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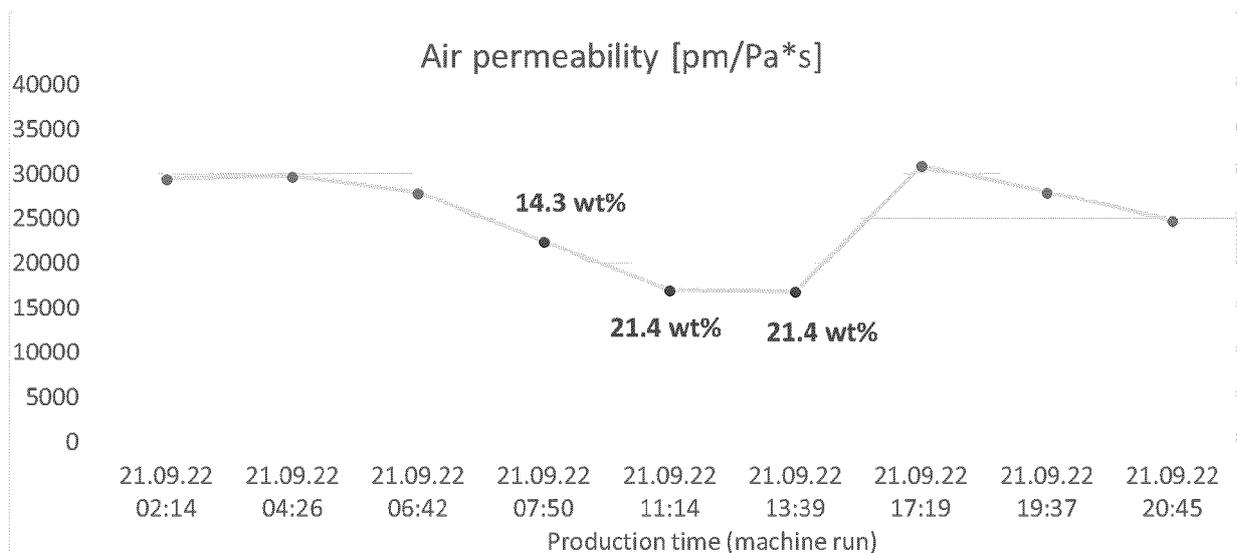
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(54) **RECYCLED FIBER-BASED RELEASE LINER BASE PAPER FOR RELEASE LINER APPLICATION**

(57) The present invention relates to a release liner base paper comprising at least 5 wt% recycled fibers coming from recycled cardboard-based fibers, printed material-based fibers, or both and having a density of at least 1.00 g/cm<sup>3</sup>. Further aspects of the present invention relate to a method of producing the release liner base paper, to the use of the release liner base paper in a method of producing a release liner, to the release liner comprising the release liner base paper and to a laminate comprising the release liner.

**FIG. 1**



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**Description****TECHNICAL FIELD**

5 [0001] The present invention relates to a high-quality release liner base paper comprising at least 5 wt% recycled fibers coming from recycled cardboard-based fibers, printed material-based fibers, or both of diverse sources and having a density of at least 1.00 g/cm<sup>3</sup>. Moreover, it relates to a method of producing the release liner base paper described herein.

[0002] Further aspects of the present invention relate to the use of the release liner base paper in a method of producing a release liner, to the release liner comprising the release liner base paper and to a laminate comprising the release liner.

**BACKGROUND ART**

15 [0003] Release liners are efficient carriers for self-adhesive labels and adhesive materials. They are formed by applying a release coating composition on a base layer and curing the coating composition to provide a release coating layer, generally a silicone layer. Self-adhesive labels and self-adhesive materials can be found everywhere in everyday products as well as in complex applications and durable equipment.

20 [0004] Base layers that are to be siliconized must possess certain properties to guarantee two primary functions of the release liner: protection of the self-adhesive products before use and perfect adhesive transfer upon removal. Key features required in the manufacture of such base layers include diverse mechanical properties and perfect silicone anchorage. The base layer should also have a low air permeability to limit penetration of the silicone inside the base layer as much as possible in order to achieve sufficient release properties and to reduce the amount of silicone. The base layer should also have a high density to have mechanical properties enabling a further die-cutting step of labels disposed on the siliconized base layer. Furthermore, the chemical structure of the base layer must not prevent the silicone system from crosslinking.

25 [0005] Compared to synthetic polymer-based release liners, natural fiber-based release liners help to reduce product waste as they comprise a base layer paper made from cellulose fibers and thus suitable for recycling. Moreover, cellulose fibers are derived from wood which is a fully renewable source. Nevertheless, the globally pursued social goal of sustainability also extends to the release liner market. In view of their countless applications, there is an increasing demand for even more sustainable release liners to help preserve the environment, save resources, and decrease the carbon footprint of the release liners.

30 [0006] Due to the good recyclability of paper, a common approach for improving sustainability in the manufacture of paper-based products is the addition of recycled raw material. However, it is well known to those skilled in the art of release liner production that high-quality requirements are placed on the fibers used for the production of release liner base paper having the desired mechanical properties, silicone anchoring and crosslinking.

35 [0007] When using fibers from recycled post-consumer waste (PCW), that is wastepaper from various sources also comprising a wide range in impurities, including so called silicon-curing poisoning additives, one would expect deterioration of the desired base paper features. Such poisoning additives are substances known as inhibiting or poisoning the crosslinking reaction of silicone release coatings (see Form No. 30-1053-01, on consumer.dow.com). Without being limited thereto, examples of such inhibitors or poisons are optical-brightening agents, colorants, deink-agents and other compounds containing one or more selected from nitrogen, sulfur and phosphorus groups.

40 [0008] For this reason, so far only negligible quantities of PCW fibers are added to release liners, if at all. US 2012/0121893, for example, mentions the possibility of adding fibers from recycled sources including PCW, however, the actual presence of such fibers in a detectable amount is not further specified.

45 [0009] An alternative approach to increase the amount of recycled fibers in release liners is described in WO 2020/084188. Therein, fibers of very high quality from quite narrow recycled sources are used. In detail, only recycled release liner pulp is considered to meet the high standards for release liners production. EN 643 (European List of Standard Grades of Paper and Board for Recycling) assigns recycled release liners to the very specific grade 5.05.03 according to Group 5. However, the provision of such high-quality recycled fibers is associated with a rather high pre-treatment effort under high energy demand.

50 [0010] Another issue that will likely keep the skilled person from using recycled fibers from various sources is the potential presence of recycled cardboard-based materials. Such materials have a high ash content. In the field of release liners, it is aimed to keep the ash content low, as its increase generally correlates with a decrease of the mechanical properties and the transparency in the finished product. Furthermore, the skilled person would not have considered using cardboard-based materials as a high ash content increases dirtiness in paper machine circuits and the possibility of fouling on the wires.

**TECHNICAL PROBLEM**

5 [0011] Sustainability of state-of-the-art release liner comprising a release liner base paper made from cellulose fibers needs to be further improved in order to preserve the environment, save resources, and decrease the carbon footprint of the release liner base paper. Generally, this can be achieved by addition of recycled fibers. However, using wastepaper from various sources in significant amounts while maintaining the desired release liner base paper features has not been realized up to now. So far, only very limited amounts of recycled fibers or significantly narrowed sources of recycled fibers have been used.

10 [0012] In view of the above, there is a demand for more sustainable release liner by providing a release liner base paper comprising significant amounts of recycled PCW fibers from various sources while maintaining the desired features. Moreover, there is a demand for a simple and less energy consuming method of producing the base paper comprising significant amounts of recycled fibers.

**SUMMARY OF THE INVENTION**

15 [0013] The present invention is based on the finding that the above problem can be solved by using at least 5 wt% recycled fibers coming from recycled cardboard-based fibers, printed material-based fibers, or both to prepare a release liner base paper with a density of at least 1.00g/cm<sup>3</sup>. That is, the present invention provides a more sustainable release liner base paper comprising significant amounts of recycled fibers from a wide range of sources while maintaining the desired features.

20 [0014] Accordingly, in a first aspect the present invention provides a release liner base paper comprising at least 5 wt% recycled fibers coming from recycled cardboard-based fibers, printed material-based fibers or both and having a density of at least 1.00 g/cm<sup>3</sup>.

25 [0015] In a second aspect, the invention provides a method for producing the release liner base paper. The method comprises the steps of dispersing recycled fibers and optionally virgin fibers in a pulper, refining the suspension of fibers, disposing the suspension of refined fibers on a forming wire and dewatering it, applying a primer composition on at least one side of the dewatered paper web, and drying the same.

30 [0016] In a third aspect, the invention provides the use of the release liner base paper according to the first aspect as a base layer in a method of producing a release liner. The method comprises the steps of applying a release coating composition on at least one side of the release liner base paper, and curing the composition to form a release coating layer.

[0017] In a fourth aspect, the invention provides a release liner comprising the release liner base paper according to the first aspect and a release coating layer on at least one side of the base layer.

35 [0018] In a fifth aspect, the invention provides a laminate comprising the release liner according to the fourth aspect, a face stock and an adhesive layer provided between the release liner and the face stock.

**BRIEF DESCRIPTION OF FIGURES****[0019]**

40 **FIG. 1** illustrates comparison of the air permeability values of inventive Base Papers E1-A (indicated with 14.3 wt%) and E1-B (indicated 21.4 wt%) with standard Base Paper CE1.

45 **FIG. 2** illustrates comparison of the Rizinus Cobb values of inventive Base Papers E1-A (indicated with 14.3 wt%) and E1-B (indicated 21.4 wt%) with standard Base Paper CE1.

**FIG. 3** illustrates comparison of the air permeability values of inventive Base Paper E2 (indicated with 14.3 wt%) with standard Base Paper CE2.

50 **FIG. 4** illustrates comparison of the Rizinus Cobb values of inventive Base Paper E2 (indicated with 14.3 wt%) with standard Base Paper CE2.

**DETAILED DESCRIPTION OF THE INVENTION**

55 [0020] In its first aspect, the present invention relates to a novel release liner base paper that comprises recycled fibers and has a density of at least 1.00 g/cm<sup>3</sup>. The recycled fibers are recycled cardboard-based fibers, printed material-based fibers, or both, and the amount of the recycled fibers in the release liner base paper is at least 5 wt%, based on the total weight of fibers in the release liner base paper.

[0021] The expression "recycled fibers" refers to fibers coming from recovered and reprocessed waste materials for

use in new products. Recycling is the key aspect for a circular economy and thus saves resources in terms of starting materials. That is, recycled fibers are derived from products that were once manufactured using virgin fibers. The expression "virgin fiber" refers to a fiber that has not yet been processed in the manufacturing of a product.

5 [0022] The fibers comprised in the base paper according to the present invention preferably consist of cellulosic fibers. The base paper may comprise natural cellulosic fibers including pulp, man-made fibers, or a mixture thereof. Man-made fibers can be synthetic fibers or modified cellulosic fibers also known as regenerated cellulose fibers. There are two main classes of regenerated cellulose: Lyocell and Viscose, aka Rayon. Cellulose fibers have a range of diameters and length that depends on the fiber type and source. In general, however, the length of recycled fibers is shorter than that of untreated virgin fibers of the same type and source.

10 [0023] The recycled fibers according to the present invention are not limited to a specific origin but based on general post-consumer waste selected from recycled cardboard-based fibers, recycled printed material-based fibers or both. The recycled fibers are such as the ones comprised in groups 1, 2, 3 except grade numbers 3.18 and 3.20, 4, and 5 except grade numbers 5.05.03 and 5.06, as defined in EN 643. Exemplary embodiments of printed material and cardboards comprise product packaging materials, newspapers, printed office papers, printed writing papers, printed letters and envelopes, multiply boards, boxes, kraft sacks, paper cups and tableware, books and magazines. Hence, the recycled fibers according to the present invention comprise a huge variety of materials.

15 [0024] The amount of the recycled fibers of at least 5 wt% implies an amount of virgin fibers in the release liner base paper of 95 wt% or less, based on the total weight of fibers in the release liner base paper. In the present disclosure, the total weight of fibers in the release liner base paper refers to the dry weight of fibers. Where the amount of recycled fibers is less than 5 wt%, the base paper is insufficient in terms of an improved air permeability, energy saving and saving resources.

20 [0025] The virgin fibers commonly used to prepare release liner base papers can be chosen among bleached or unbleached softwood pulp, bleached or unbleached hardwood pulp, bleached or unbleached chemical pulp from hardwood or softwood, bleached or unbleached chemi-thermomechanical pulp from hardwood or softwood, or mixtures thereof. The virgin fibers may comprise at least 10 wt%, or at least 25 wt%, or at least 45 wt%, or at least 70 wt% of bleached chemical pulp based on the total weight of the virgin fibers. The bleached chemical pulp can be constituted by a blend of hardwood and softwood fibers, the hardwood fibers being present in this blend in an amount of at least 50 wt%, preferably at least 75 wt%, based on the total weight of the bleached chemical pulp, and the softwood fibers being present in an amount of at most 50 wt%, preferably at most 25 wt%, based on the total weight of the bleached chemical pulp. The virgin fibers may further comprise at least 2 wt% and less than 50 wt% of bleached chemi-thermomechanical pulp, based on the total weight of the virgin fibers. According to some specific embodiments, the bleached chemi-thermomechanical pulp can be present in the virgin fibers in an amount of 5 to 45 wt%, or of 10 to 35 wt%, based on the total weight of the virgin fibers.

25 [0026] Surprisingly it has been found that the properties of release liner base papers comprising at least 5 wt% recycled fibers according to the invention are equivalent or better than those that do not contain recycled fibers. The overall good properties are in particular unexpected considering that the recycled cardboard-based and printed material-based fibers are of quite diverse sources that go hand in hand with a wide range in impurities. Without wishing to be bound by any theory, the heterogenous fiber mixture, that is a mixture of virgin fibers and recycled fibers, seems to result in a specific structural design, wherein the recycled fibers according to the present invention interact with the commonly used virgin fibers. That way, a particularly beneficial structure of the base paper results which is capable of compensating negative effects resulting from the presence of impurities.

30 [0027] In particular, the good silicone anchoring and crosslinking of the release liner base papers according to the present invention as discussed later on in further detail are surprising in view of the presence of silicon-curing poisoning additives as discussed above.

35 [0028] It also has surprisingly been found that the high ash content of recycled cardboard-based materials did not have a negative impact on the mechanical properties and the transparency of the finished products. As previously discussed, this was not to be expected when using recycled cardboard-based materials. Without wishing to be bound by theory, it appears that the previously described specific structural design of the base paper according to the present invention compensates any negative impact usually accompanying high ash contents.

40 [0029] Furthermore, it has quite surprisingly been found that release liner base papers comprising at least 5 wt% recycled fibers according to the invention, are more closed than base papers not containing recycled fibers. That is, the base paper according to the present invention shows improved (lower) air permeability with increasing amounts of recycled fibers. FIG. 1 compares the air permeability values of base papers comprising 0 wt% (not indicated), 14.3 wt% and 21.4 wt% recycled fibers. The measuring points result from measurements on Jumbo rolls of the different base papers produced in a continuous process. Without wishing to be bound by any theory, in the previously described specific structural design the recycled fibers according to the present invention appear to be able to interact with the virgin fibers in a particularly beneficial tight manner.

45 [0030] It also has been surprisingly found that the introduction of at least 5 wt% of recycled fibers in the composition

of the release liner base paper enables a decrease of the energy consumptions during the manufacturing process of the release liner base paper, and notably the refining energy of the fibers prior to their deposition on a forming wire of a paper machine.

5 **[0031]** In another preferred embodiment of the first aspect, the amount of recycled fibers in the release liner base paper is at least 10 wt%, preferably from 15 wt% to 80 wt%, more preferably from 20 wt% to 50 wt%, based on the total weight of fibers in the release liner base paper. This implies an amount of virgin fibers of 90 wt% or less, preferably from 85 wt% to 20 wt%, more preferably from 80 wt% to 50 wt%, based on the total weight of fibers in the release liner base paper. Air permeability, energy saving and saving resources are further improved when the amount of recycled fibers in the release liner base paper is at least within the preferred lower ranges specified above. Where the amount of recycled fibers is above the preferred upper ranges processability may be reduced. Moreover, it has been found that release liner base papers comprising at least 20 wt% recycled fibers according to the invention are even more closed, resulting in a further improved air permeability and the Rizinus Cobb is also improved. FIG. 2 compares the Rizinus Cobb values of base papers comprising 0 wt% (not indicated), 14.3 wt% and 21.4 wt% recycled fibers. The measuring points result from measurements on Jumbo rolls of the different base papers produced in a continuous process.

10 **[0032]** In a preferred embodiment of the first aspect of the present invention, the release liner base paper has a density of 1.05 g/cm<sup>3</sup> to 1.26 g/cm<sup>3</sup>, preferably of 1.09 g/cm<sup>3</sup> to 1.24 g/cm<sup>3</sup>, and more preferably of 1.12 g/cm<sup>3</sup> to 1.22 g/cm<sup>3</sup>. The density may be measured by methods well known in the field of papers. For instance, the density may be calculated by dividing the basis weight of the release liner base paper (measured according to ISO 536 standard) with the thickness of this release liner base paper (measured according to ISO 534 standard).

15 **[0033]** The density of the release liner base paper represents a technical feature characteristic for the high-quality of the base paper required to provide release liners with desired properties. That is, a high density of at least 1.00 g/cm<sup>3</sup> ensures that the release liner base paper has mechanical properties enabling a further die-cutting step of labels disposed on a release liner without cutting this release liner.

20 **[0034]** Preferably, quality of the release liner base paper and suitability for coating with a silicone release coating composition may further be determined by the following technical features. The primary functions of the release liner previously discussed may be further improved if one or more of the technical features selected from the group consisting of air permeability, transparency, Bekk smoothness, Rizinus Cobb, tensile strength and tear resistance can be further improved. The silicone release coating composition needs to remain at the surface of the base paper to limit the silicone consumptions while producing the release liner. Accordingly, the release liner base paper should absorb as little silicone as possible.

25 **[0035]** That is, in a preferred embodiment of the first aspect, the base paper has an air permeability from 100 pm/Pa•s to 70000 pm/Pa•s. The expression "air permeability" as referred to herein is the rate of airflow passing perpendicularly through a known area under a prescribed air pressure differential between the two surfaces of a material. Preferably, the base paper has an air permeability in the range from 500 pm/Pa•s to 50000 pm/Pa•s, measured according to SCAN P26 standard. When the air permeability is within the recited ranges of this preferred embodiment, silicone adhesion may be further improved. As mentioned before and shown in FIG. 1, it has been found that air permeability decreases with an increasing amount of recycled fibers according to the present invention.

30 **[0036]** In another preferred embodiment of the first aspect, the release liner base paper has a transparency of 4% to 65%, preferably of 25% to 60%, measured according to DIN 53147 standard, and a basis weight of 30 g/m<sup>2</sup> to 140 g/m<sup>2</sup>, preferably of 45 g/m<sup>2</sup> to 90 g/m<sup>2</sup>, measured according to ISO 536. Transparency may be particularly relevant for specific classes of release liner base papers, such as the high-end product glassine described in further detail below. It is achieved by super calendering the base paper as described below in further detail until the desired degree of transparency is reached. The expression "basis weight" is synonymous to the term "grammage" and refers to the area density of a paper product, expressed in weight per unit area (gsm = g/m<sup>2</sup>). The basis weight of the release liner base paper includes the basis weight of an optionally primer formed on at least one side of the base paper according to the preferred embodiment defined in further detail below.

35 **[0037]** In yet another preferred embodiment of the first aspect, the base paper has a Bekk smoothness on the back side of 15 s to 1500 s, preferably of 25 s to 1200 s and on the top side of 400 s to 4000 s, preferably of 500 s to 3500 s, measured according to TAPPI T479 standard. When the Bekk smoothness is below the recited ranges, formation of the release coating layer may be deteriorated.

40 **[0038]** In a further preferred embodiment of the first aspect, the base paper has a Rizinus Cobb value of 0.2 g/m<sup>2</sup> to 4 g/m<sup>2</sup>, preferably of 0.3 g/m<sup>2</sup> and 3 g/m<sup>2</sup>, more preferably of 0.6 g/m<sup>2</sup> to 1.4 g/m<sup>2</sup>. The Rizinus Cobb refers to the oil permeability and is measured on the top side according to ISO 535 standard. As mentioned above and shown in FIG. 2, it has been found that a release liner base papers comprising at least 20 wt% recycled fibers according to the invention may be even more closed, resulting in an improved (lowered) Rizinus Cobb. Rizinus Cobb values measure the ability for the silicone to penetrate into the release liner base paper. Release liner base papers with lower Rizinus Cobb value allow less penetration of silicone into the paper, therefore reducing the silicone consumption in the production of release liner.

5 [0039] In another preferred embodiment of the first aspect, the release liner base paper has a tensile strength in machine direction of 2.0 kN/m to 18.0 kN/m, preferably of 4.0 kN/m to 15.0 kN/m and in cross direction of 1.0 kN/m to 15 kN/m, preferably of 2.0 kN/m to 12.0 kN/m, measured according to ISO 1924 standard. The tensile strength refers to a maximum tensile force per unit width that paper and board will withstand before breaking under the conditions defined in the ISO 1924 standard.

[0040] In yet another preferred embodiment of the first aspect, the base paper has a tear resistance in machine direction of 100 mN to 1500 mN, preferably of 150 mN to 1300 mN and in cross-machine direction of 100 mN to 1500 mN, preferably of 150 mN to 1300 mN, measured according to ISO 1974 standard. The tear resistance refers to the maximum force required to tear a specimen in a particular direction.

10 [0041] The term "machine direction" as used herein refers the direction that the paper moves through the paper machine and the term "cross-machine direction", also known as "transverse direction", is the direction perpendicular to the machine direction.

[0042] The release liner base release liner base paper of the present invention can be preferably selected from the group of release liner known in the field of paper release liners consisting of glassine papers, clay coated kraft (CCK) papers, super calendered kraft (SCK).

15 [0043] According to a preferred embodiment of the first aspect, the release liner base paper of the present invention is a glassine paper. Glassine papers are typically made of bleached chemical pulp and widely used in release liners for self-adhesive materials. Glassine preferably has a transparency of 43% for a basis weight of 90 g/m<sup>2</sup> up to 55% for a basis weight of 45 g/m<sup>2</sup>. As previously mentioned, such high degree of transparency is achieved by super calendering the base paper as described below in further detail. Preferably, the base paper has a Gurley value of 100 s to 2000 s, when measured in a remoistened state immediately before the step of super calendering according to ISO 3687 standard.

20 [0044] According to another preferred embodiment of the first aspect, the release liner base paper is a clay coated kraft (CCK) paper. CCK paper typically comprises a paper base substrate with a clay coated front side for high quality printing that is used where a good dimensional stability is required.

25 [0045] In a further preferred embodiment of the first aspect, the release liner base paper comprises a primer applied on at least one side. In a more preferred embodiment, where the release liner base paper of the present invention is a glassine paper, the primer is compatible with a silicone release coating composition. The primer may comprise at least one water soluble binder selected from the group consisting of polyvinyl alcohol, polyvinyl alcohol modified with alkene groups, silanol groups or silane hydride groups, starch, alginate, or carboxymethyl cellulose. Preferably, the primer comprises modified polyvinyl alcohol as disclosed in EP 2 539 505. Preferably, the basis weight of the primer formed by coating on at least one side of the glassine paper is between 0.1 g/m<sup>2</sup> to 10 g/m<sup>2</sup>, more preferably between 1 g/m<sup>2</sup> to 3 g/m<sup>2</sup>.

30 [0046] In an alternative more preferred embodiment, where the release liner base paper of the present invention is a CCK paper, the primer is a coating layer comprising at least one pigment and a latex as binder. The at least one pigment may be chosen among clay, carbonate or talc. Preferably, the pigment is calcium carbonate, and the binder is an emulsion comprising styrene butadiene and styrene acrylate. The binder may constitute approximately 25 wt% in dry weight of the primer and the carbonate may constitute approximately 75 wt% in dry weight of the primer. Preferably, the basis weight of the primer formed by coating on at least one side of the CCK paper is between 15 g/m<sup>2</sup> to 30 g/m<sup>2</sup>, more preferably 20 g/m<sup>2</sup>.

35 [0047] In its second aspect, the present invention relates to a method of producing the release liner base paper according to the first aspect. The method comprises the steps of dispersing recycled fibers and optionally virgin fibers in a pulper (step a), refining the suspension of fibers (step b), disposing the suspension of refined fibers on a forming wire (step c) and dewatering it (step d), applying a primer composition on at least one side of the dewatered paper web (step e), and drying the same (step f). The recycled fibers are recycled cardboard-based fibers, printed material-based fibers, or both, and the amount of the recycled fibers in the release liner base paper is at least 5 wt%, based on the total weight of fibers in the release liner base paper.

40 [0048] The method of producing the release liner base paper according to the second aspect of the present invention may be performed by using equipment for paper production known in the art. The method may be performed in a continuous process or may be interrupted when changing the equipment.

45 [0049] The recycled cardboard-based fibers, printed material-based fibers, or both of the second aspect of the present invention are as defined above with regard to the first aspect. The amount of the recycled fibers of at least 5 wt% implies an amount of virgin fibers in the release liner base paper of 95 wt% or less, based on the total weight of fibers in the release liner base paper, that is dispersed in step a) with the recycled fibers in a pulper.

50 [0050] In the state of the art, the step b) of refining fibers generally requires high energy. It is applied to increase the specific surface of the fibers and thus improve smoothness and density of the base paper. In the production of, for instance, a glassine paper according to the first aspect, the pulp is typically refined to achieve a fiber fineness that results in a dense, almost non-porous paper surface. Such a surface is highly resistant to air and liquids, such as oil and water.

55 [0051] When using at least 5 wt% recycled fibers coming from recycled cardboard, printed material or both according

to the present invention, it has surprisingly been found that the refining energy in step b) can be reduced without any deterioration of the desired base paper features. In FIG. 3 and FIG. 4 the air permeability and Rizinus Cobb values of another base paper comprising 14.3 wt% recycled fibers according to the present invention are compared with the properties of a comparative standard base paper (comprising 0 wt% recycled fibers, not indicated). Said base paper according to the present invention has been obtained with a reduction in refining energy of 11% compared to the standard base paper. Accordingly, the method of producing the release liner base paper according to the second aspect of the present invention reduces the refining energy required for the production of release liner base papers while maintaining the high-quality requirements.

**[0052]** In step e) of the method according to the second aspect, the primer composition is disposed on at least one side of the release liner base paper by any suitable method, and preferably by rod coating or blade coating.

**[0053]** Where the release liner base paper of the present invention is a glassine, the primer composition may comprise at least one water soluble binder selected from the group consisting of polyvinyl alcohol, polyvinyl alcohol modified with alkene groups, silanol groups or silane hydride groups, starch, alginate, or carboxymethyl cellulose in order to achieve compatibility with a silicone release coating composition applied in a later step as described below. A particular preferred primer composition may comprise modified polyvinyl alcohol as described in EP 2 539 505. Preferably, the basis weight of the primer formed by coating on at least one side of the glassine paper is between 0.1 g/m<sup>2</sup> to 10 g/m<sup>2</sup>, more preferably between 1 g/m<sup>2</sup> to 3 g/m<sup>2</sup>.

**[0054]** When the release liner base paper of the present invention is a CCK paper, the primer composition may comprise at least one pigment and a latex as binder. The at least one pigment may be chosen among clay, carbonate, or talc. Preferably, the pigment is calcium carbonate, and the binder is an emulsion comprising styrene butadiene and styrene acrylate. The binder may constitute approximately 25 wt% and the carbonate may constitute approximately 75 wt%, each in dry weight of the primer composition. Preferably, the basis weight of the primer formed by coating on at least one side of the CCK paper is between 15 g/m<sup>2</sup> to 30 g/m<sup>2</sup>, more preferably 20 g/m<sup>2</sup>.

**[0055]** In a preferred embodiment of the second aspect, the method further comprises a step of calendering the dried primer-coated paper web. Where the release liner base paper of the present invention is a glassine paper according to the first aspect, the primer-coated paper web is subjected to a series of moisturising and multi-nip calender or super calendering steps, to obtain a very dense paper having a smooth surface, high impact strength, high tear resistance and transparency. In contrast, where the release liner base paper of the present invention is a CCK paper according to the first aspect, calendering is performed with only one nip.

**[0056]** In another preferred embodiment of the second aspect, the amount of recycled fibers in the release liner base paper is at least 10 wt%, preferably from 15 wt% to 80 wt%, more preferably from 20 wt% to 50 wt%, based on the total weight of fibers in the release liner base paper. This implies an amount of non-recycled fibers of 90 wt% or less, preferably from 85 wt% to 20 wt%, more preferably from 80 wt% to 50 wt%, based on the total weight of fibers in the release liner base paper.

**[0057]** In yet another preferred embodiment of the second aspect, the basis weight of the primer layer applied on at least one side of the paper is 0.1 g/m<sup>2</sup> to 30 g/m<sup>2</sup>, preferably 1 g/m<sup>2</sup> to 20 g/m<sup>2</sup>, measured according to ISO 536. The basis weight of the primer layer refers to the primer layer being in a dried state. In a more preferred embodiment, where the base paper is a glassine paper, the basis weight of the primer may be between 0.1 g/m<sup>2</sup> to 10 g/m<sup>2</sup>, more preferably between 1 g/m<sup>2</sup> to 3 g/m<sup>2</sup>. In a more preferred embodiment, where the base paper is a CCK paper, the basis weight of the primer may be between 15 g/m<sup>2</sup> to 30 g/m<sup>2</sup>, more preferably 20 g/m<sup>2</sup>.

**[0058]** In a further preferred embodiment of the second aspect, the recycled fibers used in step a) of the method have a dry content of more than 50%, measured according to TAPPI 210 standard. Using fibers with a dry content of more than 50%, is more ecological in terms of transportation, storage and processability due to increased raw material per volume rates.

**[0059]** In another further preferred embodiment of the second aspect, the recycled fibers used in step a) of the method have a pulp freeness of 25°SR to 60°SR, preferably of 30°SR to 50°SR, measured according to a derivative of UNI 7621 standard. At a pulp freeness of 25°SR to 60°SR, the recycled fibers contribute to reduce the refining energy that has to be applied at the pulp mix to reach the desired air permeability level on the finished products.

**[0060]** In yet another further preferred embodiment of the second aspect, the recycled fibers used in step a) of the method have an ash content of 0.1% to 8%, preferably of 0.5% to 7%, measured according to a derivative of TAPPI 211 standard. When the ash content is in the range of 0.1% to 8%, effects resulting from the previously described specific structural design are further improved, while transparency and mechanical properties of the finished products are not influenced.

**[0061]** In another further preferred embodiment of the second aspect, the recycled fibers used in step a) of the method have a pH value of 5 to 12, preferably of 6 to 11, measured according to a derivative of TAPPI 209 standard. A pH value of 5 to 12 guarantees a good stability of the production process and avoids negative effect on the characteristics of the finished product.

**[0062]** In an even more preferred embodiment of the second aspect, the recycled fibers have a dry content of more

than 50%, a pulp freeness of 25°SR to 60°SR, an ash content of 0.1% to 8%, and a pH value of 5 to 12, and in a most preferred embodiment of the second aspect, the recycled fibers have a dry content of more than 50%, a pulp freeness of 30°SR to 50°SR, an ash content of 0.5% to 7%, and a pH value of 6 to 11, each measured according to the standards defined above.

5 **[0063]** In its third aspect, the present invention relates to a use of the release liner base paper according to the first aspect as a base layer in a method of producing a release liner. The method comprises the steps of applying a release coating composition on at least one side of the release liner base paper and curing the composition to form a release coating layer.

10 **[0064]** In the context of the present invention, the expression "curing" is synonymous to "crosslinking" and refers to the polyaddition reaction between the vinylic functional groups of the silicone resin and the hydrogen siloxane functional groups of the crosslinking agent.

**[0065]** Preferably, the silicone release coating composition according to the third aspect may be applied to a side of the release liner base paper comprising a primer as defined above, which is compatible with the silicone release coating composition.

15 **[0066]** Silicone release coating compositions known in the field of release liners such as disclosed in EP 2 539 505 may be applied on at least one side of the release liner base paper. Generally, such compositions comprise a polymer, a crosslinker and a catalyst, preferable a platinum-based catalyst. Subsequently, crosslinking is performed by curing the composition at high temperatures until curing is complete. Preferably, crosslinking is performed for 10 seconds to 120 seconds, at temperatures in the range of 70 °C to 160 °C and under air flow, particularly preferably, in a ventilated drying kiln.

20 **[0067]** In its fourth aspect, the present invention relates to a release liner comprising the release liner base paper according to the first aspect as a base layer and a release coating layer on at least one side of the base layer.

25 **[0068]** In a preferred embodiment of the fourth aspect, the release coating is silicone. As mentioned before, it has been found that silicone anchoring and crosslinking of the release liner base papers comprising at least 5 wt% recycled fibers according to the present invention meet stringent performance targets for a release liner material. This is particularly surprising considering that the recycled cardboard-based and printed material-based fibers in the base papers are of quite diverse sources that go hand in hand with a wide range in impurities, including silicon-curing poisoning additives as described above. Without wishing to be bound by theory, it appears that the previously described specific structural design of the base paper according to the present invention compensates any negative impact usually accompanying high ash contents.

30 **[0069]** The rate of crosslinking and the anchorage of the silicone layer are examined by the subsequently described poly and "rub off" tests. The silicone crosslinking is analysed by the poly test measuring the quantity of silicone remaining on a sample of siliconized paper after it had been immersed in an organic solvent for non-crosslinked silicone (toluene or methyl isobutyl ketone). Anchorage of the silicone to the paper is analysed by the rub off test. This test measures the remaining silicone layer after an abrasion test on a textile under a weight. More particularly, the rub-off test is conducted by applying a dynamic force of 225 g/cm<sup>2</sup> on the silicone coated paper substrate at a speed of 7 m/min for 25 cm.

35 **[0070]** In another preferred embodiment of the fourth aspect, the release liner base paper has a silicone crosslinking of at least 95%, more preferably in the range between 96% and 100%, since a rate higher than 96% is indicative of particularly satisfactory crosslinking.

40 **[0071]** In yet another preferred embodiment of the fourth aspect, silicone anchorage on the at least one side of the release liner base paper is of at least 60%, preferably of at least 80%, more preferably of 95% to 100%. A rate above 60% confirms sufficient anchorage, a rate above 80% is generally indicative of good anchorage. Value is significant if the poly test is higher than 95 %.

45 **[0072]** Fields of application of the release liner according to the fourth aspect are very diverse. Without being limited hereto, they may be used in high-speed labelling applications for branding of consumer goods, but also for their pricing, identification or weighting. Further, the release liner may be used in medical applications, such as release liners protected plasters, transdermal drug delivery systems, or ostomy products, preserving hygiene, efficient treatments, and human health. Another exemplarily application may be the use in double-side adhesive tapes to assemble components.

50 **[0073]** In its fifth aspect, the present invention relates to a laminate comprising the release liner according to the fourth aspect, a face stock and an adhesive layer provided between the release liner and the face stock.

## EXPERIMENTAL SECTION

55 **[0074]** The invention and the advantages it offers will be explained in further detail by the following examples and with reference to the figures.

**[0075]** Among the various product classes of release liner base papers, the high-end product glassine sets the highest standards on its mechanical properties and usually requires a very high quality of the fibers used. The following experiments will therefore illustrate the effects of the present invention using this high-end product class.

## Preparation of release liner base papers

**[0076]** In the following experiments, virgin fibers and recycled fibers were used to prepare release liner base papers. As virgin fibers a commercially available standard pulp as defined above used in the manufacturing of release liners and comprising 100% virgin cellulose fibers was used.

**[0077]** As recycled fibers, a recycled pulp supplied by WEPA Greenfield SAS comprising 100% fibers coming from a mixture of recycled cardboard and printed materials (cf. groups 1, 2, 3 except grade numbers 3.18 and 3.20, 4, and 5 except grade numbers 5.05.03 and 5.06, as defined in EN 643). The recycled fibers had a pulp freeness of 34° SR, an ash content of 1.36 % and a pH value of 8.58, each measured according to the standards described above.

### Experiment 1

**[0078]** The following glassine release liner base papers were produced in a continuous process on a standard paper machine and the influence of varying amounts of recycled fibers was investigated.

[Base Paper E1-A]

**[0079]** In a first step, 2970 kg of bleached virgin fibers and 500 kg of recycled fibers were dispersed in a pulper equipped with 95 wt% water as dispersing medium, based on the total weight of fibers. To produce this first Base Paper E1, the refining energy applied to the suspension of fibers was maintained as for a standard production grade used for the Comparative Example CE1 presented here-after.

**[0080]** Next, the suspension of refined fibers was disposed on a flat forming wire and dewatered. At the same time, a primer composition was prepared. According to this specific example, the primer composition corresponded to a polyvinyl alcohol modified composition as disclosed in EP 2 539 505. The primer composition was applied on the top side of the dewatered paper web by metering-size-press coating at 65°C, the back side being coated with a surface treatment agent (such as for example polyvinyl alcohol, starch, CMC, alginate) in order to produce a primer coated paper web. According to this specific embodiment the total amount coated on the dewatered paper was of 1.5 g/m<sup>2</sup> in dry weight.

**[0081]** Subsequently, the primer-coated paper web was dried in an infra-red oven. In a final step, the dried, primer-coated paper web was re-moisturized to about 15-20% of the solid contents of the paper web. The Gurley value of the remoistened release liner base paper was 669 s. Afterwards, the remoistened release liner base paper was offline super calendered in order to form the glassine base paper.

[Base Paper E1-B]

**[0082]** The glassine Base Paper E1-B was manufactured, primer coated and super calendered under the same conditions as described for E1-A, except that 2720 kg of bleached virgin fibers and 750 kg of recycled fibers were dispersed in a pulper. The Gurley value of the remoistened release liner base paper, measured immediately before the step of super calendering, was 808 s.

[Comparative Base Paper CE1]

**[0083]** Comparative Example CE1 is a standard glassine that was manufactured, primer coated and super calendered under the same conditions as described for E1-A and E1-B, except that 3470 kg of bleached virgin fibers, comprising a mix of softwood, hardwood and BCTMP, were dispersed in a pulper. Accordingly, CE1 does not contain any recycled fibers. CE1 has been manufactured during the same machine run than E1-A and E1-B. More particularly, the CE1 has been produced just before and just after E1-A and E1-B as represented in Figures 1 and 2. The Gurley value of the remoistened release liner base paper, measured immediately before the step of super calendering, was 552 s.

[Characterization]

**[0084]** The glassine Base Papers E1-A, E1-B, and CE1 are produced in Jumbos rolls and the properties of these glassine papers, summarized in Table 1 below, are measured on each Jumbo roll. The values of CE1 are averaged values.

Table 1: Properties of Base Papers E1-A, E1-B and CE1.

| Technical features           | Method | E1-A | E1-B | CE1 |
|------------------------------|--------|------|------|-----|
| Amount [wt%] Recycled Fibers | /      | 14.3 | 21.4 | 0   |

(continued)

| Technical features               |      | Method          | E1-A  | E1-B  | CE1   |
|----------------------------------|------|-----------------|-------|-------|-------|
| Density [g/cm <sup>3</sup> ]     |      | ISO 536/ISO 534 | 1.15  | 1.16  | 1.15  |
| Air Permeability [pm/Pa·s]       |      | SCAN P26        | 22402 | 16904 | 28455 |
| Transparency [%]                 |      | DIN 53147       | 49    | 49    | 48    |
| Basis Weight [g/m <sup>2</sup> ] |      | ISO 536         | 55    | 55    | 55    |
| Bekk Smoothness [s]              | back | TAPPI T 479     | 450   | 516   | 524   |
|                                  | top  |                 | 1091  | 1090  | 1187  |
| Rizinus Cobb [g/m <sup>2</sup> ] |      | ISO 535         | 1.3   | 1.0   | 1.28  |
| Tensile [kN/m]                   | MD   | ISO 1924        | 5.96  | 5.98  | 5.93  |
|                                  | CD   |                 | 2.93  | 2.86  | 2.90  |
| Tear [mN]                        | MD   | ISO 1974        | 265   | 283   | 276   |
|                                  | CD   |                 | 264   | 296   | 280   |

**[0085]** As illustrated in Table 1, the properties of the highly sensitive glassine release liner base papers according to the present invention are overall good.

**[0086]** Furthermore, base papers E1-A and E1-B, containing 14.3 wt% or 21.4 wt% recycled fibers, respectively, have a more closed structure than the comparative example CE1. This is reflected by the lower air permeability and Rizinus Cobb which implies that samples E1-A and E1-B will absorb less silicone and thus have an improved adherence of the silicone compared to CE1.

**[0087]** Furthermore, it has surprisingly been found that the high ash content of recycled cardboard-based materials did not have a negative impact on the mechanical properties and the transparency of the finished products.

## Experiment 2

**[0088]** The following glassine release liner base papers were produced in a continuous process on a standard paper machine and the influence of varying the refining energies applied to the suspension of fibers was investigated. This required slightly varied setup so that the values obtained for Experiments 1 and 2 are not directly comparable. However, the values obtained for Comparative Example CE2 are directly comparable to those obtained for Base Paper E2, produced with an 11 % lower refining energy.

[Base Paper E2]

**[0089]** In a first step, 2970 kg of bleached virgin fibers and 500 kg of recycled fibers were dispersed in a pulper equipped with 95 wt% water as dispersing medium, based on the total weight of fibers. To produce Base Paper E2, the refining energy applied to the suspension of fibers was 11% reduced to Comparative Example CE2 presented here-after.

**[0090]** The subsequent steps of manufacturing, primer coating and super calendering were performed as described for Base Paper E1-A in Experiment 1 above. According to this specific embodiment the total amount coated on the dewatered paper also was of 1.5 g/m<sup>2</sup> in dry weight. Moreover, the Gurley value of the remoistened release liner base paper, measured immediately before the step of super calendering, was 747 s.

[Comparative Base Paper CE2]

**[0091]** Comparative Example CE2 is a standard glassine that was manufactured, primer coated and super calendered under the same conditions as described for E2, except that 3470 kg of bleached virgin fibers comprising a mix of softwood, hardwood and BCTMP were dispersed in a pulper. In addition, suspension of fibers has been refining at an energy normally used to produce this grade of paper. That is, the refining energy applied to the suspension of fibers was 11% increased. Comparative Example CE2 does not contain any recycled fibers. CE2 has been manufactured during the same machine run than E2. More particularly, CE2 has been manufactured just before and just after E2 as represented in Figures 3 and 4. The Gurley value of the remoistened release liner base paper, measured immediately before the step of super calendering, was 718 s.

[Characterization]

**[0092]** The glassine Base Papers E2 and CE2 are produced in Jumbos rolls and the properties of these papers, summarized in Table 2 below, are measured on each Jumbo roll. The values of CE2 are averaged values.

Table 2: Properties of Base Papers E2 and CE2.

| Technical features               |      | Method          | E2    | CE2   |
|----------------------------------|------|-----------------|-------|-------|
| Amount [wt%] Recycled Fibers     |      | /               | 14.3  | 0     |
| Density [g/cm <sup>3</sup> ]     |      | ISO 536/ISO 534 | 1.15  | 1.15  |
| Air Permeability [pm/Pa·s]       |      | SCAN P26        | 15996 | 20020 |
| Transparency [%]                 |      | DIN 53147       | 50    | 50    |
| Basis Weight [g/m <sup>2</sup> ] |      | ISO 536         | 54    | 54    |
| Bekk Smoothness [s]              | back | TAPPI T 479     | 523   | 556   |
|                                  | top  |                 | 2004  | 2333  |
| Rizinus Cobb [g/m <sup>2</sup> ] |      | ISO 535         | 0.9   | 1.0   |
| Tensile [kN/m]                   | MD   | ISO 1924        | 5.50  | 5.59  |
|                                  | CD   |                 | 2.96  | 2.90  |
| Tear [mN]                        | MD   | ISO 1974        | 327   | 310   |
|                                  | CD   |                 | 293   | 297   |

**[0093]** As illustrated in Table 2, the introduction of the recycled fibers in sample E2 enables a decrease of the energy consumptions for the manufacture of this glassine base paper without impacting the properties of this base paper compared to CE2.

#### Preparation of single side silicone-coated release liner

**[0094]** Above examples E1-A, E1-B, E2, CE1 and CE2 are used as a base layer to prepare release liners by applying a silicone release coating composition prepared with 100 g Resin W920 (supplied by Wacker®), 2.5 g Crosslinker V24 (supplied by Wacker®) and 1 g Catalyst OL (platinum based, supplied by Wacker®) onto the top side of the release liner base papers. Subsequently, crosslinking is performed by curing the composition for 30 seconds at 140 °C in ventilated drying kiln.

Table 3: Properties of release liners obtained from E1-A, E1-B, E2, CE1 and CE2.

| Technical features    | E1-A | E1-B | CE1  | E2   | CE1  |
|-----------------------|------|------|------|------|------|
| Rub-Off Anchorage [%] | 96,5 | 97,4 | 97,3 | 97,4 | 97,8 |
| Poly Crosslinking [%] | 97,9 | 98,8 | 98,2 | 98,8 | 98,2 |

**[0095]** As illustrated in Table 3, the introduction of recycled fibers from quite diverse sources comprising a wide range in impurities, including previously described silicon-curing poisoning additives into glassine paper does not impact silicone anchoring and crosslinking. Results show poly test values and rub off test values higher than 95% for all glassine papers, thus representing evidence of good silicone anchoring and crosslinking even when using recycled fibers.

#### Summary

**[0096]** Characterization of the glassine base papers produced confirms that the properties of the examples according to the invention are equivalent or better to those of glassines that do not contain recycled fibers.

**[0097]** This was by no means to be expected by those skilled in the art, which is also confirmed by the state of the art. So far, only recycled fibers of carefully selected, quite narrow origin have been used in higher proportions when preparing release liner base papers. Where recycled fibers from a mixture of wastepaper of uncertain origin have been

used, only undefined, negligible quantities of these fibers have been used to date.

**[0098]** The overall good properties of the release liner base papers according to the present invention are very surprising considering that recycled cardboard-based and printed material-based fibers are of quite diverse sources that go hand in hand with a wide range in impurities, including silicon-curing poisoning additives. In particular, the still good silicone anchoring and crosslinking measured for glassines comprising recycled fibers according to the present invention is surprising.

**[0099]** Further, the skilled person would not have expected the overall good properties of the base paper according to the present invention when using recycled cardboard-based materials. Such materials are known to have a high ash content which has a negative impact on the mechanical properties and the transparency of the finished products.

**[0100]** In addition, it has quite surprisingly been found that not only can the properties of release liner base papers be maintained when using at least 5 wt% recycled fibers coming from recycled cardboard, printed material or both according to the present invention, air permeability and Rizinus Cobb value are even improved compared to glassine papers not comprising any recycled fibers.

**[0101]** In the state of the art, the step of refining fibers generally requires high energy. It is applied to improve smoothness and density of the base paper by reducing the average fiber length. When using at least 5 wt% recycled fibers coming from recycled cardboard, printed material or both according to the present invention, it has surprisingly been found that the refining energy can be reduced without any deterioration of the desired base paper features (see results of Base Paper E2 below). Accordingly, the method of producing the release liner base paper according to the second aspect of the present invention reduces the refining energy required for the production of release liner base papers while maintaining the high-quality requirements.

## Embodiments

[Embodiment 1]

**[0102]** Release liner base paper comprising recycled fibers, wherein the release liner base paper has a density of at least 1.00 g/cm<sup>3</sup>,

wherein the recycled fibers are recycled cardboard-based and/or printed material-based fibers, and

wherein the amount of the recycled fibers in the release liner base paper is at least 5 wt%, based on the total weight of fibers in the release liner base paper.

[Embodiment 2]

**[0103]** Release liner base paper according to embodiment 1, wherein the amount of the recycled fibers in the release liner base paper is at least 10 wt%, preferably from 15 wt% to 80 wt%, more preferably from 20 wt% to 50 wt%, based on the total weight of fibers in the release liner base paper.

[Embodiment 3]

**[0104]** Release liner base paper according to embodiments 1 or 2, wherein the release liner base paper has an air permeability from 100 pm/Pa·s to 70000 pm/Pa·s, preferably from 500 pm/Pa·s to 50000 pm/Pa·s, measured according to SCAN P26 standard.

[Embodiment 4]

**[0105]** Release liner base paper according to any of embodiments 1 to 3, wherein the release liner base paper has a density of 1.05 g/cm<sup>3</sup> to 1.26 g/cm<sup>3</sup>, preferably of 1.09 g/cm<sup>3</sup> to 1.24 g/cm<sup>3</sup>, more preferably of 1.12 g/cm<sup>3</sup> to 1.22 g/cm<sup>3</sup>.

[Embodiment 5]

**[0106]** Release liner base paper according to any of embodiments 1 to 4, wherein the release liner base paper has a transparency of 4% to 65%, preferably of 25% to 60%, measured according to DIN 53147 standard, and a basis weight of 30 g/m<sup>2</sup> to 140 g/m<sup>2</sup>, preferably of 45 g/m<sup>2</sup> to 90 g/m<sup>2</sup>, measured according to ISO 536.

[Embodiment 6]

5 [0107] Release liner base paper according to any of embodiments 1 to 5, wherein the release liner base paper has a Bekk smoothness on the back side of 15 s to 1500 s, preferably of 25 s to 1200 s and on the top side of 400 s to 4000 s, preferably of 500 s to 3500 s, measured according to TAPPI T479 standard.

[Embodiment 7]

10 [0108] Release liner base paper according to any of embodiments 1 to 6, wherein the release liner base paper has a Rizinus Cobb value of 0.2 g/m<sup>2</sup> to 4 g/m<sup>2</sup>, preferably of 0.3 g/m<sup>2</sup> and 3 g/m<sup>2</sup>, more preferably of 0.6 g/m<sup>2</sup> to 1.4 g/m<sup>2</sup>, measured on the top side according to ISO 535 standard.

[Embodiment 8]

15 [0109] Release liner base paper according to any of embodiments 1 to 7, wherein the release liner base paper further comprises virgin fibers, the virgin fibers comprising at least 10 wt%, or at least 25 wt%, or at least 45 wt%, or at least 70 wt% of bleached chemical pulp based on the total weight of the virgin fibers.

[Embodiment 9]

20 [0110] Release liner base paper according to embodiment 8, wherein the bleached chemical pulp comprises hardwood fibers, softwood fibers or a blend of both.

[Embodiment 10]

25 [0111] Release liner base paper according to embodiments 8 or 9, wherein the bleached chemical pulp comprises hardwood fibers being present in this blend in an amount of at least 50 wt%, preferably at least 75 wt%, based on the total weight of the bleached chemical pulp.

[Embodiment 11]

30 [0112] Release liner base paper according to any of embodiments 8 to 10, wherein the bleached chemical pulp comprises softwood fibers being present in an amount of at most 50 wt%, preferably at most 25 wt%, based on the total weight of the bleached chemical pulp.

[Embodiment 12]

35 [0113] Release liner base paper according to any of embodiments 8 to 11, wherein the virgin fibers further comprise at least 2 wt% and less than 50 wt%, preferably 5 to 45 wt%, more preferably 10 to 35 wt% of bleached chemi-thermo-mechanical pulp, based on the total weight of the virgin fibers.

[Embodiment 13]

40 [0114] Method of producing the release liner base paper according to any of embodiments 1 to 12, the method comprising the steps of:

- 45
- a) dispersing recycled fibers and optionally virgin fibers in a pulper to form a suspension of fibers,
  - b) refining the suspension of fibers to form a suspension of refined fibers,
  - c) disposing the suspension of refined fibers on a forming wire,
  - 50 d) dewatering the suspension of refined fibers to form a dewatered paper web,
  - e) applying a primer composition on at least one side of the dewatered paper web to form a dewatered, primer-coated paper web, and
  - f) drying the dewatered, primer-coated paper web and the primer composition to form a dried, primer-coated paper web,
- 55

wherein the recycled fibers are recycled cardboard-based and/or printed material-based fibers, and

wherein the recycled fibers are added in an amount of at least 5 wt%, based on the total weight of fibers in the

release liner base paper.

[Embodiment 14]

5 **[0115]** Method of producing the release liner base paper according to embodiment 13, the method further comprising a step of calendering the dried primer-coated paper web.

[Embodiment 15]

10 **[0116]** Method according to embodiments 13 or 14, wherein the recycled fibers are added in an amount of at least 10 wt%, preferably from 15 wt% to 80 wt%, more preferably from 20 wt% to 50 wt%, based on the total weight of fibers in the release liner base paper.

[Embodiment 16]

15 **[0117]** Method according to any of embodiments 13 to 15, wherein the basis weight of the primer layer applied on at least one side of the paper is 0.1 g/m<sup>2</sup> to 30 g/m<sup>2</sup>, preferably 1 g/m<sup>2</sup> to 20 g/m<sup>2</sup>, measured according to ISO 536.

[Embodiment 17]

20 **[0118]** Method according to any of embodiments 13 to 16, wherein the recycled fibers used in step a) fulfil one or more of the following:

- 25 i) a dry content of more than 50%, measured according to TAPPI 210 standard;
- ii) a pulp freeness of 25°SR to 60°SR, preferably of 30°SR to 50°SR, measured according to a derivative of UNI 7621 standard;
- iii) an ash content of 0.1% to 8%, preferably of 0.5% to 7%, measured according to a derivative of TAPPI 211 standard; and
- 30 iv) a pH value of 5 to 12, preferably of 6 to 11, measured according to a derivative of TAPPI 209 standard.

[Embodiment 18]

35 **[0119]** Method according to any of embodiments 13 to 17, wherein the virgin fibers comprise at least 10 wt%, or at least 25 wt%, or at least 45 wt%, or at least 70 wt% of bleached chemical pulp based on the total weight of the virgin fibers.

[Embodiment 19]

40 **[0120]** Method according to any of embodiments 13 to 18, wherein the bleached chemical pulp comprises hardwood fibers, softwood fibers or a blend of both.

[Embodiment 20]

45 **[0121]** Method according to any of embodiments 13 to 19, wherein the bleached chemical pulp comprises hardwood fibers being present in this blend in an amount of at least 50 wt%, preferably at least 75 wt%, based on the total weight of the bleached chemical pulp.

[Embodiment 21]

50 **[0122]** Method according to any of embodiments 13 to 20, wherein the bleached chemical pulp comprises softwood fibers being present in an amount of at most 50 wt%, preferably at most 25 wt%, based on the total weight of the bleached chemical pulp.

[Embodiment 22]

55 **[0123]** Method according to any of embodiments 13 to 21, wherein the virgin fibers further comprise at least 2 wt% and less than 50 wt%, preferably 5 to 45 wt%, more preferably 10 to 35 wt% of bleached chemi-thermomechanical pulp, based on the total weight of the virgin fibers.

[Embodiment 23]

5 [0124] Use of the release liner base paper according to any of embodiments 1 to 12 as a base layer in a method of producing a release liner, the method comprising the steps of applying a release coating composition on at least one side of the release liner base paper, and curing the composition to form a release coating layer.

[Embodiment 24]

10 [0125] Release liner comprising the release liner base paper according to any of embodiments 1 to 12 as a base layer and a release coating layer on at least one side of the base layer.

[Embodiment 25]

15 [0126] Release liner according to embodiment 24, wherein the release coating is silicone and the silicone anchorage on the at least one side of the release liner base paper is of at least 60%, preferably of at least 80%, more preferably of 95% to 100%, measured according to the Rub test described in the specification.

[Embodiment 26]

20 [0127] Laminate comprising the release liner according to embodiments 25 or 26, a face stock and an adhesive layer provided between the release liner and the face stock.

## 25 Claims

1. Release liner base paper comprising recycled fibers, wherein the release liner base paper has a density of at least 1.00 g/cm<sup>3</sup>,

30 wherein the recycled fibers are recycled cardboard-based and/or printed material-based fibers, and wherein the amount of the recycled fibers in the release liner base paper is at least 5 wt%, based on the total weight of fibers in the release liner base paper.

35 2. Release liner base paper according to claim 1, wherein the amount of the recycled fibers in the release liner base paper is at least 10 wt%, preferably from 15 wt% to 80 wt%, more preferably from 20 wt% to 50 wt%, based on the total weight of fibers in the release liner base paper.

40 3. Release liner base paper according to claims 1 or 2, wherein the release liner base paper has an air permeability from 100 pm/Pa•s to 70000 pm/Pa•s, preferably from 500 pm/Pa•s to 50000 pm/Pa•s, measured according to SCAN P26 standard.

4. Release liner base paper according to any of claims 1 to 3, wherein the release liner base paper has a density of 1.05 g/cm<sup>3</sup> to 1.26 g/cm<sup>3</sup>, preferably of 1.09 g/cm<sup>3</sup> to 1.24 g/cm<sup>3</sup>, more preferably of 1.12 g/cm<sup>3</sup> to 1.22 g/cm<sup>3</sup>.

45 5. Release liner base paper according to any of claims 1 to 4, wherein the release liner base paper has a transparency of 4% to 65%, preferably of 25% to 60%, measured according to DIN 53147 standard, and a basis weight of 30 g/m<sup>2</sup> to 140 g/m<sup>2</sup>, preferably of 45 g/m<sup>2</sup> to 90 g/m<sup>2</sup>, measured according to ISO 536.

50 6. Release liner base paper according to any of claims 1 to 5, wherein the release liner base paper has a Bekk smoothness on the back side of 15 s to 1500 s, preferably of 25 s to 1200 s and on the top side of 400 s to 4000 s, preferably of 500 s to 3500 s, measured according to TAPPI T479 standard.

55 7. Release liner base paper according to any of claims 1 to 6, wherein the release liner base paper has a Rizinus Cobb value of 0.2 g/m<sup>2</sup> to 4 g/m<sup>2</sup>, preferably of 0.3 g/m<sup>2</sup> and 3 g/m<sup>2</sup>, more preferably of 0.6 g/m<sup>2</sup> to 1.4 g/m<sup>2</sup>, measured on the top side according to ISO 535 standard.

8. Method of producing the release liner base paper according to any of claims 1 to 7, the method comprising the steps of:

a) dispersing recycled fibers and optionally virgin fibers in a pulper to form a suspension of fibers,

- b) refining the suspension of fibers to form a suspension of refined fibers,  
c) disposing the suspension of refined fibers on a forming wire,  
d) dewatering the suspension of refined fibers to form a dewatered paper web,  
e) applying a primer composition on at least one side of the dewatered paper web to form a dewatered, primer-coated paper web, and  
f) drying the dewatered, primer-coated paper web and the primer composition to form a dried, primer-coated paper web,

wherein the recycled fibers are recycled cardboard-based and/or printed material-based fibers, and wherein the recycled fibers are added in an amount of at least 5 wt%, based on the total weight of fibers in the release liner base paper.

9. Method of producing the release liner base paper according to claim 8, the method further comprising a step of calendering the dried primer-coated paper web.

10. Method according to claims 8 or 9, wherein the recycled fibers are added in an amount of at least 10 wt%, preferably from 15 wt% to 80 wt%, more preferably from 20 wt% to 50 wt%, based on the total weight of fibers in the release liner base paper.

11. Method according to any of claims 8 to 10, wherein the basis weight of the primer layer applied on at least one side of the paper is 0.1 g/m<sup>2</sup> to 30 g/m<sup>2</sup>, preferably 1 g/m<sup>2</sup> to 20 g/m<sup>2</sup>, measured according to ISO 536.

12. Method according to any of claims 8 to 11, wherein the recycled fibers used in step a) fulfil one or more of the following:

- i) a dry content of more than 50%, measured according to TAPPI 210 standard;  
ii) a pulp freeness of 25°SR to 60°SR, preferably of 30°SR to 50°SR, measured according to a derivative of UNI 7621 standard;  
iii) an ash content of 0.1% to 8%, preferably of 0.5% to 7%, measured according to a derivative of TAPPI 211 standard; and  
iv) a pH value of 5 to 12, preferably of 6 to 11, measured according to a derivative of TAPPI 209 standard.

13. Use of the release liner base paper according to any of claims 1 to 7 as a base layer in a method of producing a release liner, the method comprising the steps of applying a release coating composition on at least one side of the release liner base paper, and curing the composition to form a release coating layer.

14. Release liner comprising the release liner base paper according to any of claims 1 to 7 as a base layer and a release coating layer on at least one side of the base layer.

15. Release liner according to claim 14, wherein the release coating is silicone and the silicone anchorage on the at least one side of the release liner base paper is of at least 60%, preferably of at least 80%, more preferably of 95% to 100%, measured according to the Rub test described in the specification.

16. Laminate comprising the release liner according to claims 15 or 16, a face stock and an adhesive layer provided between the release liner and the face stock.

FIG. 1

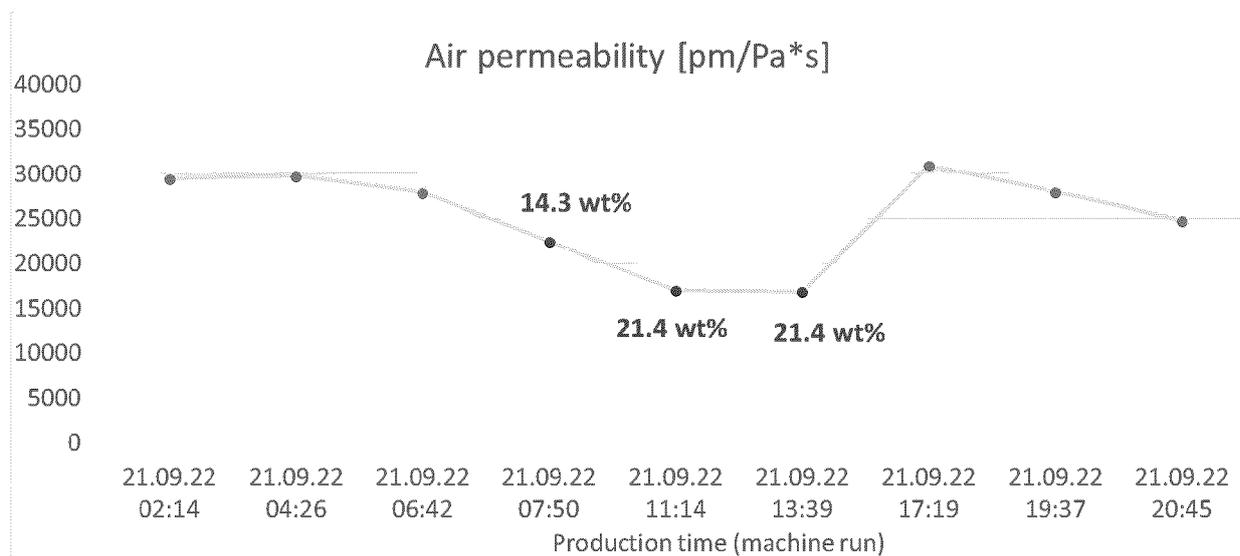


FIG. 2

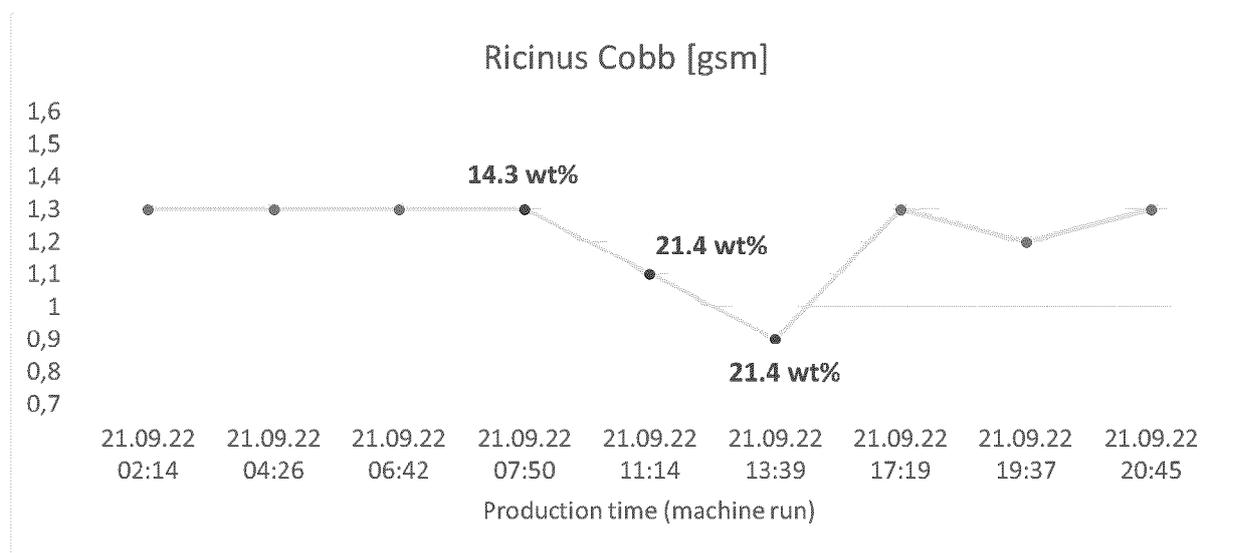


FIG. 3

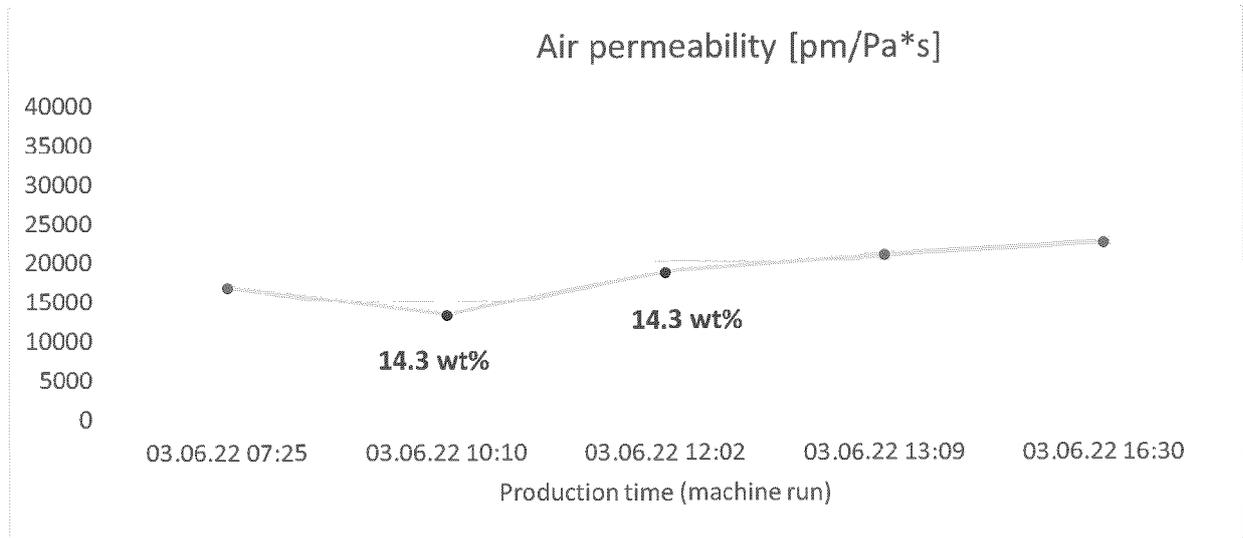
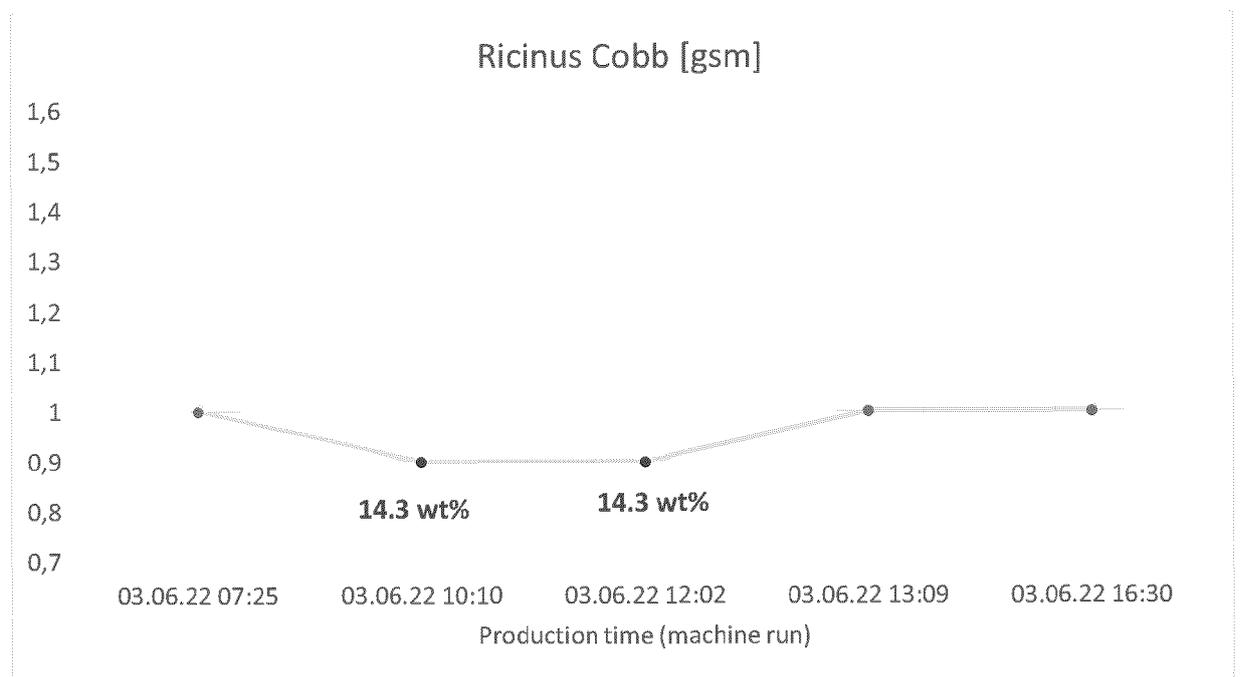


FIG. 4





EUROPEAN SEARCH REPORT

Application Number

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|   |   |   | D21H  |
| Place of search   |   | Date of completion of the search  | Examiner  |
| Munich  |   | 17 April 2023   | Billet, Aina  |
| CATEGORY OF CITED DOCUMENTS   |   | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |   |
| X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |   |   |   |

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