric diisocyanates are all the isomers of toluylene-diisocyanate (TDI), either in the isomerically pure form or as a mixture of several isomers, naphthalene-1,5-diisocyanate (NDI), naphthalene-1,4-diisocyanate (NDI), diphenylmethane-2,4'-diisocyanate (MDI) and mixtures of 4,4'-diphenylmethane-diisocyanate with the 2,4'-MDI isomer and 1,3-phenylene-diisocyanate. Examples of suitable cycloaliphatic asymmetric diisocyanates are e.g. isophorone-diisocyanate, 1-methyl-2,4-diisocyanato-cyclohexane or hydrogenation products of the abovementioned aromatic diisocyanates, in particular hydrogenated MDI in isomerically pure form, preferably hydrogenated 2,4'-MDI. Examples of aliphatic asymmetric diisocyanates are 1,6-diisocyanato-2,4,4-trimethylhexane and lysine-diisocyanate.

Aromatic isocyanates are particularly preferably suitable as isocyanates. These have a high reactivity and a rapid rate of reaction in the adhesive.

In this context, a large number of higher molecular weight polyhydroxy compounds can be used as polyols for the synthesis of the PU prepolymer. Suitable polyols are preferably polyhydroxy compounds with two or three hydroxyl groups per molecule in the molecular weight range of from 200 to 4,000 g/mol, preferably in the range of from 400 to 2,000 g/mol. Examples are di- and/or trifunctional polypropylene glycols, and random and/or block copolymers of ethylene oxide and propylene oxide can also be employed. A further group of polyethers to be employed are the polytetramethylene glycols (poly(oxytetramethylene) glycol, poly-THF), which are prepared e.g. by acid polymerization of tetrahydrofuran.

Those polyesters which can be prepared by condensation of di- or tricarboxylic acids, such as e.g. adipic acid sebacic acid, glutaric acid, azelaic acid, suberic acid, undecanedioic acid, dodecanedioic acid, 3,3-dimethyl-glutaric acid, terephthalic acid, isophthalic acid, hexahydrophthalic acid, or mixtures thereof, with low molecular weight diols or triols, such as e.g. ethylene glycol, propylene glycol, diethylene glycol, triethylene glycol, dipropylene glycol, 1,4-butanediol, 1,6-hexanediol, 1,8-octanediol, 1,10-decanediol, 1,12-dodecanediol, dimer fatty alcohol, glycerol, trimethylolpropane or mixtures thereof, are furthermore suitable as polyols. A further group of the polyols which are to be employed according to the invention are the polyesters based on ϵ -caprolactone, also called polycaprolactones. In this context, the molecular weight of such polyester polyols should be below 2,000 g/mol.

However, polyester polyols of oleochemical origin can also be used. Such polyester polyols can be prepared, for example, by complete ring-opening of epoxidized triglycerides of a fatty acid mixture

containing at least partly olefinically unsaturated fatty acid with one or more alcohols having 1 to 12 C atoms and subsequent partial transesterification of the triglyceride derivatives to give alkyl ester polyols having 1 to 12 C atoms in the alkyl radical. Further suitable polyols are polycarbonate polyols, dimer diols and castor oil and derivatives thereof. The hydroxy-functional polybutadienes
5 such as are obtainable e.g. under the trade name Poly-bd can also be employed as polyols for the compositions according to the invention.

Linear and/or weakly branched acrylic ester copolymer polyols which can be prepared, for example, by free radical copolymerization of acrylic acid esters or methacrylic acid esters with hydroxy-functional acrylic acid and/or methacrylic acid compounds, such as hydroxyethyl
10 (meth)acrylate or hydroxypropyl (meth)acrylate, are furthermore suitable as polyols. Because of this preparation procedure, the hydroxyl groups in these polyols are as a rule randomly distributed, so that these are either linear or weakly branched polyols with an average OH functionality. Although the difunctional compounds are preferred for the polyols, polyols of higher functionality can also be used, at least in minor amounts.

15 The polyols should preferably be predominantly liquid. The molecular weight should in general be below 2,000 g/mol, in particular below 1,200 g/mol. In this context, it is preferable if diols or mixtures thereof are employed. Contents of triols of higher functionality can also be employed. In a particular embodiment, polyether diols or polyalkylene diols with a molecular weight of < 2,000 g/mol are employed. In another embodiment, up to 25 wt.% of trifunctional alcohols, in
20 particular oleochemical polyols or polyethers, are additionally employed.

The reaction of the monomeric diisocyanates with the polyols in this context is carried out in a manner known per se, optionally with the addition of aprotic solvents. In order to avoid the formation of higher oligomers, it is advantageous to employ an excess of diisocyanates in relation to the diols. The formation of more highly branched prepolymers should largely be avoided.

25 In one embodiment, when the reaction has ended the reaction product can be freed as far as possible from monomeric diisocyanate. The purification step can be carried out by processes known per se. For example, the monomeric isocyanate can be removed by selective extraction, for example using supercritical carbon dioxide or other supercritical aprotic solvents. Preferably, if volatile monomeric diisocyanates are used, such as TDI, TMXDI, IPDI, XDI, MDI, the excess
30 monomeric diisocyanate can be removed from the reaction mixture by distillation. For this, the distillation is preferably carried out in vacuo with the aid of a thin layer evaporator or a thin film evaporator. Such distillation processes are described in the literature.

The polyurethane adhesives used according to the invention can furthermore contain auxiliary substances, which in the case of 2C adhesives can be added in full or in part to the polyol component, and in the case of 1C adhesives they are admixed to the prepolymer.

5 These are understood as meaning substances which as a rule are added in order to modify the properties of the essential components in the desired direction, e.g. to adapt their processability, storage stability and also use properties to the concrete field of use. Examples of these are finely divided fillers, flow agents, deaerating agents, thixotropy agents, catalysts, resins, antiageing agents, stabilizers, dyestuffs, adhesion promoters and wetting agents.

10 If the polyurethane prepolymer is built up predominantly from polyether units, antioxidants, optionally in combination with UV stabilizers, are chiefly necessary. If essential constituents of the polyurethane prepolymer consist of polyester units, hydrolysis stabilizers, e.g. of the carbodiimide type, are preferably employed.

15 The choice of these stabilizers depends on the one hand on the main components of the composition, and on the other hand on the application conditions and the expected exposure to stresses of the cured product.

The PU prepolymer can additionally contain a resin. These resins are liquid to solid organic products for which a more or less broad distribution of the relative molecular weight is characteristic. They usually have an amorphous structure. The known resins can be used, whether of natural or synthetic origin. The natural resins can be of either plant or animal origin. Examples
20 of these are shellac and colophony resins, such as tall oil resin, balsam resin or root resin. Not only the natural resins, but also derivatives thereof are suitable, such as hydrogenated, esterified or neutralized resins. The synthetic resins are in general obtained by polymerization or polycondensation. Examples of these are urea, melamine, hydrocarbon, terpene, coumarone/indene, furan, aldehyde, ketone, ketone/aldehyde, phenolic, alkyd, glycerol ester, polyester, epoxy,
25 polyamide and isocyanate resins. These resins can contain isocyanate-reactive groups, or they contain no such groups.

Adhesives can be formulated from the PU prepolymers. In this context it is possible to prepare 1C PU adhesives, these then containing 95.5 to 70 wt.% of the polyurethane prepolymer which contains NCO groups and is suitable according to the invention, and 0.5 to 30 wt.% of drying
30 and/or semi-drying oils. These 1C PU adhesives can optionally also contain up to 25 wt.% of additives and auxiliary substances. In particular, it is expedient for them to contain 0.01 to 2 % of catalysts, where the catalysts can be contained for the polyurethane reaction, and additionally catalysts for a crosslinking reaction of the drying or semi-drying oils.

In a preferred embodiment, 2 to 20 wt.%, based on the prepolymer, of drying oils are present.

2C PU adhesives can furthermore be formulated from the PU prepolymers, which have NCO groups and are suitable according to the invention, together with the drying oils. In this context, the NCO-reactive PU prepolymer component can optionally contain up to 25 wt.% of additives and
5 auxiliary substances, but in particular these are added to the component containing OH groups.

The amount of component containing OH groups should be up to 50 wt.%, based on the PU prepolymer, an NCO:OH ratio which has a low excess of isocyanate groups being chosen. For example, the NCO:OH ratio should be from 1.2 to 2, in particular from 1.05 to 1.5. These two components are stored separately until used, and are mixed directly before use and then used as an
10 adhesive.

Liquid polyols with a functionality of from 2 to 5 can be chosen as the component containing OH groups. These can be one or more of the polyols mentioned above. In this context, however, the molecular weight can be higher, and can be, for example, up to 10,000 g/mol. Preferably, these polyols have a functionality of more than two and optionally increase the crosslinking density. This
15 component can likewise contain resins containing OH groups. The corresponding functional groups are to be taken into account in the amount of isocyanate groups.

The viscosity of the adhesive according to the invention should be between 100 to 100,000 mPas (measured in accordance with EN ISO 2555, Brookfield viscometer), measured at the application temperature. This should be, in particular, between 15 and 40 °C, and in particular this viscosity
20 should exist at room temperature (20 - 30 °C).

The PU adhesives according to the invention can be applied to various substrates. Due to the low viscosity, they can be processed at room temperature. They flow well on to the substrate and can be applied in a thin layer. The adhesives crosslink by moisture from the atmosphere or by the second component containing OH groups. In this context, the crosslinking can be accelerated by elevated
25 temperature.

In a further embodiment of the process according to the invention, a pressure of from ≥ 0.1 bar to ≤ 2 bar is exerted by the contracted enclosing flexible casing on the first and second component which have been joined together. Preferably, the pressure is in a range of from ≥ 0.5 bar to ≤ 1 bar. This is sufficient to fix an adhesive bond.

30 In a further embodiment of the process according to the invention, several first and second components which have been joined together are enclosed by the enclosing flexible casing and,

after the action of the external stimulus, the contracted enclosing flexible casing is portioned into individual packages each with a first and second component which have been joined together. This has the advantage that when the process is used, each component which has been joined together is not contracted individually in the device, but several components which have been joined together
5 can be contracted at the same time. In order to separate the several components which have been joined together from one another, a separating device, such as, for example, a cutting edge, is used, which separates through the contracted enclosing flexible casing after each component which has been joined together.

The present invention also provides a component which has been joined together, obtainable by a
10 process according to the invention, wherein an enclosing flexible casing at least partly encloses the component which has been joined together and a pressure acts at least partly on adhesive between a first and second component. Details have already been described in connection with the process according to the invention, so that reference is made to these in order to avoid repetitions.

In one embodiment of the component according to the invention, the component which has been
15 joined together is footwear. In particular, the footwear can be a shoe or a boot.

The invention is explained in more detail in the following with the aid of a preferred embodiment with reference to the attached drawings. The figures show:

- | | |
|-----------|---|
| FIG. 1 | a first and a second component |
| FIG. 2 | a first and a second component on to which an adhesive has been applied |
| 20 FIG. 3 | a first and the second component which are joined together |
| FIG. 4 | an enclosing flexible casing which encloses the components which have been joined together |
| FIG. 5 | an assembled component which is surrounded by a one-part contracted enclosing flexible casing |
| 25 FIG. 6 | an assembled component which is surrounded by a two-part contracted enclosing flexible casing |
| FIG. 7 | an item of footwear which is surrounded by a contracted enclosing flexible casing |

FIG. 1 shows a diagram of a first 1 and a second component 2 which are to be joined together. The first 1 and the second component 2 are provided for further treatment.

30 An adhesive 3 is applied in FIG. 2 to in each case a facing side of the first 1 and the second component 2. It is also conceivable for the adhesive to be applied either only to the first 1 or to the second component 2. An adhesive based on a polyurethane dispersion or a polyurethane hot melt adhesive is preferably used as the adhesive.

It can be seen in FIG. 3 how the first 1 and the second component 2 have been joined together and how they are at least partly bonded to one another by the adhesive 3.

According to the invention, in FIG. 4 a component which has been joined together is placed in an enclosing flexible casing. This enclosing flexible casing 4 is constructed as one part in FIG. 5 and
5 can be a vacuum packaging, a shrink film or a film. The enclosing flexible casing 4 can be made of a thermoplastic, for example polyamide, polyethylene, polyolefins, PVDF, PVC, PTFE, and/or of a composite film.

In a device which is not shown, the enclosing flexible casing 4 is contracted by an external stimulus, so that the enclosing flexible casing 4 draws itself around the assembled component. In
10 this context, an external stimulus consists of an evacuation of the air in the enclosing flexible casing 4 and/or a heat treatment of the outside of the enclosing flexible casing 4.

A contracted one-part enclosing flexible casing 4 is shown in FIG. 5. Due to the contraction of the enclosing flexible casing 4, a pressure acts on the first 1 and the second component 2. In this context, a pressure which is sufficient to fix the first 1 and the second component 2 is generated.
15 Furthermore, due to the enclosing flexible casing, a device for pressing the first 1 and the second component 2 is saved, since the assembled component remains in the enclosing flexible casing 4, and the adhesive 3 can achieve a sufficiently high cohesive strength before the enclosing flexible casing 4 is removed.

Due to the contraction of the enclosing flexible casing 4, a pressure of from 0.1 to 2 bar is built up.
20 It can furthermore be seen that the opening of the enclosing flexible casing 4 has been welded so that no environmental influences, for example dirt particles or air, can enter from the outside into the enclosing flexible casing 4.

A multi-part contracted enclosing flexible casing 4 is shown in FIG. 6. This has the advantage that, for example, in the device which is not described and shown, several assembled components can be
25 fed simultaneously to an external stimulus. The assembled components can then be portioned with the aid of a separating device in the device, for example a cutting edge, into individual packages each with a first 1 and second component 2 which has been joined together. In a multi-part contracted enclosing flexible casing 4, a pressure also acts on the first 1 and second component 2 so that the adhesive 3 can reach a sufficiently high cohesive strength.

30 An example of the use of the process is shown in FIG. 7. In an item of footwear 5, a sole has been glued on to the upper. It can be seen how the contracted enclosing flexible casing 4 has drawn itself around the item of footwear 5. As a result, a sufficient pressure acts on the upper and the sole, so that the adhesive 3 can reach a sufficient cohesive strength. A device for pressing and the

associated waiting time can thus be dispensed with. The item of footwear 5 can furthermore be delivered in the enclosing flexible casing 4, so that repackaging can be omitted.

Claims

1. Process for joining together at least two components (1, 2), comprising the steps:
 - provision of a first (1) and a second component (2);
 - application of an adhesive (3) to the first (1) and/or second component (2);
 - 5 joining together of the first (1) and second component (2), the first (1) and second component (2) being at least partly bonded to one another by the adhesive (3);
 - introduction of the first (1) and second component (2) into a flexible casing (4);
 - exertion of pressure on the first (1) and second component (2), the pressure acting at least partly on the adhesive (3) between the first (1) and second component (2), and subsequent
 - 10 storage of the first (1) and second component (2) in the contracted flexible casing for a period of at least 1 minute;
 - the pressure being exerted such that a flexible casing (4) at least partly enclosing the first (1) and second component (2) is contracted by an external stimulus and
 - the external stimulus being based on a heat treatment and/or on an evacuation of
 - 15 the enclosing flexible casing (4).
2. Process according to claim 1, wherein the first component (1) comprises a shoe sole and the second component (2) comprises a shoe upper.
3. Process according to claim 1, wherein the storage of the first (1) and second component (2) takes place for a period of at least 5 minutes.
- 20 4. Process according to claim 1, wherein a vacuum packaging is used as the enclosing flexible casing (4).
5. Process according to claim 5, wherein a shrink film, shrink hood and/or a shrink tube is used as the enclosing flexible casing (4).
6. Process according to claim 1, wherein the adhesive (3) comprises an aqueous polyurethane
- 25 dispersion.
7. Process according to claim 1, wherein the adhesive (3) comprises a polyurethane hot melt adhesive.

8. Process according to claim 1, wherein the adhesive (3) is a moisture-curing 1C PU adhesive or a 2C PU adhesive.
9. Process according to claim 1, wherein a pressure of from ≥ 0.1 bar to ≤ 2 bar is exerted by the contracted enclosing flexible casing (4) on the first (1) and second component (2) which have been
5 joined together.
10. Process according to claim 1, wherein several first (1) and second components (2) which have been joined together are enclosed by the enclosing flexible casing (4) and, after the action of the external stimulus, the contracted enclosing flexible casing (4) is portioned into individual packages each with a first (1) and second component (2) which have been joined together.
- 10 11. Component which has been joined together, obtainable by a process according to claim 1, wherein an enclosing flexible casing (4) at least partly encloses the component which has been joined together and a pressure acts at least partly on adhesive (3) between a first (1) and second component (2).
12. Component which has been joined together according to claim 11, wherein the component
15 which has been joined together is an item of footwear (5).

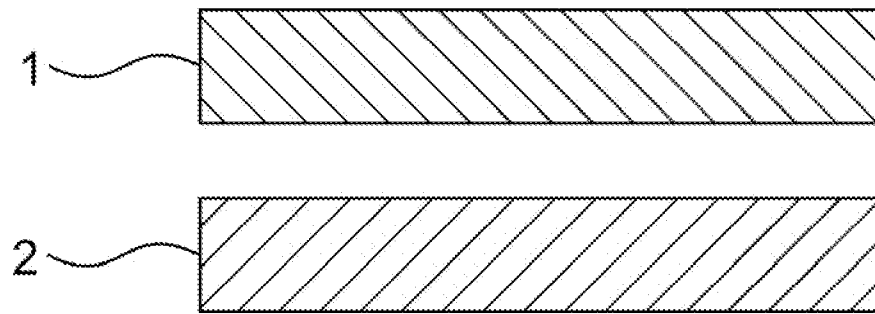


FIG. 1

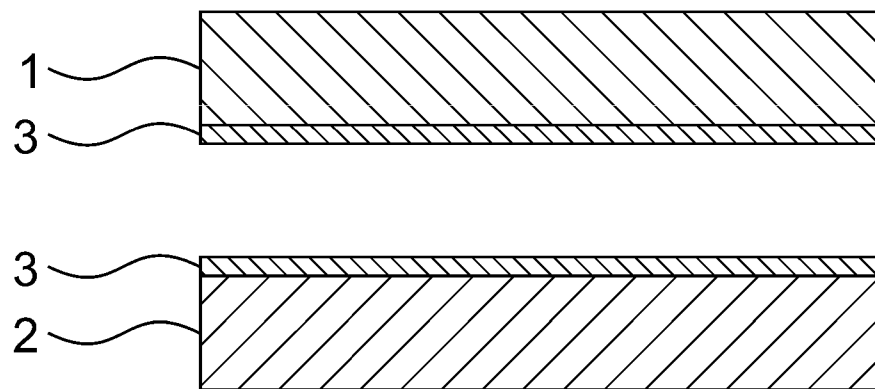


FIG. 2

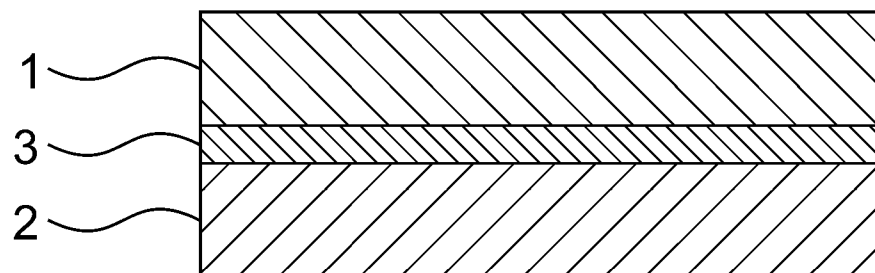


FIG. 3

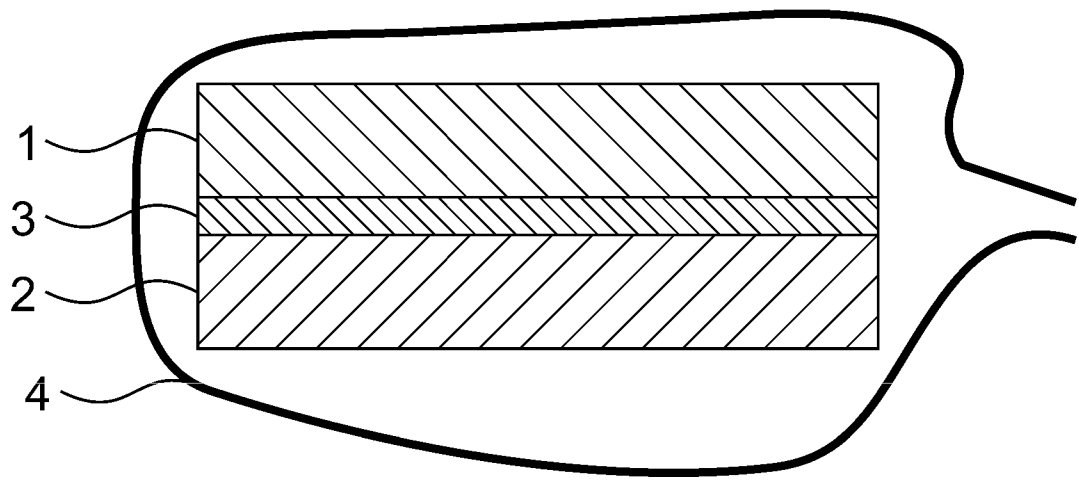


FIG. 4

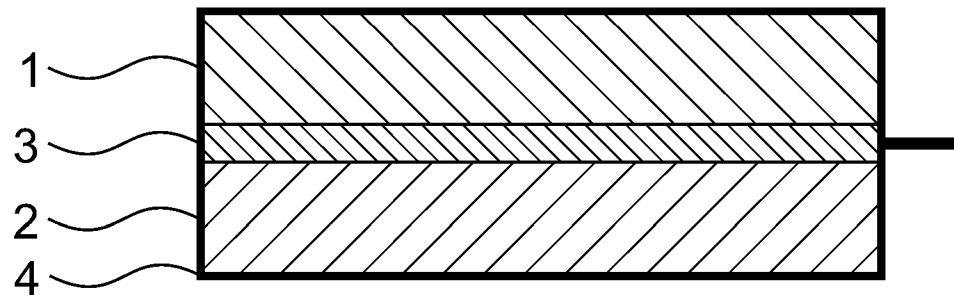


FIG. 5

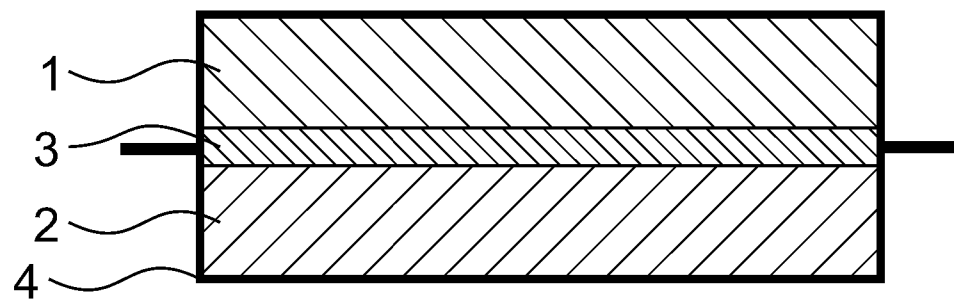


FIG. 6

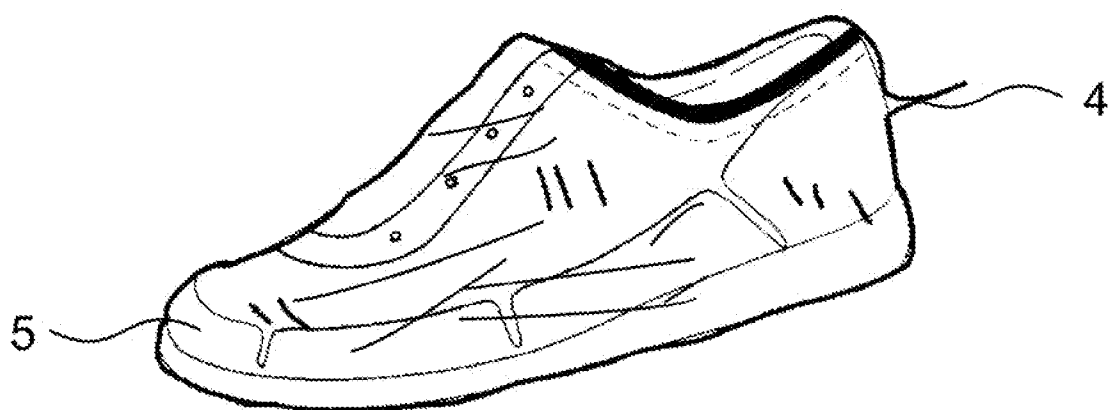


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2011/057774

A. CLASSIFICATION OF SUBJECT MATTER

INV. A43B9/12 A43D25/07 B65D71/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A43B A43D B65D B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 150 625 A1 (PRODEF [FR]) 13 April 1973 (1973-04-13)	1,3,5-11
A	page 2 - page 4; figures -----	2,4,12
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☒ Further documents are listed in the continuation of Box C.

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

International application No

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