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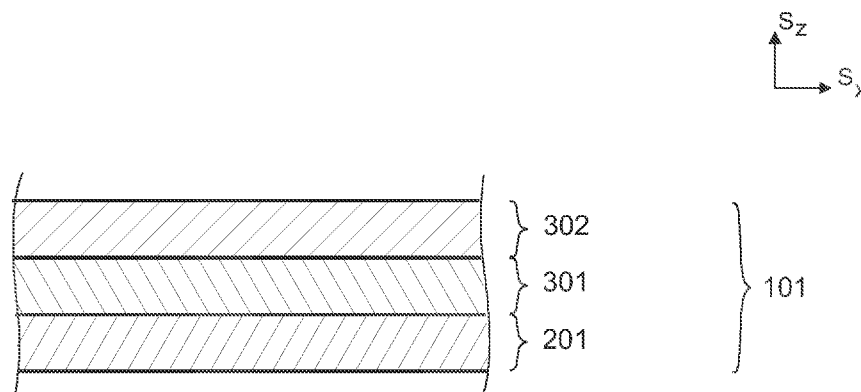


Fig. 1a

(57) **Abstract:** A coated paper (101) suitable for packaging, comprising a base paper (201) comprising cellulose fibres, wherein the coated paper comprises a first coating layer (301) having a coat weight of 2 to 8 g/m², comprising at least one platy pigment, and 20 to 60 wt.% of poly(vinyl alcohol) (PVA) of the total dry weight of the first coating layer (301); and the coated paper further comprises a second coating layer (302) having a coat weight of 4 to 12 g/m², comprising at least one platy pigment, and 20 to 60 wt.% of latex of the total dry weight of the second coating layer (302).



Dispersion coated barrier paper

Technical field

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The present invention relates to coated paper for packaging. In particular, the present invention concerns coated paper which are suitable for achieving barrier properties. The present invention also relates to methods of manufacturing such coated paper and packages containing such coated paper.

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Background

15 In packaging industry, a large variety of paper-based materials are manufactured for packaging foodstuffs, such as bread, as well as for industrial wrapping applications, for example ream wrapping. Packaging in the above-mentioned applications mostly requires barrier properties, such as water resistance, grease resistance, air permeability, and so on, for protecting the packed product from being affected by outside factors and/or preventing the features of packed product from losing. The barrier properties are often realized by using plastic material, especially polyethylene (PE), or other raw materials, such as fluorocarbons. These materials, however, cause environmental problems and/or health concerns.

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Consequently, there is a need for better packaging materials in the industry.

Summary

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It is an aim of the present application to present a coated paper which is particularly well suited for the packaging where barrier properties need to be controlled in a predictable manner. It is also an aim of the present application to provide a versatile coated paper which can be used for different industrial packaging and can protect the packed products in more challenging environments as well. Further, it is also an aim of the present application to

provide methods for manufacturing the coated paper in an easy and economical manner.

In one aspect, the present application provides a coated paper suitable for packaging, comprising a base paper comprising cellulose fibres, wherein the coated paper comprises

- a first coating layer having a coat weight of 2 to 8 g/m², preferably 5.0 – 6.5 g/m², comprising
 - o at least one platy pigment, and
 - o 20 to 60 wt.% of poly(vinyl alcohol) (PVA) of the total dry weight of the first coating layer,
- a second coating layer having a coat weight of 4 to 12 g/m², preferably 6.0 – 10 g/m², comprising
 - o at least one platy pigment, and
 - o 20 to 60 wt.% of latex of the total dry weight of the second coating layer.

The coated paper according to the present application contains two barrier layers where the first layer comprising poly(vinyl alcohol) and platy pigment provides barrier against especially grease and water vapour, and the second layer comprising latex and platy pigment further enhances the water barrier and water vapour resistance properties. The combination of the first coating layer and the second coating layer as described herein contributes a pinhole-free structure of the coated paper, and therefore the barrier properties is further improved. Furthermore, there is no need to use plastics for the barrier properties. Thanks to the structure and composition of the coating layer(s) the coated paper can be, for example, easily recycled and/or composted and/or burnt after usage, without causing environmental problems.

In some embodiments, in the coated paper according to the present application, the first coating layer is situated between the base paper and the second coating layer.

The second layer comprising latex and platy pigment provides excellent water barrier and moisture barrier especially in high humidity, and therefore when applying the coated paper in packaging product to be stored and/or delivered

to places with high humidity, for example in the humid subtropical climate region, the packed product is protected well from the moisture outside.

5 In some embodiments, the coated paper may further comprise a third coating layer comprising latex, wherein the third coating layer is situated between the base paper and the first coating layer.

10 The third coating layer contributes further enhanced water resistance and water vapour resistance to the coated paper. Further, when a coating layer comprising latex is coated directly on the base paper, the dimension stability of the base paper is improved.

In another aspect, the present application provides a method for manufacturing a coated paper according to any of preceding claims, comprising

- 15
- providing the base paper,
 - preparing a first aqueous dispersion comprising platy pigment and PVA, by adding platy pigment slurry into PVA solution,
 - dispersion coating the first aqueous dispersion and thereby forming the first coating layer, which has a coat weight of 2 to 8 g/m² and comprises
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- o at least one platy pigment and
 - o 20 to 60 wt.% of poly(vinyl alcohol) (PVA) of the total dry weight of the first coating layer,
- 25
- preparing a second aqueous dispersion comprising platy pigment and latex, by mixing latex emulsion and platy pigment slurry,
 - dispersion coating the second aqueous dispersion and thereby forming the second coating layer, which has a coat weight of 4 to 12 g/m² and comprises
- 30
- o at least one platy pigment, and
 - o 20 to 60 wt.% of latex of the total dry weight of the second coating layer.

35 The coated paper manufactured by the method as described herein has the effects as mentioned above. Besides, as the first coating dispersion comprises poly(vinyl alcohol), which has excellent film forming, emulsifying and adhesive properties, when applying a coating dispersion comprising poly(vinyl alcohol) and platy pigment, a easily uniform coating layer can be formed on the

substance it coats on. Further, the second dispersion comprising latex has excellent runnability and high-solid content capacity. Thus, when applying a coating dispersion comprising latex, a decreased time for drying is achieved which consequently facilitates the manufactural efficiency. Furthermore, when
5 a coating dispersion comprising latex is applied on the base paper, it does not wet the paper web as much as compared to other water based barrier dispersion/solution, and thus it contributes a better dimension stability of the paper web. Furthermore, the process of manufacturing the coated paper according to the present application is a lot simplified. Often base paper is
10 transported from a paper mill to a converter who adds barrier material, for example by extruding plastic on paper, as the extruder is not necessarily available at the paper mill, and then coated paper is again transported to another converter/printer for finalizing into final product. According to the present application, the barrier coating may be done already at the paper mill,
15 or at only one converter/printer's premises, and thus one converter step and transportation phase can be avoided, so that the whole process of manufacturing is more efficient.

In another aspect, the present application provides a wrapping paper or
20 packing paper comprising the coated paper as described herein, as well as a coated paper obtainable by the method as described herein, for wrapping sheet material, especially ream wrapping, or packing foodstuff such as bread.

The main embodiments are characterized in the independent claims. Various
25 embodiments are disclosed in the dependent claims. The embodiments and examples recited in the claims and in the specification are mutually freely combinable unless otherwise explicitly stated.

Brief description of the drawings

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In the following, the invention will be illustrated by drawings in which

Fig. 1a shows, by way of an example, a coated paper comprising a base paper, a first coating layer, and a second coating layer,

Fig. 1b shows, by way of an example, a coated paper comprising a base paper, a first coating layer, a second coating layer, and a third coating layer,

5 Figs 2a shows, by way of an example, a coated paper comprising a base paper, a first coating layer, and a second coating layer, in a different arrangement from Fig. 1a,

Figs 2b shows, by way of an example, a coated paper comprising a base paper, a first coating layer, a second coating layer, and a third coating layer, in a different arrangement from Fig. 1b,

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The Figures are intended to illustrate the general principles of the disclosed solution. Therefore, the illustrations in the Figures are not necessarily in scale or suggestive of precise layout of system components.

15 Detailed description

In the text, references are made to the Figures with the following numerals and denotations:

20 101 coated paper
201 base paper
301 first coating
302 second coating
303 third coating

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In this application the term "platy pigment" refers to pigments having a flat structure in which one dimension is substantially smaller than the two other dimensions of the structure. Examples of platy pigment include kaolin, talc, and mica.

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The term "base paper" refers to paper comprising natural fibres as its main raw material. The purpose of a base paper is to provide dimensionally stable and dense surface, on which a coating on one or both sides may be applied. The base paper may comprise, for example, one or more fillers and/or additives.

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The term "natural fibre" refers to any plant material that contains cellulose. The natural fibre may be woodbased. The wood may be softwood, such as spruce, pine, silver fir, larch, Douglas fir, or Canadian hemlock; or hardwood, such as birch, aspen, poplar, alder, eucalyptus, or acacia; or a mixture of softwood and hardwood. Other than woodbased raw materials may include agricultural waste, grasses or other plant materials, such as straw, leaves, bark, seeds, legumes, flowers, tops, or fruit, which have been obtained from cotton, corn, wheat, oat, rye, barley, rice, flax, hemp, Manila hemp, sisal hemp, jute, ramee, kenaf hemp, bagasse, bamboo, or reed. The diameter of the natural fibres is normally 15 to 25 μm and the length more than 500 μm , but the present application is not intended to be limited to these parameters.

The term "PVA" refers to poly(vinyl alcohol), which may be referred as polyvinyl alcohol, PVOH, or PVAI. Polyvinyl alcohol is a synthetic polymer prepared by the polymerization of vinyl acetate, followed by a controlled hydrolysis of the ester in the presence of an alkaline catalyst.

The term "latex" refers to a dispersion of polymer particles in water. Latex may be natural, for example originating from flowering plants, or be synthetic, or the combination thereof.

The term "coating layer" refers to a thin layer or a covering that is applied to the surface of an object, usually referred to as the substrate.

The term "dispersion coating" refers to a coating technique in which an aqueous dispersion comprising fine polymer particles is applied to a surface of a substrate, for example base paper or another coating layer, to form a solid coating layer after drying.

The term "ream" refers to a quantity of paper being 20 quires or variously 480, 500, or 516 sheets.

The term "WVTR" stands for water vapour transmission rate, which is a mass of water vapour transmitted through a unit area in a unit time under specified conditions of temperature and humidity. The WVTR values as disclosed herein may be measured according to the standard ISO 2528:2017.

The term "grease resistance" refers to the ability of paper to resist the formation of surface spots or stains or the permeation of grease through the sheet.

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The term "KIT" refers to a determining method according to the Tappi standard (Tappi T559 cm02) for paper and paperboard with oil and grease resistance. A higher number implies a better grease resistance for the sample tested.

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Unless otherwise stated, the following standards refer to methods which may be used in obtaining stated values of parameters representing paper or pulp quality:

Grammage: ISO 536, and

Thickness: ISO 534.

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Description of coated paper according to the application

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Reference may be made to Fig. 1a-b and Fig. 2a-b. It is noted that the examples shown in Fig. 1a-b and Fig. 2a-b do not bound to any specific embodiments, but merely serve the purpose for explaining the relative location of features denoted with reference signs. Also, Fig. 1a-b and Fig. 2a-b show the schematic drawings of examples, not scaled drawings.

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According to the first aspect, there is provided a coated paper 101 suitable for packaging, comprising a base paper 201 comprising cellulose fibres, wherein the coated paper comprises

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- a first coating layer 301 having a coat weight of 2 to 8 g/m², comprising
 - o at least one platy pigment, and
 - o 20 to 60 wt.% of poly(vinyl alcohol) (PVA) of the total dry weight of the first coating layer,
- a second coating layer 302 having a coat weight of 4 to 12 g/m², comprising
 - o at least one platy pigment, and
 - o 20 to 60 wt.% of latex of the total dry weight of the second coating layer.

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The coated paper 101 as disclosed herein exhibit a WVTR in a range of 10 to 30 g/m²/day in a medium humid condition (RH 50%, 23°C), and WVTR in a range of 200 to 300 g/m²/day in a high humid condition (RH 75%, 23°C). In some examples, the coated paper 101 as disclosed herein also exhibit a grease resistance KIT value in a grange of 4 – 9 when testing with the Tappi standard T559. Thus, when using the coated paper 101 in packaging, especially foodstuff packages, it is possible to keep the moisture content inside the packages in a predictable manner. Thus, the taste experience and shelf life may be guaranteed. Furthermore, with the growing business of package delivery globally, it is possible to maintain the barrier properties in different environments, for example in high moisture conditions, in a predictable manner. The coated paper 101 as described in the present application exhibits appropriate barrier properties without using plastic.

The combination of the first coating layer 301 and the second coating layer 302 as described herein contributes a pinhole-free structure of the coated paper 101. Pinholes are a coating defect, pore-like penetrations present on a coating. They may appear in solvent-based coatings due to the entrapment of moisture, air, solvents or other fluids in the coating solution. Also, fibers on the paperboard substrate surface can puncture the coating. Thus, the factors intended to be barriered, e.g. moisture and grease, can still penetrate the base paper and the coating through pinholes, and vice versa. Thus, for base paper with one-layered coating, the existence of pinholes affects the barrier properties significantly. The coated paper 101 according to the present application has a multiple coating structure, and thus the barrier properties can be improved.

Accordingly, the first coating layer 301 and second coating layer 302 may be arranged so that the coated layer 101 has a multiple coating structure. For example, with reference to Fig. 1a, in some embodiments, the coated paper 101 comprises a base paper 201, a first coating layer 301 on one side of the base paper 201, and a second coating layer 302 in contact with the first coating layer 301. It is possible to arrange the coating in such a way that, the coated paper 101 comprises a base paper 201, a second coating layer 302 on one side of the base paper 201, and a first coating layer 301 in contact with the second coating layer 302. Also, it is possible to arrange the coating in such a

way that, with reference to Fig. 2a, a first coating layer 301 and a second coating layer 302 are coated on the opposite sides of the base paper 201, so that the coated paper 101 has a multilayered structure.

- 5 In the coated paper 101, the first coating layer 301 comprises platy pigment and poly(vinyl alcohol) (PVA). PVA is bio-compatible, odourless and non-toxic, and thus it is especially suitable for foodstuff packaging. An amount of more than 20 wt.% of PVA of the total dry weight of the first coating layer is sufficient for the desired barrier properties for grease and oxygen, when the coat weight
10 of the first coating layer 301 is between 2 to 8 g/m², preferably 5.0 – 6.5 g/m², for example 5.5 g/m² or 6.0 g/m². Thus, the first coating layer 301 serves as a good aroma-, oil- and steam-proof coating, particularly beneficial for food packaging. Preferably, the first coating layer 301 has 20 to 60 wt.%, for example 20 wt.%, 25 wt.%, 30 wt.%, 35 wt.%, 40 wt.%, 45 wt.%, 50 wt.%, 55
15 wt.%, 60 wt.%, or ranges inbetween, of PVA of the total dry weight of the first coating layer. PVA with variety of degrees of hydrolysis may be used in the first coating layer 301, while fully hydrolyzed PVA is preferable for contributing the better water-resistance, tear strength and notch impact toughness of the coating. Preferably, the PVA in the first coating layer 301 has a degree of
20 hydrolysis in a range from 96 to 100 mol%. Advantageously, the PVA has a viscosity between 6 – 10 mPa · s, when measured in the 4% aqueous solution at 20 °C. When PVA has a viscosity less than 6 mPa · s, the first coating would not be suitable for being used in packing foodstuffs. Further, PVA has high pigment binding power and thus form a firmly binding structure with pigment.
25 Platy pigment is advantageous for the barrier coating layer as the platy, flaky structure, when piling inside the coating layer, forms more difficult paths for small penetrants to travel as compared to cubic- or spherical-shaped pigments, thus contributes barrier properties.
- 30 In the coated paper 101, the second coating layer 302 comprises platy pigment and latex. The second coating layer 302 provides an enhanced water barrier property to the coated paper 101. Latex may be natural latex and synthetic latex, or the mixture thereof. Natural latex has better stretching effect, lower tearing strength, mechanical strength, and biodegradable, while synthetic
35 latex, for example styrene-butadiene latex or styrene-acrylate latex, can be produced on a large scale and its cost is lower. Latex particles with a variety

of chemical functional groups can be prepared, and these are also available commercially from a variety of sources. Latex provides also grease barrier. An amount of more than 20 wt.% of latex of the total dry weight of the second coating layer 302 is sufficient for the desired barrier properties for enhanced water resistance, when the coat weight of the second coating layer 302 is between 4 to 12 g/m², preferably 6.0 – 10 g/m², for example 7.0 g/m², 8.0 g/m², or 9.0 g/m². Preferably, the second coating layer 302 has 20 to 60 wt.%, for example 20 wt.%, 25 wt.%, 30 wt.%, 35 wt.%, 40 wt.%, 45 wt.%, 50 wt.%, 55 wt.%, 60 wt.%, or ranges inbetween, of latex of the total dry weight of the second coating layer.

The arrangement of base paper 201, first coating layer 301, and second coating layer 302 may vary according to the end use of the coated paper 101. In some embodiments, such as shown in Fig. 1a, the first coating layer 301 is situated between the base paper 201 and the second coating layer 302. This arrangement is suitable when the package is to be delivered to and/or stored in a high humidity condition. In some embodiments, such as shown in Fig. 2a, the base paper 201 is situated between the first coating layer 301 and the second coating layer 302. This arrangement is suitable when the package is used for packing greasy product, especially food product, and is also to be delivered to and/or stored in a high humidity condition. It is also possible, that the second coating layer 302 is situated between the first coating layer 301 and the base paper. This arrangement is suitable for providing a good layer for further coating layer(s), for example e.g. converter would provide moisture & heat seal layer on top of the first coating layer 301.

In some embodiments, the coated paper may further comprise a third coating layer 303 comprising latex. The third coating layer 303 may comprise latex and platy pigment. The third coating layer contributes further enhanced water resistance and water vapour resistance to the coated paper. Again, the arrangement of coating layers may vary according to the purposes of use. In some examples, the third coating layer 303 is situated between the base paper 201 and the first coating layer 301, as shown in Fig. 1a and Fig. 1b. The third coating layer 303 may have a coat weight of 4 to 12 g/m² and comprise 20 to 60 wt.% of latex of the total dry weight of the third coating layer 303. The third coating layer 303 may be the same as the second coating layer 302. The

second/third coating layer(s) comprising latex, contain less water than the first coating layer comprising PVA, and have minor wettability influence on paper web in manufacturing phase, which improves runnability. Thus, when a coating layer comprising latex is coated directly on the base paper, the dimension stability of the base paper is improved.

The coating layer 301, 302, 303 may further comprise additives, for example thickeners or stearates, according to the actual needs for the applications which are knowledgeable by the skilled person.

The base paper 201 may be a wide range of industrial paper, for example natural, bleached, or semi-bleached kraft paper, calendered or supercalendered kraft (SCK) paper, parchment, glassine paper, machine-finished paper, machine-glazed paper, or fine paper. In an example, the base paper may be so-called bag paper, such as so-called machine glazed (MG) paper. One side of MG paper is typically smoother than the other side of the paper. Paperboard having basis weights of 150 - 400 g/m² may not be suitable for ream wrapping or certain foodstuffs packaging such as bag paper for bread.

The base paper 201 comprises natural fibre. Preferably, the natural fibre comprises chemically pulped natural fibre, that is, pulp made in a chemical pulping process. In an advantageous example, the content of chemically pulped natural fibres in all the natural fibres used in the base paper product is thus at least 70 wt%, at least 80 wt% or at least 90 wt%, advantageously at least 95 wt% or 98 wt%. Preferably, all the natural fibres used in the base paper are chemically pulped natural fibres.

Advantageously, the base paper 201 is a single layer. As mentioned above, the base paper 201 is preferably having a lower grammage, and therefore making multilayer paper is not very practical in this kind of lower grammage papers.

The properties of coating layers 301, 302, 303 can be adjusted, for example by changing the thickness of the coating layer(s) so that the insulating capacity of the coating layer is typically improved when the thickness of the coating layer is increased. Furthermore, the properties can be influenced, among other

things, by changing the relative contents of the platy pigment and PVA and/or latex. When the content of the platy pigment increases in relation to the content of PVA/latex, the viscosity of the coating typically decreases and its porosity increases.

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Advantageously, the platy pigment comprises talc, kaolin, and/or mica. Talc is more difficult to disperse into water and tend to agglomerate. Thus, according to an advantageous example, the content of kaolin in the platy coating pigments used in the coating is 50 wt%, 60 wt%, 70 wt%, 80 wt%, 90 wt%, 95 wt%, or 100 wt%, including any ranges and partial ranges.

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In the coating layer 301 the relative portion of the platy pigment in the total content of said platy pigment and PVA is at least 40 wt%, more advantageously 45 to 80 wt%, and even more advantageously 50 to 70 wt%. In the coating layer(s) 302 and/or 303 the relative portion of the platy pigment in the total content of said platy pigment and latex is at least 40 wt%, more advantageously 45 to 80 wt%, and even more advantageously 50 to 70 wt%.

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According to the present application, the grammage of the coated paper 101 may be in a grange of 40 – 120 g/m², preferably 55 - 90 g/m², such as 55 g/m², 60 g/m², 65 g/m², 70 g/m², 75 g/m², 80 g/m², 85 g/m², or 90 g/m², or ranges inbetween.

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Coated paper 101 having a grammage in a grange of 70 – 120 g/m², preferably 80 - 90 g/m² is particularly suitable for using in ream wrapping. In some embodiments, wherein the first coating layer 301 contains dry content 20 – 60 wt.% PVA and the second coating layer 302 contains dry content 20 – 60 wt.% latex and the grammage of the coated paper 101 is 80 - 90 g/m², the WVTR (RH 50%, 23°C) is in a range of 10 – 30 g/m²/day, the WVTR (RH 75%, 23°C) is in a range of 200 – 300 g/m²/day. In some preferred embodiments, wherein the first coating layer 301 contains dry content 40 – 60 wt.% PVA and the second coating layer 302 contains dry content 40 – 60 wt.% latex and the grammage of the coated paper 101 is 90 g/m², the WVTR (RH 50%, 23°C) is 10-15 g/m²/day, and the WVTR (RH 75%, 23°C) is 200 – 220 g/m²/day.

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The coated paper 101 according to the present application can be used for forming a food package. For this purpose, the coated paper 101 advantageously has a grammage in a range of 40 – 70 g/m², preferably 55 - 65 g/m². In some embodiments, wherein the first coating layer 301 contains dry content 20 – 60 wt.% PVA and the second coating layer 302 contains dry content 20 – 60 wt.% latex and the grammage of the coated paper 101 is 55 - 65 g/m², the WVTR (RH 50%, 23°C) is in a range of 10 – 30 g/m²/day, the WVTR (RH 75%, 23°C) is in a range of 200 – 300 g/m²/day. In some preferred embodiments, wherein the first coating layer 301 contains dry content 20 – 40 wt.% PVA and the second coating layer 302 contains dry content 20 – 40 wt.% latex and the grammage of the coated paper 101 is 65 g/m², the WVTR (RH 50%, 23°C) is 15 - 30 g/m²/day, and the WVTR (RH 75%, 23°C) is 220 – 300 g/m²/day.

The food package may be a bag or have a substantially bag-like shape. The food package may or may not also comprise one or more other materials, for example as a so-called "window". However, in order to achieve the desired barrier properties, the content of the coated paper 101 according to the present application is at least 50%, more advantageously at least 60% or at least 70%, and most advantageously at least 80% or at least 90% of the surface area of the outer layer of said food package. In an example, the coated paper 101 for packaging foodstuffs is used for packaging fresh bread. In another example, the coated paper 101 for packaging foodstuffs is used for packaging bakery products, such as hamburgers or pastries. In still another example, the coated paper 101 is used for packaging dry products, such as dried bread and/or crispbread.

Detailed description of methods according to the application

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According to another aspect, the present application provides a method for manufacturing a coated paper 101, comprising

- providing a base paper 201,
- preparing a first aqueous dispersion comprising platy pigment and PVA, by adding platy pigment slurry into PVA solution,

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- dispersion coating the first aqueous dispersion and thereby forming a first coating layer 301, which has a coat weight of 2 to 8 g/m² and comprises
 - at least one platy pigment and
 - 20 to 60 wt.% of poly(vinyl alcohol) (PVA) of the total dry weight of the first coating layer 301,
- preparing a second aqueous dispersion comprising platy pigment and latex, by mixing latex emulsion and platy pigment slurry,
- dispersion coating the second aqueous dispersion and thereby forming the third coating layer 303, which has a coat weight of 4 to 12 g/m² and comprises 20 to 60 wt.% of latex of the total dry weight of the third coating layer 303.

The coated paper 101 manufactured by the method as described herein has the properties and effects as mentioned above.

The first coating layer 301 may have a coat weight of 5.0 – 6.5 g/m². The second coating layer 302 may have a coat weight of 6.0 – 10 g/m².

It is possible to have a third coating layer 303 by dispersion coating a third aqueous dispersion comprising latex. The third coating layer 303 may be situated between the base paper 201 and the first coating layer 301. The third coating layer 303 may have a coat weight of 4 to 12 g/m² and comprise 20 to 60 wt.% of latex of the total dry weight of the third coating layer 303.

PVA has excellent film forming, emulsifying and adhesive properties, and thus when applying a coating dispersion comprising PVA and platy pigment, an easily uniform coating layer can be formed on the substance it coats on. PVA with variety of degrees of hydrolysis may be used in the first coating layer 301, while fully hydrolyzed PVA is preferable for the better water-resistance. Preferably, the PVA in the first coating layer 301 has a degree of hydrolysis in a range from 96 to 100 mol%. Preferably, the first aqueous dispersion contains PVA in a dry weight between 20 to 60 wt.%, for example 20 wt.%, 25 wt.%, 30 wt.%, 35 wt.%, 40 wt.%, 45 wt.%, 50 wt.%, 55 wt.%, 60 wt.%, calculated from the total dry weight of the first coating layer. A dry weight amount of more than 60 wt.% of PVA is less preferred as it may cause the problems with runnability

of the coating dispersion. For a better film formability, the PVA may have the viscosity between 6 - 10 mPa · s, when measured in the 4% aqueous solution at 20 °C. When PVA has a viscosity higher than 10 mPa · s, the first aqueous dispersion would be difficult to spread. Advantageously, when preparing the first aqueous dispersion, PVA is firstly dissolved in water in a vessel, and then slurry of platy pigment is added into the vessel while stirring, to avoid spontaneous viscosity increase.

According to the method of the present application, the second dispersion comprising latex has excellent runnability and high-solid content capacity. Thus, when applying a coating dispersion comprising latex, a decreased time for drying is achieved. Furthermore, as described, the second/third coating layer(s) comprising latex, contain less water than the first coating layer comprising PVA, and have minor wettability influence on paper web in manufacturing phase, which improves runnability. Thus, when a coating dispersion comprising latex is applied on the base paper, it does not wet the paper web as much as compared to other water based barrier dispersion/solution, and thus it contributes a better dimension stability of the paper web. It is favorable to have non-foaming latex to avoid pinholes and voids. The second dispersion may further comprise additives. The second dispersion may comprise a surfactant to keep the dispersion stable. Latex may be natural or synthetic, such as styrene-butadiene latex or styrene-acrylate latex.

For coating the aqueous dispersion(s), commonly used coating techniques may be used, such as one or more of the following: blade coating, flooded nip application, nozzle application, short dwell time application, rod coating, air brush coating, film transfer coating, curtain coating, or spray coating. In an advantageous example, at least one coating layer is formed by film transfer coating, rod coating, or blade coating. Dispersion coating produces barrier layer by water evaporation, dense packing and coalescence.

The examples described hereunder are covered within the concept of the present application.

- A package for sheet material, in which package a set of paper sheets is wrapped within wrapping paper, wherein the wrapping paper may comprise PVA, latex and platy pigment. The set of paper sheets may contain 400 – 550 sheets, or the set of paper sheets is a ream of paper. The wrapping paper may have at least one of the following properties: the grammage may be in a grange of 40 – 120 g/m², preferably 55 - 90 g/m²; the water vapour transmission rate may be in a grange of 5 to 40 g/m²/day, at an air humidity of RH 50% and a temperature of 23°C; the water vapour transmission rate may be in a grange of 200 to 300 g/m²/day, at an air humidity of RH 75% and a temperature of 23°C; the grease resistance KIT value may be in a grange of 4 – 9 when testing with the Tappi standard T559. The coating may be in a multilayer structure having a first sublayer of PVA and platy pigment, and a second sublayer of latex and platy pigment.
- A coated paper suitable for packaging, comprising a base paper, a first PVA coating on the base paper, and a second latex coating on the first PVA coating, wherein the first PVA coating may have a coat weight of 2 to 8 g/m², and the second latex coating has a coat weight of 4 to 12 g/m². The the second latex coating may have a basis weight that is 1 to 6 times the basis weight of the first PVA coating. The first PVA coating and the second latex coating may further contain platy pigment. The coated paper may have at least one of the following properties: the grammage may be in a grange of 40 – 120 g/m², preferably 55 - 90 g/m²; the water vapour transmission rate may be in a grange of 5 to 40 g/m²/day, at an air humidity of RH 50% and a temperature of 23°C; the water vapour transmission rate may be in a grange of 200 to 300 g/m²/day, at an air humidity of RH 75% and a temperature of 23°C; the grease resistance KIT value may be in a grange of 4 – 9 when testing with the Tappi standard T559.

30

Examples

35 Example 1:

A commercially available uncoated Kraft base paper having a basis weight of 55 g/m² was provided.

5 A first aqueous dispersion containing PVA and Kaolin pigment was dispersion coated on a first side of the base paper and formed a first coating layer after drying. The dry weight of PVA was 35 wt.% and the dry weight of Kaolin was 65 wt.% of the total dry weight of the first coating layer.

10 A second aqueous dispersion containing latex and kaolin was dispersion coated on the first coating layer and formed a second coating layer after drying. The dry weight of latex was 35 wt.% and the dry weight of Kaolin was 65 wt.% of the total dry weight of the second coating layer.

15 The coated paper had a grammage of 65 g/m².

Example 2:

20 A commercially available uncoated Kraft base paper having a basis weight of 80 g/m² was provided.

25 A first aqueous dispersion containing PVA and Kaolin pigment was dispersion coated on a first side of the base paper and formed a first coating layer after drying. The dry weight of PVA was 40 wt.% and the dry weight of Kaolin was 60 wt.% of the total dry weight of the first coating layer.

30 A second aqueous dispersion containing latex and kaolin was dispersion coated on the first coating layer and formed a second coating layer after drying. The dry weight of latex was 40 wt.% and the dry weight of Kaolin was 60 wt.% of the total dry weight of the second coating layer.

The coated paper had a grammage of 90 g/m².

35 Measurements of properties:

Sheets of coated paper obtained from Example 1, Example 2 and Comparative Example, respectively, were tested. The results are shown in the Table 1 below.

	WVTR (RH50%, 23°C) g/m ² /day	WVTR (RH75%, 23°C) g/m ² /day	KIT
Example 1	25	540	6
Example 2	13	210	8

Claims:

1. A coated paper (101) suitable for packaging, comprising a base paper (201) comprising cellulose fibres, **characterized in that**, the coated paper comprises
- 5 - a first coating layer (301) having a coat weight of 2 to 8 g/m², comprising
- at least one platy pigment, and
 - 20 to 60 wt.% of poly(vinyl alcohol) (PVA) of the total dry weight of the first coating layer (301),
- 10 - a second coating layer (302) having a coat weight of 4 to 12 g/m², comprising
- at least one platy pigment, and
 - 20 to 60 wt.% of latex of the total dry weight of the second coating layer (302).
- 15
2. The coated paper (101) according to claim 1, wherein the first coating layer (301) has a coat weight of 5.0 – 6.5 g/m².
3. The coated paper (101) according to any of preceding claims, wherein the
- 20 second coating layer (302) has a coat weight of 6.0 – 10 g/m².
4. The coated paper (101) according to any of preceding claims, wherein the first coating layer (301) is situated between the base paper (201) and the second coating layer (302).
- 25
5. The coated paper (101) according to any of preceding claims, further comprising a third coating layer (303) comprising latex, wherein the third coating layer (303) is situated between the base paper (201) and the first coating layer (301).
- 30
6. The coated paper (101) according to claim 5, wherein the third coating layer (303) has a coat weight of 4 to 12 g/m² and comprise 20 to 60 wt.% of latex of the total dry weight of the third coating layer (303).

7. The coated paper (101) according to any of preceding claims, wherein the base paper (201) comprises at least 95 wt.% of chemically pulped natural fibres.
- 5 8. The coated paper (101) according to any of preceding claims, wherein the platy pigment contains at least 50 wt.% kaolin.
9. The coated paper according to any of preceding claims, wherein the PVA has has a degree of hydrolysis in a range from 97 to 100 mol% and/or a
10 viscosity between 6 – 10 mPa · s, when measured in the 4% aqueous solution at 20 °C.
10. The coated paper according to any of preceding claims, wherein the latex comprises styrene-butadiene latex, styrene-acrylate latex, or a mixture thereof.
- 15 11. The coated paper according to any of preceding claims, wherein the base paper 201 is in a single-layered form.
12. The coated paper according to any of preceding claims, the coated paper
20 has at least one of the following properties:
- the grammage of the coated paper is in a grange of 40 – 120 g/m², preferably 55 - 90 g/m²,
 - the water vapour transmission rate is in a grange of 10 to 30 g/m²/day, at an air humidity of RH 50% and a temperature of 23°C,
 - 25 - the water vapour transmission rate is in a grange of 200 to 300 g/m²/day, at an air humidity of RH 75% and a temperature of 23°C,
 - the grease resistance KIT value is in a grange of 4 – 9 when testing with the Tappi standard T559.
- 30 13. A method for manufacturing a coated paper (101), comprising
- providing a base paper (201),
 - preparing a first aqueous dispersion comprising platy pigment and PVA, by adding platy pigment slurry into PVA solution,
 - dispersion coating the first aqueous dispersion and thereby forming a
35 first coating layer (301), which has a coat weight of 2 to 8 g/m² and comprises

- at least one platy pigment and
 - 20 to 60 wt.% of poly(vinyl alcohol) (PVA) of the total dry weight of the first coating layer (301),
 - preparing a second aqueous dispersion comprising platy pigment and latex, by mixing latex emulsion and platy pigment slurry,
 - dispersion coating the second aqueous dispersion and thereby forming the third coating layer (303), which has a coat weight of 4 to 12 g/m² and comprises 20 to 60 wt.% of latex of the total dry weight of the third coating layer (303).
14. The method according to claim 13, wherein the first coating layer (301) has a coat weight of 5.0 – 6.5 g/m², and/or wherein the second coating layer (302) has a coat weight of 6.0 – 10 g/m².
15. The method according to any of claims 13-14, further comprising
- preparing a third aqueous dispersion comprising latex,
 - dispersion coating the third aqueous dispersion and thereby forming the second coating layer (302), which preferably has a coat weight of 4 to 12 g/m² and comprises
 - at least one platy pigment, and
 - 20 to 60 wt.% of latex of the total dry weight of the second coating layer (302).
16. The method according to any of claims 13-15, wherein the PVA has a degree of hydrolysis in a range from 97 to 100 mol%, and/or a viscosity between 6 – 10 mPa · s, when measured in the 4% aqueous solution at 20 °C.
17. A coated paper obtainable by the method according to any of claims 13-16.
18. A wrapping paper for wrapping sheet material, **characterized in that** said wrapping paper comprises the coated paper 101 according to any of claims 1-12, or the coated paper 101 obtained according to any of claims 13-16, wherein
- the grammage of the coated paper 101 is in a range of 70 – 120 g/m², preferably 80 - 90 g/m².

19. A package for sheet material, in which package a set of paper sheets is placed within the wrapping paper according to claim 18, wherein the set of paper sheets contains 400 – 550 sheets, or the set of paper sheets is a ream of paper.

20. A packing paper for packing foodstuff, **characterized in that** said packing paper comprises the coated paper 101 according to any of claims 1-12, or the coated paper 101 obtained according to any of claims 13-16, wherein

- the grammage of the coated paper 101 is in a grange of 40 – 70 g/m², preferably 55 - 65 g/m².

21. The packing paper according to claim 20, wherein at least of 50 % of the area of the packing paper is the coated paper 101.

22. A package for sheet material, in which package a set of paper sheets is wrapped within wrapping paper, **characterized in that** the wrapping paper comprises PVA, latex and platy pigment.

23. The package according to claim 22, wherein the set of paper sheets contains 400 – 550 sheets, or the set of paper sheets is a ream of paper.

24. The package according to claim 22 or 23, wherein the wrapping paper comprises a base paper and a coating, said coating comprising PVA, latex and platy pigment.

25. The package according to any of claims 22 to 24, wherein the wrapping paper has at least one of the following properties:

- the grammage is in a grange of 40 – 120 g/m², preferably 55 - 90 g/m²,
- the water vapour transmission rate is in a grange of 5 to 40 g/m²/day, at an air humidity of RH 50% and a temperature of 23°C,
- the water vapour transmission rate is in a grange of 200 to 300 g/m²/day, at an air humidity of RH 75% and a temperature of 23°C,
- the grease resistance KIT value is in a grange of 4 – 9 when testing with the Tappi standard T559.

26. The package according to claim 24 to 25, wherein the coating is in a multilayer structure having a first sublayer of PVA and platy pigment, and a second sublayer of latex and platy pigment.

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27. A coated paper suitable for packaging, comprising a base paper, a first PVA coating on the base paper, and a second latex coating on the first PVA coating, wherein the first PVA coating has a coat weight of 2 to 8 g/m², and the second latex coating has a coat weight of 4 to 12 g/m².

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28. The coated paper according to claim 27, wherein the second latex coating has a basis weight that is 1 to 6 times the basis weight of the first PVA coating.

29. The coated paper according to claim 27 or 28, wherein the first PVA coating and the second latex coating further contain platy pigment.

15

30. The coated paper according to any of claims 27 to 29, wherein the coated paper has at least one of the following properties:

20

- the grammage is in a grange of 40 – 120 g/m², preferably 55 - 90 g/m²,
- the water vapour transmission rate is in a grange of 5 to 40 g/m²/day, at an air humidity of RH 50% and a temperature of 23°C,
- the water vapour transmission rate is in a grange of 200 to 300 g/m²/day, at an air humidity of RH 75% and a temperature of 23°C,
- the grease resistance KIT value is in a grange of 4 – 9 when testing with the Tappi standard T559.

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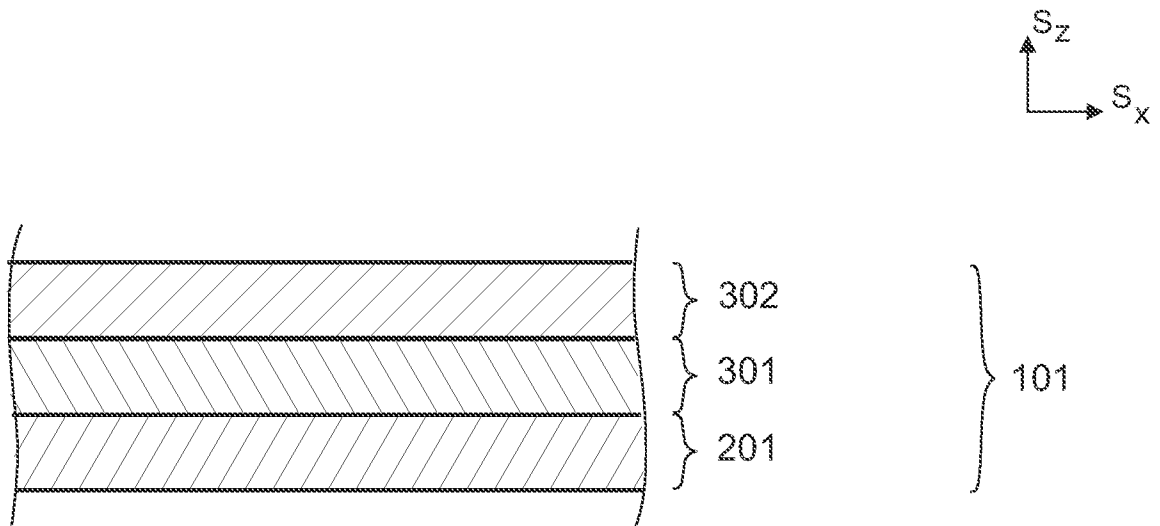


Fig. 1a

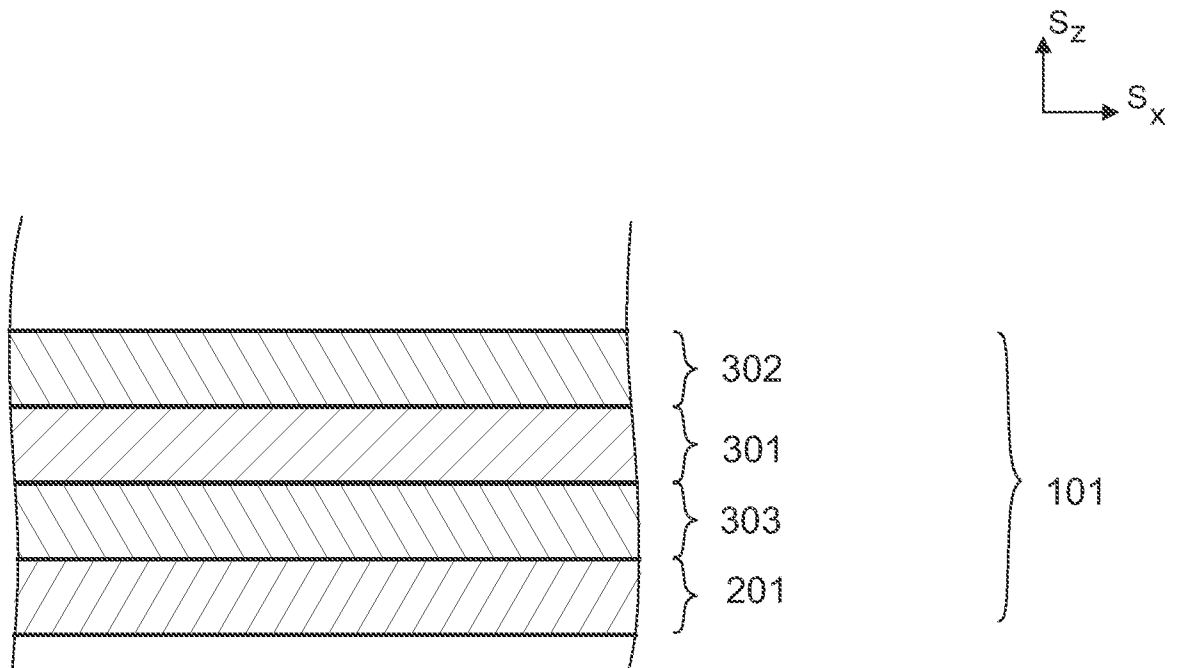


Fig. 1b

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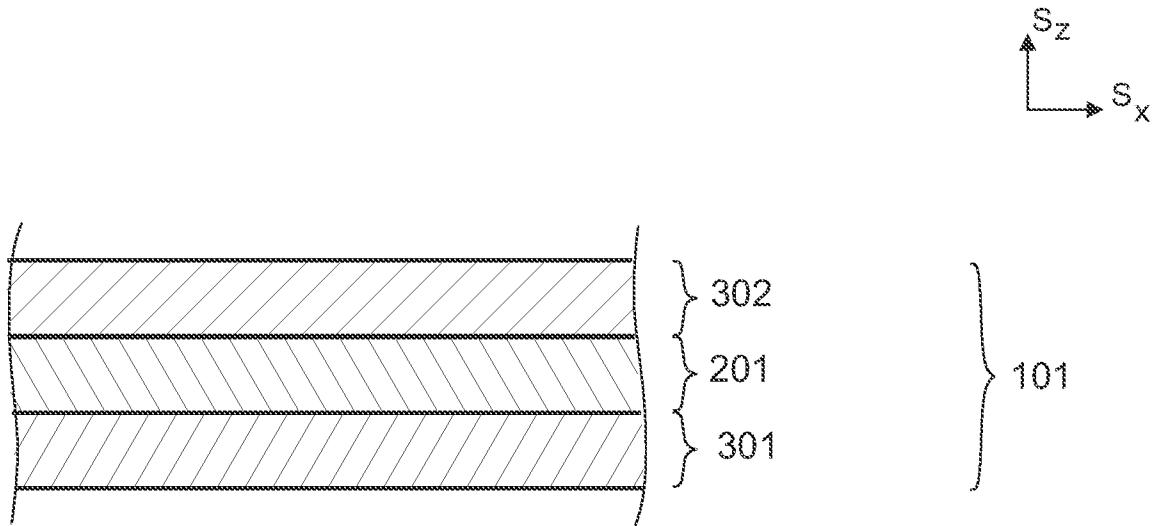


Fig. 2a

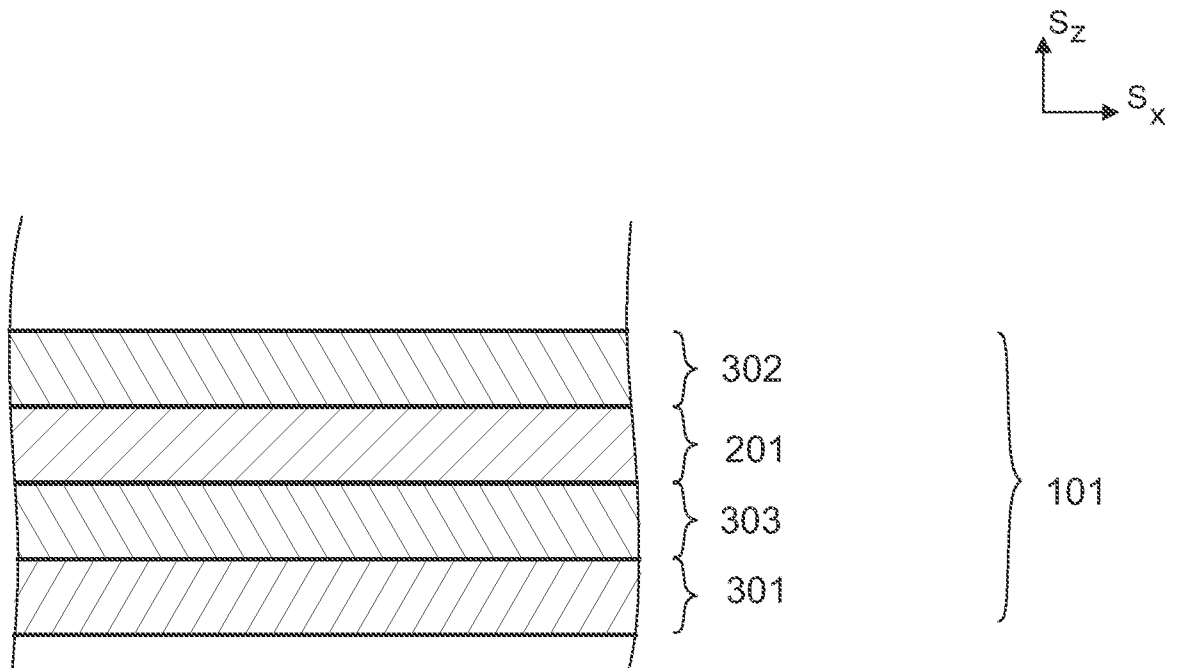


Fig. 2b

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2020/050849

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: D21H, B41M

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

FI, SE, NO, DK

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

EPODOC, EPO-Internal full-text databases, full-text translation databases from Asian languages, WPIAP, PRH Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	WO 2013017857 A1 (IMERYS MINERALS LTD [GB]) 07 February 2013 (07.02.2013) Background; example 1	22-25
A		26
X	US 6458413 B1 (HIRABAYASHI TETSUYA [JP] et al.) 01 October 2002 (01.10.2002) Examples 1 and 3	1-17, 27-30
A		18-21

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
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"E" earlier application or patent but published on or after the international filing date	"&" document member of the same patent family
"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	

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INTERNATIONAL SEARCH REPORT
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2020/050849

CLASSIFICATION OF SUBJECT MATTER

IPC

D21H 19/82 (2006.01)

D21H 19/80 (2006.01)

D21H 19/60 (2006.01)

D21H 27/10 (2006.01)

B65D 81/34 (2006.01)