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(54) **A process for producing security tapes**

(57) A process for producing security tapes wound in webs which comprise the following layers:

- a support film (1),
 - a layer of adhesive material (2) or adhesive layer (2), positioned on the internal surface of the support film,
 - a protective film (3) which is coated with an antiadhesive material on the side contacting the exposed surface of the adhesive layer, the protective film (3) being cut longitudinally from the web in two parts (3a) and (3b), optionally, between the support film (1) and the layer of adhesive material (2), one or more additional layers are inserted,
- said process comprising the following passages:

- a1) optionally application on the internal surface of the support film (1) of one or more additional layers,
- b) application of the adhesive layer (2) on the internal surface of the last additional layer applied, when present, or on the internal surface of the support film (1),
- c) application of the protective film (3) to the adhesive layer (2),
- d) cutting longitudinally the protective film (3) to form two parts (3a) and (3b),
- e) winding the security tape in web.

EP 1 961 552 A2

Description

[0001] The present invention relates to a process for the manufacture of security adhesive tapes for detecting unauthorized opening of packages, for example of envelopes and containers in general, for mailing.

[0002] The present invention relates also to the security adhesive tapes obtainable by said process.

[0003] It is known in the prior art that security adhesive tapes are applied on packages to ensure that an envelope or a container is not open before the delivery to the addressee. One type of these tapes is for example made of an adhesive generally coloured layer and of a support which easily breaks when one tries to open the package.

[0004] However this type of tape has the drawback that it can be removed from envelopes or from containers without damaging the tape. This can be done by using solvents, or heat or steam, etc. As a consequence this type of tape can then be repositioned on the package without leaving traces of an unauthorized opening. In conclusion this kind of tape cannot be reliably used as a security tape.

[0005] Furthermore, if the adhesive layer is not protected, as in the case of a commercial self-adhesive tape roll, tape application is made when the container is closed. This represents a drawback, since with this type of tape it is not possible to make ready-to-use safety envelopes, i.e. with the tape already positioned on the envelope for its closure.

[0006] Self-adhesive security tapes which have a non removable image on the container upon unauthorized opening, are also known. These tapes are generally self-adhesive and have a removable protective film superimposed to the adhesive layer so that the adhesive layer is protected until its use for closing the containers. With this kind of tape it is possible to produce for example packages having a ready-to-use security closing device. They can be prepared by applying longitudinally the tape on one of the two openings of the packaging and by using for the adhesion to the container one longitudinal portion of the adhesive layer, which has been uncovered by shifting aside and repositioning the protective film on the adhesive layer. The remaining longitudinal portion of the adhesive layer is covered by the protective film until closure of the packaging for shipping. At this time the protective film is completely removed and the security tape adheres also to the other opening of the packaging. These security tapes are applied to packages on a manufacturing line by using a machine which carries out the following operations:

- separation of the protective film from the adhesive tape;
- transversal shifting of the protective film of some millimeters from the adhesive tape;
- repositioning of the protective film on a longitudinal portion of the adhesive tape.

[0007] In this way, a longitudinal part of the surface of the adhesive layer is no longer protected by the protective film and therefore the adhesive tape can be applied to the package.

[0008] The drawback of this application system is that in the starting web the adhesive tape and the protective film are superimposed. Therefore the adhesive tape has a length different from that of the protective film, even reaching notable values in case of large size webs. Therefore when the web is unwound from the reel for the application, the adhesive tape and the protective film being of different length bring to jamming in the machine with consequent production downtimes.

For reducing these inconveniences it is necessary to keep the applying machine under continuous control. This leads to an increase of the production costs and to a low productivity. A further drawback of these security tapes resides in that they are difficult to use outside industrial manufacturing lines, as manual dispensers do not work satisfactorily with these tapes.

[0009] The need was felt to have available a process to prepare security adhesive tapes, usable on production lines for the manufacture of packages with security closure devices, said security tapes showing the following combination of properties:

- when they are used on manufacturing lines for application to packages they do not cause jamming and therefore avoid production downtimes thus allowing to obtain an improved productivity in the application;
- when applied on packages, they cannot be removed without evidencing tampering;
- they allow to obtain ready-to-use security envelopes, comprising the security tape already positioned on the envelope for its closure;
- they can be used also with manual dispensers, besides that on the industrial manufacturing lines.

[0010] It has been found unexpectedly and surprisingly by the Applicant a process for producing security tapes having the above mentioned combination of properties.

[0011] An object of the present invention is a process for producing security tapes wound in webs, for the closing of packages, comprising the following layers (see Fig. 1):

- a support film (1),
- an adhesive layer (2), positioned in correspondence of the internal surface of the support film,
- a protective film (3), coated with an antiadhesive material on the side or the surface in contact with the exposed surface of the adhesive material layer, the protective film (3) being longitudinally cut, i.e. in the direction of unwinding of the security tape from the web, into two parts (3a) and (3b),

said process comprising the following steps:

- a1) optionally, application on the internal surface of the support film (1) of one or more additional layers,
- b) application of the adhesive layer (2) on the internal surface of the last additional layer applied, when present, or on the internal surface of the support film (1),
- c) application of the protective film (3) to the adhesive layer (2),
- d) longitudinal cut of the protective film (3) into two parts (3a) and (3b),
- e) winding in web of the security tape.

[0012] In Fig. 1, (4) indicates the security tape; (5) indicates the internal surface of the security tape which comes into contact with the support film (1) when the tape is wound in a web. Therefore the internal surface of each layer of the security tape is defined, as the surface of the layer facing the inner part of the web. In Fig. 1 the inner part of the web is in the direction from the support film (1) to tape (5).

[0013] By exposed surface of the adhesive layer its internal surface is meant.

[0014] By longitudinal direction, as said, that of the tape unwinding from the web is meant.

[0015] The optional additional layers which can be inserted between the support film (1) and the adhesive layer (2) are for example plastic-, metal-, paper-films. For example an additional plastic film can be used to confer a higher stiffness. A paper film or sheet can be used to confer a higher opacity to the security tape, a metal film can be used to confer a visibility to the security tape, for example by using aluminum as metal.

Of course one or more additional layers can be used.

[0016] Preferably before the optional step a1), step a) is carried out:

- a) printing, for example by rotogravure or flexography, of the internal surface of the film (1) with inks (10) and (11) (see Fig. 2).

[0017] If step a1) is carried out, the optional additional layers as defined above are applied on the ink layer (11).

[0018] In step a1) the optional additional layers can be applied by lamination. Optionally it is also possible to carry out the printing on holographic images on metal films. Optionally it is possible to insert in the structure of the security tape also more than one metal layer by means of metallization processes in vapour phase.

[0019] In step b) the adhesive layer, as said, is generally applied on the internal surface of the last layer applied on the support (1). When the security tape comprises the ink layer (11) (Fig. 2) and does not comprise any additional layer, the adhesive layer (2) is applied on the internal surface of the ink layer (11).

[0020] When using liquid adhesives, step b) is carried out for example by an application head with a Mayer bar or by roll application groups. By using hot-melt adhesives, application heads are used suitable for these ad-

hesives, for example they are in the form of slits driven by electrovalves.

[0021] In step c) the application of the protective film (3) to the adhesive layer (2) is carried out by lamination and the surface of the protective film (3) coated with antiadhesive material comes into contact with the internal surface of the adhesive material layer.

[0022] In step d) the longitudinal cut of the protective film (3) into two parts (3a) and (3b) is carried out for example by longitudinal die cut of the protective film (3).

[0023] Optionally it is possible to carry out step c) by using a protective film longitudinally cut in two parts already. In this case step d) is not carried out.

[0024] The support film (1) is made generally of plastic material and can be oriented, for example bioriented, or non oriented, and is made for example of the following polymers: polypropylene and propylene copolymers, polyester, polyethylene and ethylene copolymers, polyamide, polyisoprene, or it can also be formed of laminates or plastic coupled articles in general. By propylene copolymers, the propylene polymers with ethylene and/or one or more C_4-C_{10} linear or branched alpha olefins are meant. Generally ethylene ranges from 0 to 40% by moles on the total of the comonomers, preferably from 3% to 15% by moles, more preferably from 5% to 10%. The C_4-C_{10} olefins, for example butene, hexene and octene, when present, are in amounts not higher than 10% by moles and preferably range from 0.5% to 9% by moles. By ethylene copolymers, the ethylene polymers with one or more C_3-C_{10} linear or branched alpha olefins are meant. Generally the amounts of the comonomers in the ethylene copolymers range from 0.5% to 10% by weight, preferably from 1% to 7% by weight.

[0025] The adhesive layer (2) is made of adhesives available on the market and are selected for example from the following: water acrylic adhesives, in the form of aqueous emulsion based on a C_3-C_{20} , preferably C_3-C_5 ester of (meth)acrylic acid, for example butyl methacrylate; "hot melt" adhesives formed of thermoplastic rubbers and hydrocarbon resins in general; natural rubber dissolved in organic solvents, for example hexane or toluoyl, aqueous emulsions of natural rubber latexes.

[0026] The adhesive security tapes of the invention preferably contain one ink layer (10) or (11), more preferably both layers (10) and (11) are present.

[0027] Moreover and preferably it is possible to add to the ink layers (10), (11) also thermosensitive inks of irreversible type indicating the package exposure to particularly high or particularly low temperatures. This points out an attempt of the tape tampering, for example by using heat sources.

[0028] As said, between the support film (1) and the adhesive layer (2) one or more ink layers and optionally on said ink layers one or more additional layers formed of plastic-, metal-, paper-films can be inserted, so that, at an unauthorized opening of the sealed package, an indication appears on the security tape and/or is left on the package pointing out the occurred tampering. For

example the wording OPENED VOID FRAUD could appear. The additional layers can comprise images, texts, serial numbers, holograms, both visible and not.

[0029] The protective film (3) can be an oriented plastic film, for example bioriented, or non oriented, and can be carried out for example with materials selected from the above mentioned ones used for the support film (1). As said, the surface of the protective film (3) which is in contact with the adhesive material layer is coated with an antiadhesive material, that for example can be a silicon-based polymer.

[0030] The width of each of the two parts or sections (3a) and (3b) of the protective film (3) are equal or different.

[0031] The Applicant has found that the security tape according to the present invention can be unexpectedly and surprisingly obtained by using machines normally used in the adhesive tape manufacture. This represents a remarkable advantage from the industrial point of view as it avoids the additional costs for machines specifically devised for the manufacture of the tape. In fact the security tapes of the prior art, such as for example that described above, require for their manufacture a machine devised for the specific purpose.

[0032] A further object of the present invention is represented by security tapes obtainable by the process of the present invention.

[0033] In particular, as said, the security tapes comprise the following layers, see Fig. 1:

- a support film (1),
- an adhesive layer (2), positioned in correspondence of the internal surface of the support film,
- a protective film (3) coated with an antiadhesive material on the side or the surface in contact with the exposed surface of the adhesive material layer, the protective film (3) being longitudinally cut, i.e. in the direction of unwinding of the security tape from the web, in two parts (3a) and (3b),

optionally between the support film (1) and the adhesive layer (2) one or more layers formed of inks and/or more additional layers as above defined are inserted.

[0034] Preferably the security tape according to the present invention, see Fig. 2, is formed of the following layers:

- a support film (1),
- a transparent ink layer (10) applied on a portion of the internal surface of the film (1), having a poor adhesion to the film (1);
- an adhesive layer (2), applied so as to completely cover the ink layer (10) and the internal surface of the film (1) not covered by the ink (10);
- a protective film (3) which protects the exposed surface of the adhesive layer (2), the film (3) being longitudinally cut in two parts (3a) and (3b).

[0035] Preferably on the ink layer (10) it is applied a further ink layer (11), preferably a coloured ink layer so as to completely coat both the portion of the internal surface of the film (1) not coated by the ink (10), and that coated by the ink (10). In this case the applied adhesive layer (2) covers completely the ink layer (11).

[0036] By poor adhesion of the ink layer (10) to the support film (1) it is meant that the following test is satisfied.

- a tape is prepared by applying the adhesive layer (2) to the internal surface of the support film (1), on which the ink layer (10) has been previously applied; the tape so obtained is applied to an edge of the package by manually removing the support film (1) from the package, the ink layer (10) must remain attached to the adhesive layer attached to the package.

[0037] The ink layer (11) satisfies the following test:

a tape is prepared by applying to the internal surface of the support film (1) the ink layer (11) and, above said layer, the adhesive layer (2), by applying the tape to an edge of the packaging by manually removing the support film (1) from the package, the ink layer (11) must remain attached to the support film (1). Therefore the ink layer (11) shows a strong adhesion to the film (1).

[0038] Therefore generally the security tape according to the present invention has a total thickness between 10 micron and 300 micron, preferably between 30 micron and 150 micron.

[0039] The width of the security tape of the present invention is generally between 5 mm and 500 mm, preferably between 10 mm and 100 mm.

[0040] The length of the security tape wound in web can be, at will, generally higher than 50 m up to, for example, 10,000 m.

[0041] Optionally and preferably the longitudinal edges of the security tape show notches which favour tape breaking in case of tampering.

[0042] The security tape according to the present invention is applied to containers/envelopes by a process comprising the following steps:

- I unwinding of the tape (4) from the web,
- II removal of one of the two parts (3a) or (3b), of the protective film (3),
- III application of the tape (4) on one of the edges of the package opening by means of the portion of the adhesive layer (2) which has been uncoated by removing one of the two parts (3a) or (3b) of the protective film (3) in step II.

[0043] When the application process is carried out on a manufacturing line, in step II the portion of the tape (3) which has been removed, or first part of the tape (3), is

wound again and discarded.

[0044] The package closure is carried out by removing the remaining part or second part of the protective film (3) so that the portion of the adhesive material layer (2) no longer coated by the second part of the protective film (3) can adhere to the other edge of the container.

[0045] The security tape according to the present invention can easily be used in private uses by utilizing for example a manual dispenser. As a matter of fact the security tape according to the present invention is ready to use since, as said, it requires only the removal of one of the two parts (3a) and (3b) of the protective film. This is a remarkable advantage in comparison with the security tapes of the prior art having protective film on the adhesive layer which, as said, require a lateral shifting of the protective film and therefore they can be used in practice only on industrial manufacturing lines of security packages.

[0046] The following examples are given for illustrative and not limitative purposes of the present invention.

EXAMPLES

EXAMPLE 1

[0047] A security adhesive tape according to the present invention is used formed of the following parts:

- a support film (1), see Fig. 2, in bioriented polypropylene having a thickness of 32 μm ;
- a layer (10) of transparent ink applied on a portion of the internal surface of the film (1) by rotogravure printing, having poor adhesion to the film (1), as defined in the description;
- a coloured ink layer (11), applied by rotogravure printing, to completely coat the portion of the internal surface of the film (1) i.e. both that coated by ink (10) and that not coated by the ink layer (10), the ink layer (11) having a strong adhesion to the film (1), as defined in the description;
- a layer (2), 22 μm thick, of pressure sensitive acrylic adhesive applied by an industrial coating machine for water-based acrylic adhesives (roll application group), so as to completely coat the coloured ink layer (11);
- a protective film (3), 36 μm thick, of siliconized polyester, applied by lamination, which protects the exposed surface of the adhesive material layer (2), the protective layer (3) being longitudinally cut in two parts (3a) and (3b).

[0048] The total thickness of the tape is about 90 μm , the width is of 30 mm. The tape is wound in webs having a length of 1,000 meters.

[0049] The tape webs have been used for a production cycle of 8 hours on a machine manufacturing security envelopes made of polyethylene. The machine comprises a rewinding system for the part (3b) of the protective

film (3) which in the present example is the one removed from the tape in the application to the envelope.

[0050] The production speed has been of 120 envelopes/minute.

[0051] During the 8 hours of the continuous running of the machine, no jamming occurred.

EXAMPLE 2 (comparative)

[0052] A security adhesive tape (24) is formed of the following parts:

- a support film (21), see Fig. 3, in bioriented polypropylene having a thickness of 32 μm ;
- a transparent ink layer (30) applied on a portion of the internal surface of the film (21) by rotogravure printing, having a poor adhesion to the film (21);
- a coloured ink layer (31), applied by rotogravure printing so as to completely coat the internal surface of the film (21) and of the ink layer (30);
- a layer (22), 22 μm thick, of pressure sensitive acrylic adhesive applied by lamination so as to completely coat the coloured ink layer (31);
- a protective film (23), 36 μm thick, of siliconized polyester which protects the exposed surface of the adhesive material layer (22).

[0053] The total thickness of the tape is of about 90 μm , the width is of 30 mm. The tape is wound in webs having a length of 1,000 meters.

[0054] The tape webs have been used for a production cycle of 8 hours on a machine manufacturing security envelopes made of polyethylene. The machine is moreover equipped with a device for separating the protective film (23) from the adhesive layer (22), shifting aside the protective film (23) with respect to one of the edges of the adhesive layer (22), and then coupling again the protective film (23) in the shifted position with the adhesive layer (22). In this step a longitudinal section of the adhesive layer (22) is uncovered to allow the tape application on the envelope. The remaining longitudinal portion of the adhesive layer (22), as it is reported in the background art of this invention, remains coated with the protective film (23) until the envelope is sealed by the user.

[0055] The production speed has been of 70 envelopes/minute.

[0056] On an average every 10 minutes the machine was stopped for about 3 minutes each time, since the lengths of the protective film (23) and of the adhesivized tape on the coloured ink layer (31) at the end of said period of 10 minutes, resulted different and caused jamming. Therefore the machine has to be regulated in order to compensate the difference and to longitudinally realign the protective film (2,3) with the tape formed by the support film (21), the ink layers (30) and (31) and the adhesive layer 22.

Claims

1. A process for producing safety tapes wound in webs and comprising the following layers:

- a support film (1),
 - an adhesive layer (2), positioned in correspondence of the internal surface of the support film,
 - a protective film (3), coated with an antiadhesive material on the side of the surface in contact with the exposed surface of the adhesive material layer, the protective film (3) being longitudinally cut, i.e. in the direction of unwinding of the security tape from the web, in two parts (3a) and (3b),

said process comprising the following passages:

a1) optionally, application on the internal surface of the support film (1) of one or more additional layers,
 b) application of the adhesive layer (2) on the internal surface of the last supplementary layer applied, if present, or on the internal surface of the support film (1),
 c) application of the protective film (3) to the adhesive layer (2),
 d) longitudinal cut of the protective film (3) into two parts (3a) and (3b),
 e) winding in web of the security tape.

2. A process according to claim 1, wherein additional layers are inserted between the support film (1) and the adhesive layer (2), said layers are selected from plastic films, metal films, paper films.

3. A process according to claims 1-2, wherein before the optional step a1), step a) is carried out:

a) printing of the internal surface of the film (1) with inks (10) and (11).

4. A process according to claim 3, wherein additional layers selected from plastic films, metal films, paper films are applied on the ink layer (11).

5. A process according to claims 1-3, wherein in step a1) the additional layers are applied by lamination.

6. A process according to claims 1-5, wherein in step c) the application of the protective film (3) coated with antiadhesive material to the adhesive layer (2) is carried out by lamination, the surface of the protective film (3) coated with antiadhesive material being in contact with the internal surface of the adhesive layer.

7. A process according to claims 1-6, wherein in step d) the longitudinal cut of the protective film (3) in two parts (3a) and (3b) is carried out by longitudinally die cutting of the protective film (3).

8. A process according to claims 1-7, wherein in step c) a protective film already longitudinally cut in two parts is used.

9. A process according to claims 1-8, wherein the support film (1) is an oriented or non oriented plastic film.

10. A process according to claims 1-9, wherein the adhesive material layer (2) is made of adhesives selected from water acrylic adhesives, "hot melt" adhesives formed of thermoplastic rubbers and hydrocarbon resins, natural rubber dissolved in organic solvents, aqueous emulsions of natural rubber latexes.

11. A process according to claims 1-10, wherein the protective film (3) is an oriented or a non oriented plastic film.

12. A process according to claims 1-11, wherein the width of each of the two parts (3a) and (3b) wherein the protective film (3) is longitudinally divided is equal or different.

13. Security tapes obtainable by the process of claims 1-12.

14. Security tapes according to claim 13 comprising the following layers:

- a support film (1),
 - an adhesive layer (2), positioned in correspondence of the internal surface of the support film,
 - a protective film (3) coated with an antiadhesive material on the side in contact with the exposed surface of the adhesive material layer; the protective film (3) being longitudinally cut in two parts (3a) and (3b);

optionally, between the support film (1) and the adhesive layer (2) one or more layers formed of inks and/or one or more additional layers are inserted.

15. Security tapes according to claims 13-14, formed of the following layers:

- a support film (1),
 - a transparent ink layer (10) applied on a portion of the internal surface of the film (1), having a poor adhesion to the film (1);
 - a coloured ink layer (11), applied so as to completely coat both the portion of the internal sur-

face of the film (1) not coated by the ink (10),
and that coated by the ink (10);
- an adhesive material layer (2), applied so as
to coat completely the ink layer (10);
- a protective film (3), the film (3) being longitu- 5
dinally cut in two parts (3a) and (3b).

16. A security tape according to claim 15, further comprising an ink layer (11), preferably coloured, applied on the ink layer (10) to coat both the portion of the internal surface of the film (1) not coated by the ink layer (10) and that coated by the ink layer (10). 10

17. A process for applying the security tapes of claims 13-16 to packages comprising the following steps: 15

I unwinding of the tape (4) from the web,
II removal of one of the two parts (3a) or (3b),
of the protective film (3),
III application of the tape (4) on one of the edges 20
of the package opening.

18. A process according to claim 17, wherein the packages are containers or envelopes. 25

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