



(51) International Patent Classification:

C09J 153/02 (2006.01) C09J 123/26 (2006.01)

C09J 193/04 (2006.01) C09J 167/02 (2006.01)

C09J 157/02 (2006.01) C09J 7/00 (2018.01)

(21) International Application Number:

PCT/EP2018/064230

(22) International Filing Date:

30 May 2018 (30.05.2018)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

17173738.0 31 May 2017 (31.05.2017) EP

(71) Applicant: SIKA TECHNOLOGY AG [CH/CH]; Zugerstrasse 50, 6340 Baar (CH).

(72) Inventor: BRÜGGEMANN, Simon; Heidhörn 7, 22307 Hamburg (DE).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: HOT-MELT PRESSURE SENSITIVE ADHESIVE COMPOSITION HAVING REDUCED SENSORY IMPRESSION OF SMELL

(57) Abstract: The invention is directed to adhesive compositions containing 20 – 60 wt.-% of at least one styrene block copolymer, 25 – 70 wt.-% of at least one at 25 °C solid tackifying resin, and 0.1 – 20 wt.-% of at least one polyester polyol. The adhesive composition is especially suitable for use as a hot-melt pressure sensitive adhesive. The invention is also directed to a method for bonding substrates together using the adhesive composition and to the use of polyester polyols for reducing sensory impression of smell of adhesives containing 15 – 70 wt.-% of at least one styrene block copolymer.



Hot-melt pressure sensitive adhesive composition having reduced sensory impression of smell

5 Technical field

The invention relates to an adhesive composition, in particular to a hot-melt pressure sensitive adhesive compositions and use thereof for bonding substrates.

10

Background of the invention

Hot-melt adhesives are one-component, water and solvent free adhesives,
15 which are solid at room temperature. These adhesives are applied as a melt and the adhesive bond is established by solidifying on cooling. Due to the relatively short open time, the substrates to be bonded are normally fitted together immediately or few minutes after the application of the adhesive melt. In some applications the waiting time, i.e. the time period between applying the
20 adhesive to the surface of the first substrate and contacting the adhesive film with the second substrate, is relatively long and the adhesive layer must be reactivated by heating. Typically the first substrate coated with the adhesive is cooled and stored for more or less long period of time until the adhesive coating is heated to an application temperature and contacted with surface of
25 another substrate.

Hot-melt adhesives have the advantage of developing a high initial strength immediately after their application upon cooling and they also provide good thermal stability and resistance to environmental influences. State-of-the-Art
30 hot-melt adhesives have the disadvantage that they have to be melted, not only for application, but also for bonding of substrates in case of long waiting times. Also bonding of large surfaces with thin layer of adhesives is typically not possible without additional heating. Patent application JP 2007153364 A

discloses a packaging material comprising a printing layer formed on a sheet of base material. The printing layer is composed of a composition containing as its main constituent a hydrogenated styrene-butadiene-styrene block copolymer, which has been modified with unsaturated carboxylic acid or its anhydride. The primer composition further comprises a polyester polyol having a hydroxyl value of 50 – 200 g/KOH. Another patent application US 2006/0084755 A1 discloses a reactive hot-melt adhesive composition comprising an isocyanate, one or more acrylic copolymers having at least one functional group, which is capable of reacting with isocyanate groups. The reactive adhesive composition can further comprise a tackifier and a polyol. According to the patent application, the disclosed adhesive compositions have the advantage of increased pre-cure bond strength and improved machining characteristics.

Hot-melt adhesives that can be used as pressure sensitive adhesives are also known (PSA-HM). These adhesives can be applied as a melt and they adhere immediately to almost any kind of substrates by application of light pressure. Typically the surface of a PSA-HM adhesive is permanently tacky at normal room temperature and a silicone paper is used as a release liner to avoid unwanted bonding. These types of adhesives have the advantage over conventional hot-melt adhesives that they can be used for bonding of large surfaces with thin adhesive films. Furthermore, in case of long waiting times PSA-HM adhesives can be used without reactivation by heating since the adhesive layer is permanently tacky.

25

The State-of-the-Art PSA-HM adhesive, however, have the disadvantage of having an unpleasant odor resulting from the relatively high amount of low molecular weight substances contained in the adhesive, which makes them less suitable for indoor applications. The low molecular weight substances include monomer residues like styrene, vinyl-acetate, and acrylic esters, by-products of natural resins such as sulphur containing molecules, and synthetic stabilizers. In particular, adhesives that are used for bonding automotive interior parts, such as headliners, consoles, door panels, flooring, and

30

instrument panels should be as odorless as possible. These types of adhesives should also have a very low odor at elevated temperatures and at varying climate conditions.

- 5 There is thus a need for a low-odor PSA-HM adhesive, which has high tackiness, initial bonding strength and thermal stability.

Summary of the invention

10

The objective of the present invention is to provide a low-odor adhesive composition, which has a high tackiness, initial bonding strength, and thermal stability.

- 15 Another objective of the present invention is to provide a method for bonding substrates.

It has been surprisingly found out that an adhesive composition comprising at least one styrene block copolymer, at least one at temperature of 25 °C solid
20 tackifying resin, and at least one polyester polyol is able to solve the problems related to State-of-the-Art PSA-HM adhesive compositions.

The subject of the present invention is an adhesive composition as defined in claim 1.

25

One of the main advantages of the adhesive composition of the present invention is that it has a very low odor, which makes it suitable also for indoor applications, in particular for bonding automotive interior parts.

- 30 Other aspects of the present invention are presented in other independent claims. Preferred aspects of the invention are presented in the dependent claims.

Detailed description of the invention

The subject of the present invention is an adhesive composition comprising:

5

- a) 20 – 60 wt.-% of at least one styrene block copolymer,
- b) 25 – 70 wt.-% of at least one at 25 °C solid tackifying resin, and,
- c) 0.1 – 20.0 wt.-% of at least one polyester polyol, all proportions being based on the total weight of the adhesive composition.

10

Substance names beginning with "poly" designate in the present document substances which formally contain, per molecule, two or more of the functional groups occurring in their names. For instance, a polyol refers to a compound having at least two hydroxyl groups. A polyether refers to a compound having at least two ether groups.

15

The term "polyester polyol" designates in the present document organic compounds having at least two hydroxyl groups (preferably including alpha, omega hydroxyl-groups) and at least one carboxylic ester-functionality (CO₂ – C). Polyester polyols can be obtained from reaction aliphatic or aromatic diacids or anhydrides with an excess of polyols. The term "polyester polyol" also includes copolyesters obtained from reaction of more than one polyol and/or more than one dibasic acid.

20

The term "molecular weight" designates in the present document the molar mass (g/mol) of a molecule or a part of a molecule, also referred to as "moiety". The term "average molecular weight" refers to number average molecular weight (M_n) of an oligomeric or polymeric mixture of molecules or moieties. The molecular weight may be determined by gel permeation chromatography using polystyrene as standard in a polymer solution in tetrahydrofuran

25
30

The term "glass transition temperature" refers to the temperature measured by DSC according to ISO 11357 standard above which temperature a polymer

component becomes soft and pliable, and below which it becomes hard and glassy. The measurements can be performed with a Mettler Toledo 822e device at a heating rate of 2 degrees centigrade /min. The T_g values can be determined from the measured DSC curve with the help of the DSC software.

5

The term "softening point" refers in the present document to a temperature at which compound softens in a rubber-like state, or a temperature at which the crystalline portion within the compound melts. The softening point can be measured by a ring and ball method according to DIN EN 1238.

10

The adhesive composition is preferably a hot-melt adhesive composition, preferably a hot-melt pressure sensitive adhesive composition (HMPSA).

The adhesive composition of the present invention comprises at least one
15 styrene block copolymer, preferably at temperature of 25 °C solid styrene block copolymer, which is present in the adhesive composition in a total amount of 20 – 60 wt.-%, preferably 25 – 55 wt.-%, more preferably 30 – 50 wt.-%, most preferably 30 – 45 wt.-%, based on the total weight of the adhesive composition.

20

Suitable styrene block copolymers include block copolymers of the SXS type, in each of which S denotes a non-elastomer styrene (or polystyrene) block and X denotes an elastomeric α -olefin block, which may be polybutadiene, polyisoprene, polyisoprene-polybutadiene, completely or partially
25 hydrogenated polyisoprene (poly ethylene-propylene), completely or partially hydrogenated polybutadiene (poly ethylene-butylene). The elastomeric α -olefin block preferably has a glass transition temperature in the range from -55 °C to -35 °C. The elastomeric α -olefin block may also be a chemically modified α -olefin block. Particularly suitable chemically modified α -olefin blocks include,
30 for example, maleic acid-grafted α -olefin blocks and particularly maleic acid-grafted ethylene-butylene blocks.

Preferably, the at least one styrene block copolymer is selected from the group consisting of SBS, SIS, SIBS, SEBS, and SEPS block copolymers. These can have a linear, radial, diblock, triblock or star structure, linear structure being preferred. Suitable styrene block copolymers of the SXS type include block
5 copolymers based on saturated or unsaturated middle blocks X. Hydrogenated styrene block copolymers may be preferred in applications, where improved UV and ozone resistance are required.

The proportion of styrene blocks in the styrene block copolymer should be such
10 that styrene as compared with further constituents of the styrene block copolymer is present in deficiency. Preferably, the at least one styrene block copolymer has a styrene content of 10 – 45 wt.-%, more preferably of 15 – 40 wt.-%, based on the total weight of the styrene block copolymer. A styrene content of 20 – 35 wt.-% is particularly preferable. Alternatively, it may be
15 preferable for the at least one styrene block copolymer to have a low styrene content. In this case, a styrene content of 10 – 20 wt.-%, in particular 12 – 15 wt.-%, is preferred.

It may be advantageous the at least one styrene block copolymer to have a
20 melt flow index as determined at 200 °C/5 kg of not more than 50 g/10 min, in particular 1 – 45 g/10 min, preferably 2 – 40 g/10 min, more preferably 3 – 30 g/10 min.

Suitable commercial styrene block copolymers in the context of the present
25 invention include, for example, Kraton® D4141, Kraton® D4150, and Kraton® 4433, and linear styrene-isoprene-styrene block copolymers Kraton® D1111, Kraton® D1111, Kraton® D1113, Kraton® D1114, Kraton® D1117, Kraton® D1119, Kraton® D1124, Kraton® D1126, Kraton® D1161, Kraton® D1162, Kraton® D1163, Kraton® D1164, Kraton® D1165, Krato® D1183, and Kraton®
30 D1193 (all from Kraton Performance Polymers).

Suitable styrene block copolymers also include hydrogenated styrene block copolymers, for example Kraton® G1652, Kraton® G1657, Kraton® G1726,

Kraton® MD1648 and Kraton® FG1901 (all from Kraton Performance Polymers).

- Preferably, the adhesive composition comprises at least one SBS block copolymer. The adhesive composition may further comprise at least one other styrene block copolymer, preferably selected from the group consisting of SIS, SIBS, SEBS, and SEPS block copolymers, in particular at least one SIS block copolymer.
- 10 It may be preferable that the adhesive composition comprises a first styrene block copolymer, preferably a first SBS block copolymer, and a second styrene block copolymer different from the first styrene block copolymer, preferably a second SBS block copolymer, wherein the first styrene block copolymer is present in the adhesive composition in an amount of 1 – 25 wt.-%, preferably 5
15 – 25 wt.-%, most preferably 10 – 20 wt.-% and the second styrene block copolymer is present in the adhesive composition in an amount of 1 – 25 wt.-%, preferably 5 – 25 wt.-%, most preferably 10 – 20 wt.-%, all proportions being based on the total weight of the adhesive composition.
- 20 It may also be preferable that the first styrene block copolymer has a diblock content of not more than 35 %, more preferably not more than 30 %, even more preferably not more than 25 %, most preferably not more than 20 %. The second styrene block copolymer may have a diblock content of not less than 40 %, preferably not less than 50 %, more preferably not less than 55 %, most
25 preferably not less than 60 %. The second styrene block copolymer may also be a styrene diblock copolymer, such as a styrene-butadiene (SB) diblock copolymer, preferably having a total styrene content of not more than 35 wt.-%, more preferably not more than 30 wt.-%.
- 30 According to one or more embodiments, the adhesive composition comprises a first styrene block copolymer, preferably a SBS block copolymer, having a diblock content of not more than 35 %, more preferably not more than 30 % and a second styrene block copolymer, preferably a SB diblock copolymer

having a total styrene content of not more than 35 wt.-%, more preferably not more than 30 wt.-%.

The adhesive composition of the present invention further comprises 25 – 70
5 wt.-%, preferably 30 – 65 wt.-%, more preferably 35 – 65 wt.-%, most preferably 40 – 65 wt.-%, based on the total weight of the adhesive composition, of at least one at a temperature of 25 °C solid tackifying resin, which is compatible with the at least one styrene block copolymer. The term “tackifying” resin refers to resins that in general enhance the adhesion and/or
10 tackiness of an adhesive composition. The term “tackiness” refers in the present document to the property of a substance of being sticky or adhesive by simple contact, which can be measured, for example, as a loop tack. Preferred tackifying resins are tackifying at a temperature of 25 °C.

15 Tackifying resins typically have a relatively low average molecular weight (M_n), such as in the range of 250 – 5,000 g/mol, in particular 300 – 3,500 g/mol, preferably 500 – 3,000 g/mol.

Preferably, the least one tackifying resin has a softening point measured by a
20 Ring and Ball method according to DIN EN 1238 in the range of 50 – 180 °C, more preferably 75 – 160 °C, even more preferably 80 – 150 °C, most preferably 85 – 140 °C.

Suitable tackifying resins to be used in the adhesive composition include
25 synthetic resins, natural resins, and chemically modified natural resins.

Examples of suitable natural resins and chemically modified natural resins include rosins, rosin esters, phenolic modified rosin esters, and terpene resins. The term “rosin” is to be understood to include gum rosin, wood rosin, tall oil
30 rosin, distilled rosin, and modified rosins, for example dimerized, hydrogenated, maleated and/or polymerized versions of any of these rosins.

Suitable rosin esters can be obtained, for example, from reactions of rosins and polyhydric alcohol or polyol such as pentaerythritol, glycerol, dipentaerythritol, tripentaerythritol, trimethylol ethane, trimethylol propane, ethylene glycol, polyethylene glycol, 1,3-propanediol, 1,4-butanediol, 1,5-
5 pentanediol, 1,6-hexanediol, trimethylene glycol, propylene glycol, neopentyl glycol, in the presence of acid or base catalyst.

Suitable commercially available rosin ester resins include, for example, Sylvatac® RAZ 100S, Sylvatac® RE 85, Sylvatac® RE 95, Sylvatac® RE 98,
10 Sylvatac® RE 101RM, and Sylvatac® RE 103S (all from Arizona Chemicals); and Sylvalite® RE 80HP, Sylvalite® RE 85GB, Sylvalite® RE 88F, Sylvalite® RE 100F, Sylvalite® RE 100L, Sylvalite® RE 100S, Sylvalite® RE 105L, Sylvalite® RE 105 XL, Sylvalite®, Sylvalite® RE 110L, and Sylvalite® RE 115 (all from Arizona Chemical).

15

Suitable terpene resins include copolymers and terpolymers of natural terpenes, such as styrene/terpene and alpha methyl styrene/terpene resins; polyterpene resins generally resulting from the polymerization of terpene hydrocarbons, such as the bicyclic monoterpene known as pinene, in the
20 presence of Friedel-Crafts catalysts at moderately low temperatures; hydrogenated polyterpene resins; and phenolic modified terpene resins including hydrogenated derivatives thereof.

Suitable commercially available terpene resins include, for example, Sylvares®
25 TP 96, Sylvares® TP 115P, Sylvares® TP 300, Sylvares® TP 2019, Sylvares® TP 2040, Sylvares® TP 2040HM, Sylvares® TR 7115, Sylvares® TR 7125, Sylvares® TR B115, Sylvares® TR M1115, and Sylvares® ZT 106LT (all from Arizona Chemicals).

30 The term "synthetic resin" refers to compounds obtained from the controlled chemical reactions such as polyaddition or polycondensation between well-defined reactants that do not themselves have the characteristic of resins.

Monomers that may be polymerized to synthesize the synthetic resins may include aliphatic monomer, cycloaliphatic monomer, aromatic monomer, or mixtures thereof. Suitable aliphatic monomers may include C₄, C₅, and C₆ paraffins, olefins, and conjugated diolefins. Examples of aliphatic monomers or cycloaliphatic monomers include butadiene, isobutylene, 1,3-pentadiene, 1,4-pentadiene, cyclopentane, 1-pentene, 2-pentene, 2-methyl-1-pentene, 2-methyl-2-butene, 2-methyl-2-pentene, isoprene, cyclohexane, 1-3-hexadiene, 1-4-hexadiene, cyclopentadiene, dicyclopentadiene. Examples of aromatic monomer can include C₈, C₉, and C₁₀ aromatic monomers. Typical aromatic monomers include, styrene, alphamethyl styrene, vinyl toluene, methoxy styrene, tertiary butyl styrene, chlorostyrene, coumarone, and indene monomers including indene, and methyl indene, and combinations thereof.

Suitable synthetic resins include petroleum hydrocarbon resins, coumarone-indene resins, polyindene resins, polystyrene resins, vinyl toluene-alphamethyl styrene copolymer resins, and alphamethyl styrene resin.

The term "petroleum hydrocarbon resin" refers in the present document to synthetic resins made by polymerizing mixtures of unsaturated monomers obtained from petroleum based feedstocks, such as by-products of cracking of natural gas liquids, gas oil, or petroleum naphthas. The petroleum hydrocarbon resins include also pure monomer aromatic resins, which are prepared by polymerizing aromatic monomer feedstocks that have been purified to eliminate color causing contaminants and to precisely control the composition of the product.

Examples of suitable petroleum hydrocarbon resins may include C₅ aliphatic petroleum hydrocarbon resins, mixed C₅/C₉ aliphatic/aromatic petroleum hydrocarbon resins, aromatic modified C₅ aliphatic petroleum hydrocarbon resins, cycloaliphatic petroleum hydrocarbon resins, mixed C₅ aliphatic/cycloaliphatic petroleum hydrocarbon resins, mixed C₉ aromatic/cycloaliphatic petroleum hydrocarbon resins, mixed C₅ aliphatic/cycloaliphatic/C₉ aromatic petroleum hydrocarbon resins, aromatic

modified cycloaliphatic petroleum hydrocarbon resins, C9 aromatic petroleum hydrocarbon resins, as well hydrogenated versions of the aforementioned resins. The notations "C5" and "C9" indicate that the monomers from which the resins are made are predominantly hydrocarbons having 4-6 and 8-10 carbon atoms, respectively. The term "hydrogenated" includes fully, substantially and at least partially hydrogenated resins. Partially hydrogenated resins may have a hydrogenation level, for example, of 50 %, 70 %, or 90 %.

Examples of suitable commercially available petroleum hydrocarbon resins include, for example, Wingtack® 86, Wingtack® 95, Wingtack® 98 (from Cray Valley); Wingtack® Plus, Wingtack® Extra, Wingtack® ET, Wingtack® STS, and Wingtack® 86 (from Cray Valley); Escorez® 1000-series, Escorez® 2000-series, Escorez® 5300-series, Escorez® 5400-series, and Escorez® 5600-series (all from Exxon Mobile Chemical);

Preferably, the at least one at 25 °C solid tackifying resin is selected from the group consisting of rosins, rosin ester resins, phenolic modified rosin ester resins, terpene resins, petroleum hydrocarbon resins, coumarone-indene resins, polyindene resins, polystyrene resins, vinyl toluene-alpha-methyl styrene copolymer resins, and alpha-methyl styrene resins.

According to one or more embodiments the adhesive composition comprises 25 – 70 wt.-%, preferably 30 – 65 wt.-%, more preferably 35 – 65 wt.-%, most preferably 40 – 65 wt.-%, based on the total weight of the adhesive composition, of at least one at 25 °C solid tackifying resin selected from the group consisting of rosins, rosin ester resins, phenolic modified rosin ester resins, and terpene resins, preferably having a softening point measured by a Ring and Ball method according to DIN EN 1238 in the range of 70 – 160 °C, more preferably 80 – 150 °C, most preferably 100 – 140 °C.

According to one or more embodiments the adhesive composition comprises 25 – 70 wt.-%, preferably 30 – 65 wt.-%, more preferably 35 – 65 wt.-%, most preferably 40 – 65 wt.-%, based on the total weight of the adhesive

composition, of at least one at 25 °C solid tackifying resin selected from the group consisting of petroleum hydrocarbon resins, coumarone-indene resins, polyindene resins, polystyrene resins, vinyl toluene-alphamethyl styrene copolymer resins, and alphamethyl styrene resins, preferably having a
5 softening point measured by a Ring and Ball method according to DIN EN 1238 in the range of 70 – 160 °C, more preferably 80 – 150 °C, most preferably 85 – 130 °C.

According to one or more embodiments, the adhesive composition comprises
10 at least one first at 25 °C solid tackifying resin selected from the group consisting of rosins, rosin ester resins, phenolic modified rosin ester resins, and terpene resins and at least one second at 25 °C solid tackifying resin selected from the group consisting of petroleum hydrocarbon resins, coumarone-indene resins, polyindene resins, polystyrene resins, vinyl toluene-
15 alphamethyl styrene copolymer resins, and alphamethyl styrene resins.

The at least one first at 25 °C solid tackifying resin may be present in the adhesive composition in a total amount of 10 – 65 wt.-%, preferably 25 – 60 wt.-%, more preferably 35 – 55 wt.-%, most preferably 40 – 50 wt.-% and the at
20 least one second at 25 °C solid tackifying resin may be present in the adhesive composition in a total amount of and 0.5 – 30 wt.-%, preferably 1.0 – 25 wt.-%, more preferably 2.5 – 20 wt.-%, most preferably 5 – 15 wt.-%, all proportions being based on the total weight of the adhesive composition.

25 Preferably, the at least one first at 25 °C solid tackifying resin is a rosin ester resin, preferably having a softening point measured by a ring and ball method according to DIN EN 1238 in the range of 70 – 160 °C, more preferably 80 – 150 °C, most preferably 100 – 140 °C and the at least one second at 25 °C tackifying resin is a hydrocarbon petroleum resin, preferably selected from the
30 group consisting of C5 aliphatic petroleum hydrocarbon resins, mixed C5/C9 aliphatic/aromatic petroleum hydrocarbon resins, aromatic modified C5 aliphatic petroleum hydrocarbon resins, and C9 aromatic petroleum hydrocarbon resins, and preferably having a softening point measured by a

ring and ball method according to DIN EN 1238 in the range of 70 – 160 °C, more preferably 80 – 150 °C, most preferably 85 – 130 °C.

According to one or more embodiments, the adhesive composition further
5 comprises at least one pure monomer aromatic petroleum hydrocarbon resin different from the at least one first and at least one second tackifying resins and having a softening point measured by a ring and ball method according to DIN EN 1238 in the range of 50 – 180 °C, preferably 70 – 160 °C, more preferably 80 – 150 °C, most preferably 85 – 140 °C. The term “pure monomer
10 aromatic petroleum hydrocarbon resin” refers in the present document to aromatic petroleum hydrocarbon resins produced from aromatic monomer feedstocks that have been purified, for example, by distillation and/or thermal soaking. The pure monomer aromatic petroleum hydrocarbon resins have been found out to perform as end-block re-enforcers enhancing the cohesive
15 strength of the adhesive composition of the present invention.

Suitable pure monomer aromatic petroleum hydrocarbon resins are commercially available, for example, under the tradenames of Kristalex®, Plastolyn®, Piccotex®, Piccolastic® and Endex® from Eastman Chemicals,
20 under the trade name of Norsolene from Cray Valley.

The at least one pure monomer aromatic resin, if used, may be present in the adhesive composition in a total amount of 0.5 – 35.0 wt.-%, preferably 1.0 – 30.0 wt.-%, more preferably 2.5 – 25.0 wt.-%, most preferably 3.0 – 20.0 wt.-%,
25 based on the total weight of the adhesive composition.

The adhesive composition further comprises at least one polyester polyol, which is present in the adhesive composition in a total amount of 0.1 – 20.0 wt.-%, preferably 0.25 – 18.5 wt.-%, more preferably 0.5 – 17.5 wt.-%, even
30 more preferably 0.5 – 15.0 wt.-%, most preferably 1.0 – 12.5 wt.-%, based on the total weight of the adhesive composition. According to one or more embodiments, the at least one polyester polyol is present in the adhesive composition in a total amount of 0.5 – 17.5 wt.-%, preferably 1.0 – 15.0 wt.-%,

more preferably 1.5 – 12.5 wt.-%, most preferably 1.5 – 10.0 wt.-%, based on the total weight of the adhesive composition.

Preferred polyester polyols include amorphous, semi crystalline, crystalline,
5 and liquid polyester polyols, for example polyester triols and in particular polyester diols. In particular, mixtures of one or more amorphous, semi crystalline or crystalline polyester polyols, with or without one or more liquid polyester polyols, may also be used. Preferred polyester polyols also include amorphous polycarbonate diols and mixtures of polyester diols and
10 polycarbonate diols.

Suitable polyester polyols, for example polyester triols, in particular polyester diols, have an average molecular weight (M_n) in the range of 1,000 – 15,000 g/mol, preferably 1,250 – 10,000 g/mol, and more preferably of 1,500 – 6,500
15 g/mol.

Suitable polyester polyols, preferably polyester triols and especially polyester diols, are those which are products of the polycondensation reaction of dihydric to trihydric, preferably dihydric, alcohols, such as, for example, 1,2-ethanediol,
20 diethylene glycol, triethylene glycol, 1,2-propanediol, 1,3-propanediol, dipropylene glycol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,8-octanediol, 1,10-decanediol, 1,12-dodecanediol, dimer fatty alcohol, neopentyl glycol, glycerol, 1,1,1-trimethylolpropane or mixtures of the aforesaid alcohols, with organic dicarboxylic acids or tricarboxylic acids, preferably dicarboxylic
25 acids, or their anhydrides or esters, such as succinic acid, glutaric acid, 3,3-dimethylglutaric acid, adipic acid, suberic acid, sebacic acid, undecanedioic acid, dodecanedicarboxylic acid, azelaic acid, maleic acid, fumaric acid, phthalic acid, dimer fatty acid, isophthalic acid, terephthalic acid, and hexahydrophthalic acid, or mixtures of the aforesaid acids, and also polyester
30 polyols made from lactones such as from ϵ -caprolactone, for example, also called polycaprolactones.

Further examples of suitable polyester polyols are polyester polyols of oleochemical origin. Polyester polyols of this kind may be prepared, for example, by complete ring opening of epoxidized triglycerides of a fat mixture comprising at least partly olefinically unsaturated fatty acid, with one or more
5 alcohols having 1 to 12 C atoms, and by subsequent partial transesterification of the triglyceride derivatives to give alkyl ester polyols having 1 to 12 C atoms in the alkyl radical. Suitable polycarbonate polyols are those as are obtainable by reaction, for example, of the abovementioned dihydric or trihydric alcohols with dialkyl carbonates, diaryl carbonates or phosgene. Other suitable polyols
10 are castor oil and its derivatives or hydroxy-functional polybutadienes, which are available, for example, under the trade name of "Poly bd" (from Cray Valley). Polycarbonate diols are particularly suitable, especially amorphous polycarbonate diols.

15 Preferably, the at least one polyester polyol is selected from a group consisting of amorphous, semi crystalline, and crystalline polyester polyols having a softening point in the range of 50 – 160 °C, preferably 60 – 150 °C, most preferably 70 – 140 °C, and liquid polyester polyols having a having a glass transition temperature (T_g) of not more than 25 °C, preferably not more than 0
20 °C. It may be preferable that the at least one polyester polyol has a hydroxyl number (mg KOH/g, measured according to DIN 53 240-2) in the range of 5 – 60, in particular 10 – 55, preferably 20 – 50.

Suitable crystalline or semicrystalline polyester polyols are solid at a
25 temperature of 25 °C and have a glass transition temperature of < 0 °C. These can comprise a reaction product of an aliphatic diol having from 2 to 10 methylene groups and an aliphatic diacid having from 2 to 10 methylene groups. Diols useful in preparing of the crystalline polyester polyol include ethylene glycol, 1,4butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,8-octanediol,
30 and 1,10-decanediol. Cycloaliphatic diols such as 1,4-cyclohexanediol and 1,4-cyclohexanedimethanol can also be used. Suitable aliphatic diacids for preparing the crystalline polyester polyol include succinic acid, glutaric acid,

adipic acid, sebacic acid, 1,12-dodecanedioic acid, dimerized fatty acids, derivatives thereof, and mixtures thereof.

Particularly suitable crystalline and semi crystalline polyester polyols include
5 hexanediol/adipic acid polyester, butanediol/adipic acid polyester, hexanediol/
dodecanedioic acid polyester, ϵ -caprolactone polyesters, and the like. Such
crystalline and semi crystalline polyester polyols are commercially available, for
example, under the trade name Dynacoll® 7300-series (from Evonik
Industries).

10

Suitable amorphous polyester polyols are solid at a temperature of 25 °C and
have a glass transition temperature of > 0 °C. These are the reaction product
of diol and diacid. Diols useful in preparing the amorphous polyester polyol
include, for example, hexanediol, butanediol, neopentyl glycol, ethylene glycol,
15 diethylene glycol, propylene glycol, and 2-methylpropanediol. Suitable diacids
for preparing the amorphous polyester polyol include, for example, adipic acid,
isophthalic acid, terephthalic acid. Such amorphous polyester polyols are
commercially available, for example, under the trade name Dynacoll® 7100-
series (from Evonik Industries).

20

Suitable liquid polyester polyols have a glass transition temperature of not
more than 25 °C, preferably not more than 0 °C. Diols useful in preparing the
liquid polyester polyol include, for example, hexanediol, butanediol, neopentyl
glycol, ethylene glycol, diethylene glycol, propylene glycol, 2-
25 methylpropanediol. Diacids suitable for preparing the liquid polyester polyol
include, for example, adipic acid, isophthalic acid, terephthalic acid. Such liquid
polyester polyols are commercially available, for example, under the trade
name Dynacoll® 7200-series (from Evonik Industries).

30 According to one or more embodiments, the adhesive composition comprises
at least one polyester polyol selected from the group consisting of amorphous,
semi crystalline, and crystalline polyester polyols having a softening point in the
range of 50 – 160 °C, more preferably 60 – 150 °C, most preferably 70 – 140

°C and at least at one temperature of 25 °C liquid polyester polyol having a glass transition temperature (T_g) of not more than 25 °C, preferably not more than 0 °C.

- 5 The adhesive composition may further comprise up to 35 wt.-%, based on the total weight of the adhesive composition, of at least one plasticizer. The at least one plasticizer is preferably selected from the group consisting of process oils, plasticizers on the basis of adipic acid, and at 25 °C liquid polyolefin resins.
- 10 Preferably, the at least one plasticizer, if used, is present in the adhesive composition in a total amount of 1 – 35 wt.-%, more preferably 2 – 30 wt.-%, most preferably 5 – 25 wt.-%, based on the total weight of the adhesive composition.
- 15 Suitable process oils include mineral oils, synthetic oils, paraffins, and vegetable oils. The term “mineral oil” refers in this document to includes any hydrocarbon liquids of lubricating viscosity (i.e., a kinematic viscosity at 100 °C of 1 cSt or more) derived from petroleum crude oil and subjected to one or more refining and/or hydroprocessing steps, such as fractionation,
- 20 hydrocracking, dewaxing, isomerization, and hydrofinishing, to purify and chemically modify the components to achieve a final set of properties. They can be characterized as either “paraffinic”, “naphthenic”, or “aromatic” based on the relative content of paraffinic, naphthenic, and aromatic moieties therein. Particularly suitable mineral oils include paraffinic and naphtenic oils, which
- 25 contain low amounts of aromatic moieties, preferably less than 15 wt.-%, more preferably less than 10 wt.-%, based on the total weight of the mineral oil. Refined mineral oils are different from “synthetic oils”, which are manufactured by combining monomer units using catalysts and/or heat and which are also known as “basestocks”. Particularly suitable synthetic oils include
- 30 polyalphaolefins (PAOs), which are obtained from so-called Gas-To-Liquids processes.

The term "paraffin" refers in the present document to saturated hydrocarbons, including normal paraffins, branched paraffins, isoparaffins, cycloparaffins, and blends thereof, which may be derived synthetically or from refined crude oil by means known in the art.

5

Preferred plasticizers on the basis of adipic acid include, for example, butylbenzyl adipate, benzyl-2-ethylhexyl adipate, triisotridecyl adipate, di(2-ethylhexyl) adipate, diisononyl adipate, diisodecyl adipate, dibutyl adipate, diisobutyl adipate, dibutoxyethyl adipate, diisooctyl adipate, and di-n-alkyl
10 adipate, in particular di(2-ethylhexyl) adipate.

Suitable at 25 °C liquid polyolefin resins include, for example, polybutene and polyisobutylene (PIB), in particular low molecular weight polybutene and low molecular weight polyisobutylene. The term "polybutene" refers in the present
15 document to low molecular weight olefin oligomers comprising isobutylene and/or 1-butene and/or 2-butene. The ratio of the C₄-olefin isomers can vary by manufacturer and by grade. When the C₄-olefin is exclusively 1-butene, the material is referred to as "poly-n-butene" or "PNB". The term "polyisobutylene" refers in the present document to polyolefins and olefin oligomers of
20 isobutylene. Typically, the polybutene and polyisobutylene have an average molecular weight (M_n) of less than 15,000 g/mol, preferably less than 5,000 g/mol, even more preferably less than 1,000 g/mol.

Suitable commercially available liquid polybutenes include, for example,
25 Indopol® H- and L-series from Ineos Oligomers, Infineum® C-series and Parapol® series from Infineum, and PB-series from Daelim. Suitable commercially available liquid polyisobutylenes (PIB) include, for example, Glissopal® V-series from BASF and Dynapak®-series from Univar GmbH, Germany.

30

In addition, the adhesive composition can contain additional auxiliary substances and additives, for example, those selected from the group consisting of UV absorption agents, UV and heat stabilizers, optical

brighteners, pigments, dyes, and desiccants. Exemplary UV stabilizers that can be included in the adhesive composition include, for example, sterically hindered phenols. However, the total amount of such additional auxiliary substances and additives is, preferably, not more than 10 wt.-%, more
5 preferably not more than 5 wt.-%, most preferably not more than 2 wt.-%, based on the total weight of the adhesive composition.

The adhesive composition according to the invention can be prepared by mixing its ingredients at a temperature of 130 – 200 °C until a homogeneously
10 mixed mixture is obtained. Any convention mixing technique known to those skilled in the art may be used. Preferably, the mixing is conducted by using a kneading process.

Another subject of the present invention is a method for bonding two substrates
15 together, the method comprising steps of:

- i) applying the adhesive composition as a melt to a surface of a first substrate,
- ii) letting the applied adhesive to cool and to solidify,
- iii) contacting the solidified adhesive with a surface of a second substrate and
20 pressing the substrates together without re-heating the solidified adhesive.

Preferably, in step iii) the substrates are pressed together for a period of at least 1 minute and using a pressure of at least 1 kg/cm².

25 Another subject of the present invention is use of at least one polyester polyol in an adhesive composition comprising 15 – 70 wt.-%, preferably 20 – 60 wt.-%, more preferably 25 – 55 wt.-%, most preferably 30 – 50 wt.-%, of at least one at 25 °C solid styrene block copolymer for reducing the sensory impression of smell of the adhesive composition measured according to VDA
30 270-A3. The adhesive composition is preferably a hot-melt adhesive composition, more preferably a hot-melt pressure sensitive adhesive composition (HMPSA).

Preferably, the sensory impression of smell of the adhesive composition measured according to VDA 270-A3 is reduced by 10 %, more preferably by 15 %, most preferably by 20 %, compared to an adhesive composition comprising 15 – 70 wt.-%, preferably 20 – 60 wt.-%, of at least one at 25 °C solid styrene
5 block copolymer and no polyester polyols.

According to one or more embodiments, the sensory impression of smell of the adhesive composition measured according to VDA 270-A3 is reduced to a value of not more than 4.0, preferably not more than 3.5.

10

The at least one styrene block copolymer is preferably selected from the group consisting of SBS, SIS, SIBS, SEBS, and SEPS block copolymers. Suitable commercially available styrene block copolymers include those described above as suitable for use in the adhesive composition of the present invention.

15

Preferably, the adhesive composition comprises at least one SBS block copolymer. The adhesive composition may further comprise at least one other styrene block copolymer selected from the group consisting of SIS, SIBS, SEBS, and SEPS, preferably SIS.

20

It may be preferable that the adhesive composition comprises a first styrene block copolymer, preferably a first SBS block copolymer, and a second styrene block copolymer different from the first styrene block copolymer, preferably a second SBS block copolymer, wherein the first styrene block copolymer is
25 present in the adhesive composition in an amount of 1 – 25 wt.-%, preferably 5 – 25 wt.-%, most preferably 10 – 20 wt.-% and the second styrene block copolymer is present in the adhesive composition in an amount of 1 – 25 wt.-%, preferably 5 – 25 wt.-%, most preferably 10 – 20 wt.-%, all proportions being based on the total weight of the adhesive composition.

30

According to one or more embodiments, the at least one polyester polyol is present in the adhesive composition in a total amount of 0.1 – 20 wt.-%,

preferably 0.5 – 17.5 wt.-%, more preferably 0.5 – 15.0 wt.-%, most preferably 1.0 – 12.5 wt.-%, based on the total weight of the adhesive composition.

Suitable commercially available polyester polyols include those described
5 above as suitable for use in the adhesive composition of the present invention.

Preferably, the at least one polyester polyol is selected from a group consisting of amorphous, semi crystalline and crystalline polyester polyols having a softening point in the range of 50 – 160 °C, more preferably 60 – 150 °C, most
10 preferably 70 – 140 °C, and liquid polyester polyols having a glass transition temperature of not more than 25 °C, preferably not more than 0 °C.

According to one or more embodiments, the adhesive composition comprises at least one polyester polyol selected from the group consisting of amorphous,
15 semi crystalline and crystalline polyester polyols having a softening point in the range of 50 – 160°C, more preferably 60 – 150°C, most preferably 70 – 140°C and at least one at a temperature of 25°C liquid polyester polyol having a glass transition temperature of not more than 25°C, preferably not more than 0°C.

20 The adhesive composition may further comprise 25 – 70 wt.-%, preferably 30 – 65 wt.-%, more preferably 35 – 65 wt.-%, most preferably 40 – 65 wt.-%, based on the total weight of the adhesive composition, of at least one at 25 °C solid tackifying resin selected from the group consisting of natural resins, chemically modified natural resins, and synthetic resins.

25

According to one or more embodiments the adhesive composition comprises 25 – 70 wt.-%, preferably 30 – 65 wt.-%, more preferably 35 – 65 wt.-%, most preferably 40 – 65 wt.-%, based on the total weight of the adhesive composition, of at least one at 25 °C solid tackifying resin selected from the
30 group consisting of rosins, rosin ester resins, phenolic modified rosin ester resins terpene resins, wherein the tackifying resin has a softening point measured by a Ring and Ball method according to DIN EN 1238 in the range of 50 – 180 °C, preferably 60 – 150 °C, most preferably 80 – 130 °C.

According to one or more embodiments the adhesive composition comprises 25 – 70 wt.-%, preferably 30 – 65 wt.-%, more preferably 35 – 65 wt.-%, most preferably 40 – 65 wt.-%, based on the total weight of the adhesive composition, of at least one tackifying resin selected from the group consisting of petroleum hydrocarbon resins, coumarone-indene resins, polyindene resins, polystyrene resins, vinyl toluene-alpha-methyl styrene copolymer resins, and alpha-methyl styrene resins, wherein the tackifying resin has a softening point measured by a Ring and Ball method according to DIN EN 1238 in the range of 50 – 180 °C, preferably 60 – 150 °C, most preferably 80 – 130 °C.

According to one or more embodiments, the adhesive composition comprises at least one first tackifying resin selected from the group consisting of rosin, rosin ester resins, phenolic modified rosin ester resins, terpene resins and at least one second tackifying resin selected from the group consisting of petroleum hydrocarbon resins, coumarone-indene resins, polyindene resins, polystyrene resins, vinyl toluene-alpha-methyl styrene copolymer resins, and alpha-methyl styrene resins.

The at least one first tackifying resin may be present in the adhesive composition in a total amount of 10 – 65 wt.-%, preferably 25 – 60 wt.-%, more preferably 35 – 55 wt.-%, most preferably 40 – 50 wt.-% and the at least one second tackifying resin may be present in the adhesive composition in a total amount of 0.5 – 30 wt.-%, preferably 1.0 – 25 wt.-%, more preferably 2.5 – 20 wt.-%, most preferably 5 – 15 wt.-%, all proportions being based on the total weight of the adhesive composition.

Preferably, the at least one first tackifying resin is a rosin ester resin, preferably having a softening point measured by a ring and ball method according to DIN EN 1238 in the range of 50 – 180 °C, preferably 60 – 150 °C, most preferably 80 – 130 °C and the at least one second tackifying resin is a hydrocarbon petroleum resin, preferably selected from the group consisting of C5 aliphatic petroleum hydrocarbon resins, mixed C5/C9 aliphatic/aromatic petroleum

hydrocarbon resins, aromatic modified C5 aliphatic petroleum hydrocarbon resins, and C9 aromatic petroleum hydrocarbon resins, and preferably having a softening point measured by a ring and ball method according to DIN EN 1238 in the range of 50 – 180°C, preferably 60 – 150°C, most preferably 80 – 130°C.

5

Example

The followings compounds and products shown in Table 1 were used in the
10 examples.

Table 1

SBC-1	Oil extended linear styrene-butadiene (SBS) block copolymer having a polystyrene content of 30-40 wt.-%
SBC-2	Linear random-block styrene-butadiene (SB) copolymer having a total styrene content of 20-30 wt.-%
TR-1	Rosin ester resin having a softening point (AQCM 003) of 100-110 °C
TR-2	Aromatically modified C5-hydrocarbon resin having a softening point of 85-95 °C
CP-1	Slightly crystalline saturated copolyester having a softening point (DIN ISO 4625) of 90-95 °C and a glass transition temperature (DSC) of -20 °C
CP-2	Partially crystalline saturated copolyester having a softening point (DIN ISO 4625) of 125-130 °C and a melting point (DSC) of 120-125 °C
CP-3	Amorphous saturated copolyester having a softening point (DIN ISO 4625) of 90-95 °C and a glass transition temperature (DSC) of 50 °C
CP-4	Liquid saturated copolyester having a glass transition temperature (DSC) of -50 °C
Process oil	Paraffinic process oil free of aromatics having a viscosity index (DIN ISO 2909) of 101
Antioxidant	Sterically hindered phenolic antioxidant

15

Preparation of the exemplary adhesive compositions

For each adhesive composition the ingredients given in Table 1 were mixed in a kneading reactor at a temperature of 200 °C until a homogenously mixed mixture was obtained. The adhesive compositions were stored in siliconized
5 boxes for 1 day before they were used for characterization of their properties.

Measurement of sensory impression of smell

The sensory impression of smell of the adhesive compositions was determined
10 by following the procedure as described in VDA 270-A3 standard. In this method, the sample size is according to variant A, i.e. 10 +/- 1g (for a 1 liter vessel) or 30 +/- 3g (for a 3 liter vessel). A heating chamber with an air circulation according to DIN 50 011-12 and a test panel of ~6 people was used in the measurements. The results in Table 2 related to the sensory impression
15 of smell are presented in relation to a similar adhesive composition which does not contain any polyester polyols.

20

25

Table 2: Adhesive compositions and results

Composition, [wt.-%]	Ref-1	Ex-1	Ex-2	Ex-3	Ref-2	Ex-4	Ex-5	Ex-6	Ex-7	Ex-8	Ex-9
SBC-1	17.12	16.72	16.72	16.72	16.72	16.72	16.72	16.9	16.2	16.72	16
SBC-2	17.12	16.72	16.72	16.72	16.72	16.72	16.72	16.9	16.2	16.72	16
TR-1	48.63	45.15	45.15	45.15	-	40.15	45.15	47.15	44	45.15	38.2
TR-2	8.91	9.03	9.03	9.03	-	9.03	9.03	9.03	8.13	9.03	6.2
CP-1		5.02			65.89	10.02	2.52	2	10		20
CP-2			5.02								
CP-3				5.02							
CP-4										5.02	
Process oil	7.54	6.69	6.69	6.69	-	6.69	9.19	7.35	4.8	6.69	2.93
Antioxidant	0.68	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Total	100	100	100	100	100	100	100	100	100	100	100
Sensory impression of smell compared to Ref-1	0	++	+	+	++	+	0	+/-	+	+	+
Adhesive properties compared to Ref-1	0	0	0	0	-	-	0/-	0/-	0/-	0	-

"++" = significant improvement, "+" = slight improvement, "0" = no change, "0/-" = slight impairment, "-" = significant impairment

Claims

1. An adhesive composition comprising:
 - a) 20 – 60 wt.-% of at least one styrene block copolymer,
 - b) 25 – 70 wt.-% of at least one at temperature of 25 °C solid tackifying resin, and
 - c) 0.1 – 20.0 wt.-% of at least one polyester polyol, all proportions being based on the total weight of the adhesive composition.
2. The adhesive composition according to claim 1, wherein the at least one styrene block copolymer is selected from the group consisting of SBS, SIS, SIBS, SEBS, and SEPS block copolymers.
3. The adhesive composition according to claim 1 or 2 comprising at least one SBS block copolymer.
4. The adhesive composition according to any of previous claims, wherein the at least one tackifying resin is selected from the group consisting of rosins, rosin ester resins, phenolic modified rosin ester resins terpene resins, petroleum hydrocarbon resins, coumarone-indene resins, polyindene resins, polystyrene resins, vinyl toluene-alpha-methyl styrene copolymer resins, and alpha-methyl styrene resins.
5. The adhesive composition according to any of previous claims comprising at least one first at 25 °C solid tackifying resin selected from the group consisting of rosins, rosin ester resins, phenolic modified rosin ester resins terpene resins and at least one second at 25 °C solid tackifying resin selected from the group consisting of petroleum hydrocarbon resins, coumarone-indene resins, polyindene

resins, polystyrene resins, vinyl toluene-alpha-methyl styrene copolymer resins, and alpha-methyl styrene resins.

- 5 6. The adhesive composition according to 5, wherein the at least one first at 25 °C solid tackifying resin is present in the adhesive composition in a total amount of 10 – 65 wt.-%, preferably 25 – 60 wt.% and the at least one second at 25 °C solid tackifying resin is present in the adhesive composition in a total amount of 0.5 – 30 wt.-%, preferably 1.0 – 25 wt.-%, all proportions being based on the total weight of the adhesive composition.
- 10 7. The adhesive composition according to claim 5 or 6, wherein the at least one first at 25 °C tackifying resin is a rosin ester resin and the at least one second at 25 °C solid tackifying resin is a hydrocarbon petroleum resin.
- 15 8. The adhesive composition according to any of previous claims, wherein the at least one polyester polyol is selected from a group consisting of amorphous, semi crystalline, and crystalline polyester polyols having a softening point measured by a ring and ball method according to DIN EN 1238 in the range of 50 – 160 °C, preferably 60 – 150 °C, and liquid polyester polyols having a glass transition temperature of not more than 25 °C, preferably not more than 0 °C.
- 20 9. The adhesive composition according to any of previous claims, wherein the at least one polyester polyol has an average molecular weight (M_n) in the range of 1,000 – 15,000 g/mol, preferably of 1,250 – 10,000 g/mol, and more preferably of 1,500 – 6,500 g/mol.
- 25 10. The adhesive composition according to any of previous claims further comprising 1 – 35 wt.-%, preferably 2 – 30 wt.-%, based on the total weight of the adhesive composition, of at least one plasticizer selected from the group consisting of process oils,
- 30

plasticizers on the basis of adipic acid, and at temperature of 25 °C liquid polyolefin resins.

11. A method for bonding two substrates together, the method comprising steps of:

5

i) applying the adhesive composition according to any of claims 1-10 as a melt to a surface of a first substrate,

ii) letting the applied adhesive to cool and to solidify,

10

iii) contacting the solidified adhesive with a surface of a second substrate and pressing the substrates together without re-heating the solidified adhesive.

12. Use of at least one polyester polyol in an adhesive composition comprising 15 – 70 wt.-%, preferably 20 – 60 wt.-%, based on the total weight of the adhesive composition, of at least one styrene block copolymer for reducing the sensory impression of smell measured according to VDA 270-A3.

15

13. The use according to claim 12, wherein the sensory impression of smell measured according to VDA 270-A3 of the adhesive composition is reduced by 10 %, more preferably by 15 %, compared to an adhesive composition comprising 15 – 70 wt.-%, preferably 20 – 60 wt.-%, of at least one styrene block copolymer and no polyester polyols.

20

25

14. The use according to claim 12 or 13, wherein the sensory impression of smell measured according to VDA 270-A3 of the adhesive composition is reduced to a value of not more than 4.0, preferably not more than 3.5.

30

15. The use according to any of claims 12-14, wherein the at least one polyester polyol is present in the adhesive composition in a total

amount of 0.1 – 20 wt.-%, preferably 0.5 – 17.5 wt.-%, based on the total weight of the adhesive composition.

- 5 16. The use according to any of claims 12-15, wherein the adhesive composition further comprises 25 – 70 wt.-%, preferably 30 – 65 wt.-%, based on the total weight of the adhesive composition, of at least one at 25 °C solid tackifying resin selected from the group consisting of natural resins, chemically modified natural resins, and synthetic resins.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/064230

A. CLASSIFICATION OF SUBJECT MATTER INV. C09J153/02 C09J193/04 C09J157/02 C09J123/26 C09J167/02 C09J7/00 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) C09J C08L 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 practicable, search terms used) EPO-Internal, WPI Data																	
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>JP 2007 153364 A (KONISHI CO LTD; PACK CORP) 21 June 2007 (2007-06-21) table 1</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>US 2006/084755 A1 (GOOD DAVID J [US] ET AL) 20 April 2006 (2006-04-20) lines 7 - 17; paragraph [0028]</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>WO 2015/147298 A1 (ARAKAWA CHEM IND [JP]) 1 October 2015 (2015-10-01) the whole document</td> <td>1-16</td> </tr> <tr> <td>A</td> <td>CN 102 775 938 A (SHENZHEN GUKANGLI CHEMICAL CO LTD) 14 November 2012 (2012-11-14) the whole document</td> <td>1-16</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	A	JP 2007 153364 A (KONISHI CO LTD; PACK CORP) 21 June 2007 (2007-06-21) table 1	1-16	A	US 2006/084755 A1 (GOOD DAVID J [US] ET AL) 20 April 2006 (2006-04-20) lines 7 - 17; paragraph [0028]	1-16	A	WO 2015/147298 A1 (ARAKAWA CHEM IND [JP]) 1 October 2015 (2015-10-01) the whole document	1-16	A	CN 102 775 938 A (SHENZHEN GUKANGLI CHEMICAL CO LTD) 14 November 2012 (2012-11-14) the whole document	1-16
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.															
A	JP 2007 153364 A (KONISHI CO LTD; PACK CORP) 21 June 2007 (2007-06-21) table 1	1-16															
A	US 2006/084755 A1 (GOOD DAVID J [US] ET AL) 20 April 2006 (2006-04-20) lines 7 - 17; paragraph [0028]	1-16															
A	WO 2015/147298 A1 (ARAKAWA CHEM IND [JP]) 1 October 2015 (2015-10-01) the whole document	1-16															
A	CN 102 775 938 A (SHENZHEN GUKANGLI CHEMICAL CO LTD) 14 November 2012 (2012-11-14) the whole document	1-16															
☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.																	
* Special categories of cited documents : <table border="0"> <tr> <td> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family													
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family																
Date of the actual completion of the international search 16 July 2018		Date of mailing of the international search report 27/07/2018															
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Friebe, Lars															

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/064230

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2007153364 A	21-06-2007	JP 4804130 B2 JP 2007153364 A	02-11-2011 21-06-2007
US 2006084755 A1	20-04-2006	CN 1775887 A EP 1650282 A1 JP 5886788 B2 JP 2006117932 A JP 2013163821 A TW I390001 B US 2006084755 A1	24-05-2006 26-04-2006 16-03-2016 11-05-2006 22-08-2013 21-03-2013 20-04-2006
WO 2015147298 A1	01-10-2015	CN 106170517 A JP WO2015147298 A1 WO 2015147298 A1	30-11-2016 13-04-2017 01-10-2015
CN 102775938 A	14-11-2012	NONE	