

DESCRIPTION

TITLE OF INVENTION

COVER FILM AND ELECTRONIC COMPONENT PACKAGE USING SAME

TECHNICAL FIELD

[0001] The present invention relates to a cover film used in a package for electronic components, and an electronic component package using the same.

BACKGROUND

[0002] As electronic devices have become smaller, the electronic components that are used therein are also becoming progressively smaller with higher performance. Additionally, during the process of assembly of electronic devices, electronic components are automatically mounted on printed circuit boards. Electronic components that are to be surface-mounted are housed in carrier tape in which pockets are formed in a linked manner, the pockets being embossed and being able to house the electronic components in conformity with the shapes thereof. After the electronic components have been housed, a cover film is laid, as a lid material, on the upper surface of the carrier tape, and a heated seal bar is used to continuously heat-seal both edges of the cover film in the lengthwise direction, thereby forming a package. As the cover film material, a material obtained by laminating a heat-sealable layer of thermoplastic resin on a substrate of a biaxially stretched polyester film or the like is used.

[0003] Patent Document 1 discloses a cover tape in which the dependence on the heat-sealing temperature is low and for which the peel strength can be easily adjusted, and a carrier tape body using the same.

[0004] Additionally, Patent Document 2 discloses a cover tape for packaging electronic components, having an excellent balance of adhesiveness (tackiness) and transparency.

[0005] Furthermore, Patent Document 3 discloses a cover film for which the peel strength is constant over a prescribed range of values, which has excellent transparency, and in which "film breaking" does not occur easily during high-speed peeling.

[0006] However, none of the documents could be considered to be necessarily adequate in terms of achieving both anti-blocking properties of the cover film and stability in the peel strength.

CITATION LIST

PATENT LITERATURE

[0007] Patent Document 1: JP 2002-154573 A
Patent Document 2: JP 2017-222387 A
Patent Document 3: WO 2016/024529 A1

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0008] The present invention addresses, as a main problem, that of providing a cover film having both anti-blocking properties and stability of peel strength. Furthermore, the present invention also addresses the problem of providing a cover film in which the productivity is also increased.

[0009] As a result of diligent investigation of the aforementioned problems, the present inventors discovered that a cover film overcoming the problems addressed by the present invention can be obtained by a laminated film having at least a substrate layer (A), an adhesive layer (B), an intermediate layer (C), and a heat-sealable layer (D), wherein a surface of the heat-sealable layer (D) not contacting the intermediate layer (C) has bumps, and the bumps are arranged so as to be staggered with respect to a widthwise direction and a lengthwise direction of the laminated film, thereby completing the present invention.

[0010] That is, the present invention pertains to a cover film that is a laminated film having at least a substrate layer (A), an adhesive layer (B), an intermediate layer (C), and a heat-sealable layer (D), wherein a surface of the heat-sealable layer (D) not contacting the intermediate layer (C) has bumps, and the bumps are arranged so as to be staggered with respect to a widthwise direction and a lengthwise direction of the laminated film.

[0011] Additionally, in the present invention, the adhesive layer (B) preferably is a urethane adhesive having a backbone comprising at least one component selected from the group

consisting of a polyether polyol and a polyester polyol, and at least one component selected from the group consisting of diphenylmethane diisocyanate, 2,4-tolylene diisocyanate, and isophorone diisocyanate.

[0012] Furthermore, in the present invention, the resin constituting the heat-sealable layer (D) preferably contains 60-98 mass% of an ethylene-vinyl acetate copolymer (d-1), and 2-40 mass% of a potassium ionomer of an ethylene (meth)acrylic acid copolymer (d-2).

[0013] Additionally, in the present invention, the resin constituting the heat-sealable layer (D) preferably further contains a styrene-butadiene copolymer.

[0014] Furthermore, in the present invention, the substrate layer (A) preferably comprises a polyethylene terephthalate film.

[0015] Additionally, in the present invention, the polyethylene terephthalate film preferably is a biaxially stretched polyethylene terephthalate film.

[0016] Furthermore, in the present invention, the intermediate layer (C) preferably comprises a linear low-density polyethylene.

[0017] Additionally, in the present invention, the linear low-density polyethylene preferably includes m-LLDPE.

[0018] Furthermore, in the present invention, the bumps that are arranged so as to be staggered preferably have a height of 2 μm or more.

[0019] Additionally, the present invention also pertains to an electronic component package in which the cover film as described above is used as a lid material for carrier tape comprising a thermoplastic resin.

[0020] For the purposes of the present invention, "A-B" shall refer to the range "A or more and B or less".

EFFECTS OF INVENTION

[0021] According to the present invention, a cover film having both anti-blocking properties and stability of peel strength can be provided. Additionally, a cover film in which the productivity is also increased can be further provided.

BRIEF DESCRIPTION OF DRAWINGS

[0022] Fig. 1 is a section view indicating an example of the layer structure of the cover film of the present invention.

Fig. 2 is a diagram illustrating an example of a staggered arrangement.

DESCRIPTION OF EMBODIMENTS

[0023] The cover film of the present invention includes at least a substrate layer (A), an adhesive layer (B), an intermediate layer (C), and a heat-sealable layer (D), as illustrated in Fig. 1. An example of the structure of the cover film of the present invention is illustrated in Fig. 1. The cover film 1 illustrated in Fig. 1 comprises a substrate layer 2, an adhesive layer 3, an intermediate layer 4, and a heat-sealable layer 5. This cover film 1 is laminated, in the following order, the substrate layer 2, the adhesive layer 3, the intermediate layer 4, and the heat-sealable layer 5.

[0024]

[Substrate layer (A)]

As the substrate layer (A), a polyethylene terephthalate film can be particularly favorably used. Additionally, the polyethylene terephthalate film should preferably be a biaxially stretched polyethylene terephthalate film. Additionally, a material which has been coated with an antistatic agent or into which an antistatic agent has been kneaded for antistatic treatment, or which has been subjected to corona treatment or easy-adhesion treatment may be used as the substrate layer. If the substrate layer is too thin, then the tensile strength of the cover film itself becomes low, and "film rupture" tends to occur when peeling the cover film. Conversely, if the substrate layer is too thick, then not only does the heat-sealability with respect to carrier tape become lower, but the cost also increases. For this reason, as the thickness of the substrate layer (A), a thickness of 12-25 μm may normally and favorably be used.

[0025]

[Adhesive layer (B)]

The adhesive layer (B) is preferably composed of a cured two-part curable adhesive having a primary agent component and a curing agent component. Additionally, the adhesive layer more preferably comprises a urethane adhesive having a backbone comprising at least one component selected from the group consisting of a polyether polyol and a polyester polyol, and at least one component selected from the group consisting of diphenylmethane diisocyanate,

2,4-tolylene diisocyanate, and isophorone diisocyanate. By using such a two-part curable adhesive, practical and adequate adhesive strength can be achieved in a short time for interlayer adhesion between the substrate layer (A) and the intermediate layer (C), thus obtaining the effect of excellent productivity of the cover film.

[0026] The two-part curable adhesive is preferably used by being diluted in a solvent, then being mixed at a prescribed ratio. The diluting solvent is not particularly limited, and a solvent such as water, ethyl acetate, toluene, or methyl ethyl ketone may be used. The adhesive layer (B) may be formed by coating the substrate layer (A) with the two-part curable adhesive, then drying the adhesive. The thickness after drying (i.e., the thickness of the adhesive layer (B)) should preferably be 1-5 μm . By setting the thickness to be 1 μm or more, cases in which the adhesive layer (B) cannot completely conform to the surface roughness of the intermediate layer (C) and the adhesive strength becoming inadequate can be prevented. By setting the thickness to be 5 μm or less, the variation in the peel strength after heat-sealing the cover film to carrier tape can be better prevented from increasing.

[0027]

[Intermediate layer (C)]

In the present invention, the intermediate layer (C) is provided so as to be laminated onto one surface of the substrate layer (A) with the adhesive layer (B) therebetween. As the resin constituting the intermediate layer (C), in particular, linear low-density polyethylene (hereinafter also referred to as LLDPE), which has flexibility while also having an appropriate degree of rigidity, and has excellent tear strength at ambient temperature, can be favorably used. In particular, by using a resin having a density in the range 0.900×10^3 - $0.925 \times 10^3 \text{ kg/m}^3$, the intermediate layer resin does not tend to be squeezed out from the edges of the cover film due to heat and pressure when heat-sealing the cover film. Therefore, not only does the iron tend not to be soiled during heat sealing, but also, when heat-sealing the cover film, the intermediate layer is softened, thereby reducing uneven contact of the heat-sealing iron, and allowing stable peel strength to be easily obtained when peeling the cover film.

[0028] The LLDPE includes types that are polymerized by a Ziegler catalyst and types that are polymerized by a metallocene catalyst (hereinafter also referred to as m-LLDPE). Since m-LLDPE has a tightly controlled molecular weight distribution, the tear strength thereof is particularly high. Thus, it is particularly preferable to use m-LLDPE in the intermediate layer (C) in the present invention.

[0029] The above-mentioned m-LLDPE is a copolymer containing ethylene and, as comonomers, olefins having three or more carbon atoms, preferably linear, branched, or aromatic nucleus-substituted α -olefins having 3-18 carbon atoms. Linear mono-olefins include, for example, propylene, 1-butene, 1-pentene, 1-hexene, 1-octene, 1-nonene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene, 1-octadecene, and the like. Additionally, branched mono-olefins include, for example, 3-methyl-1-butene, 3-methyl-1-pentene, 4-methyl-1-pentene, 2-ethyl-1-hexene, and the like. Additionally, aromatic nucleus-substituted mono-olefins include styrene and the like. These comonomers may be copolymerized with ethylene as a single type or as a combination of two or more types. This copolymerization may include copolymerization with a polyene such as butadiene, isoprene, 1,3-hexadiene, dicyclopentadiene, or 5-ethylidene-2-norbornene.

[0030] The thickness of the intermediate layer (C) is preferably 15-25 μm , and more preferably 15-20 μm . If the thickness of the intermediate layer (C) is less than 15 μm , then it can become difficult to obtain the effect of reducing uneven contact of the heat-sealing iron when heat-sealing the cover film to carrier tape. Conversely, if the thickness exceeds 25 μm , then the total thickness of the cover film will be large, and it can become difficult to obtain adequate peel strength when the cover film is heat-sealed to carrier tape.

[0031]

[Heat-sealable layer (D)]

In the cover film of the present invention, the heat-sealable layer (D) is formed on the surface of the intermediate layer (C). In the cover film of the present invention, there are bumps on the surface of the heat-sealable layer (D) not contacting the intermediate layer (C), and the bumps are arranged so as to be staggered in the widthwise direction and the lengthwise direction of the laminated film. By arranging the bumps on the heat-sealable layer so as to be staggered in the widthwise direction and the lengthwise direction of the laminated film, a cover film that not only has excellent anti-blocking properties, but that also has little variation in peel strength, i.e., has excellent stability in peel strength, can be obtained.

[0032] The height of the bumps is preferably 1.5 μm or more, and more preferably 2.0 μm or more. Additionally, the distance between the bumps should preferably be 50-300 μm , and more preferably 70-150 μm .

[0033] The resin of the heat-sealable layer (D) preferably contains an olefin resin (d-1) and an antistatic potassium ionomer (d-2). Additionally, the resin constituting the heat-sealable layer (D) preferably further contains a styrene-butadiene copolymer.

[0034] As the olefin resin (d-1), 60-98 mass% of an ethylene-vinyl acetate copolymer is preferably included. As the antistatic potassium ionomer (d-2), 2-40 mass% of a potassium ionomer of an ethylene (meth)acrylic acid copolymer is preferably included.

[0035] The heat-sealable layer (D) preferably has a thickness of 5-40 μm , and more preferably 7-20 μm . If the thickness of the heat-sealable layer is less than 5 μm , then adequate peel strength cannot be obtained when the cover film is heat-sealed to carrier tape, and there is a risk of the film breaking. If the thickness exceeds 40 μm , then not only does the cost increase, but also, the transparency tends to decrease.

[0036]

[Cover film production method]

The method for producing the cover film is not particularly limited, and a common method may be used. For example, a two-part curable adhesive may be coated onto the surface of the substrate layer (A) to form the adhesive layer (B), and a resin composition for forming the intermediate layer (C) may be extruded from a T-die and coated onto the coating surface of the adhesive layer (B), thereby forming a three-layered film comprising the substrate layer (A), the adhesive layer (B), and the intermediate layer (C). The surface of the intermediate layer (C) is then further coated with a resin for forming the heat-sealable layer (D) extruded from a T-die, thereby obtaining the objective cover film.

[0037] As another method, resins for constituting the intermediate layer (C) and the heat-sealable layer (D) may be respectively used to form films by T-die casting or inflation, then adhered to the substrate layer (A) by means of, for example, dry lamination by adhesion with the adhesive layer (B) comprising a two-part curable adhesive, thereby obtaining the objective cover film.

[0038] As yet another method, the objective cover film may be obtained by means of sand lamination. That is, a resin for constituting the heat-sealable layer (D) is used to form a film by T-die casting or inflation. Next, a resin composition for forming the intermediate layer is supplied between the heat-sealable layer (D) and the substrate layer (A) to form and laminate the intermediate layer (C), thereby obtaining the objective cover film. In the case of this method, as

with the above-mentioned methods, the surface on the side of the substrate layer (A) that is to be laminated is coated with, for example, a two-part curable adhesive as the adhesive layer (B).

[0039] In particular, the cover film of the present invention is preferably obtained by using a multi-manifold or a feed block to coextrude and thereby laminate, by means of T-die casting or inflation, the resin composition that is to form the intermediate layer (C) and the resin of the heat-sealable layer (D), and laminating this two-layer film, by means of extrusion lamination, onto the substrate layer (A) coated with, for example, a two-part curable adhesive as the adhesive layer (B), so that the adhesive layer (B) is disposed therebetween, thereby obtaining the cover film. Furthermore, it is more preferable for this two-layer film to be laminated, by means of dry lamination, onto the substrate layer (A) coated with, for example, a two-part curable adhesive as the adhesive layer (B), so that the adhesive layer (B) is disposed therebetween.

[0040] In addition to the aforementioned steps, at least one surface of the cover film may be subjected to an antistatic treatment, as needed. As an antistatic agent, for example, an anionic, cationic, non-ionic, betaine, or other surfactant-type antistatic agent, or a polymer-type antistatic agent and a conductive material or the like dispersed in a binder may be coated by means of a roll coater using a gravure roller, a lip coater, a sprayer, or the like. Additionally, in order to apply these antistatic agents evenly, the film surface should preferably be subjected to corona discharge treatment or ozone treatment before the antistatic treatment, and corona discharge treatment is particularly preferable.

[0041]

[Electronic component package]

The electronic component package of the present invention is a package in which the above-described cover film is used as the lid material for carrier tape that serves as a container for housing electronic components. Carrier tape is a tape-shaped article having a width of approximately 8-100 mm and having pockets for housing electronic components. When heat-sealing the cover film as a lid material, the material constituting the carrier tape is not particularly limited, and a commercially available type may be used. For example, a material such as polystyrene, polyester, polycarbonate, or polyvinyl chloride may be used. The carrier tape may be of a type that has been provided with conductivity by kneading carbon black or carbon nanotubes into a resin, a type in which an antistatic agent or a conductive filler has been kneaded, or a type that has been provided with antistatic properties by coating the surface with a coating solution obtained by dispersing a surfactant-type antistatic agent or a conductive material such as polypyrrole or polythiophene in an organic binder such as acrylic.

[0042] A package housing electronic components is obtained, for example, by housing the electronic components or the like in electronic component housing portions of carrier tape, using the cover film as a lid material, then packaging the electronic components by continuously heat-sealing both lengthwise edges of the cover film, and winding the package on a reel. By being packaged in this form, the electronic components and the like can be stored and transported. The cover film is intermittently peeled off while conveying the package housing the electronic components or the like by using holes known as sprocket holes for conveying the carrier tape, provided on the lengthwise edges of the carrier tape. A component mounting apparatus extracts the electronic components or the like while verifying the presence, orientations and positions thereof, and mounts the electronic components or the like on a substrate.

[0043] If the peel strength for peeling the cover film is too low, then the cover film can be peeled from the carrier tape while the package is being stored or transported, and there is a risk that the housed components may fall out. If the peel strength is too high, then it becomes difficult to peel the carrier tape and there is a risk of rupture when peeling the cover film. For this reason, when heat-sealed at 120-220 °C, the peel strength should be 0.05-1.0 N, and the variation in the peel strength should preferably be lower than 0.4 N (less than 0.4 N).

EXAMPLES

[0044] Hereinafter, examples of the present invention will be explained in detail. However, the present invention is not limited thereto. In the examples and the comparative examples, the resin raw materials indicated below were used in the substrate layer (A), the adhesive layer (B), the intermediate layer (C), and the heat-sealable layer (D).

Resin film of substrate layer (A)

(a-1) Biaxially stretched polyethylene terephthalate film (o-PET): E-5100 (manufactured by Toyobo Co., Ltd.), 16 µm thick

[0045]

Primary agent component in adhesive layer (B)

Primary agent (b-1): TM-319 (manufactured by Toyo-Morton, Ltd.), polyether polyol, ethyl acetate solution, solid concentration 70 mass%

Primary agent (b-2): product synthesized in-house, polyether polyol, ethyl acetate solution, solid concentration 70 mass%

Primary agent (b-3): LIOSTAR 1000 (manufactured by Toyo-Morton, Ltd.), polyester polyol, ethyl acetate solution, solid concentration 50 mass%

[0046]

Curing agent component in adhesive layer (B)

Curing agent (b-4): CAT-11B (manufactured by Toyo-Morton, Ltd.), diphenylmethane diisocyanate, ethyl acetate solution, solid concentration 60 mass%

Curing agent (b-5): Coronate 2067 (manufactured by Tosoh Corp.), diphenylmethane diisocyanate, solid concentration 100 mass%

Curing agent (b-6): Coronate L-45E (manufactured by Tosoh Corp.), 2,4-tolylene diisocyanate, ethyl acetate solution, solid concentration 45 mass%

Curing agent (b-7): LIOSTAR 500H (manufactured by Toyo-Morton, Ltd.), isophorone diisocyanate, ethyl acetate solution, solid concentration 70 mass%

[0047]

Resin in intermediate layer (C)

m-LLDPE (c-1): Umerit 2040F (manufactured by Ube-Maruzen Polyethylene Co., Ltd.), MRF 4.0 g/10 min (measurement temperature 190 °C, load 2.16 kgf), density $0.904 \times 10^3 \text{ kg/m}^3$

[0048]

Resin in heat-sealable layer (D)

Resin (d-1): Evaflex EV360 (Du Pont-Mitsui Polychemicals Co., Ltd.), ethylene-vinyl acetate copolymer resin (EVA)

Resin (d-2): Clearen 335A (manufactured by Denka Co., Ltd.), styrene-butadiene copolymer resin (SBC)

[0049]

Antistatic agent in heat-sealable layer (D)

Antistatic agent (d-3): Entira MK440 (Du Pont-Mitsui Co., Ltd.), potassium ionomer

[0050]

(Example 1)

As the raw material of the heat-sealable layer (D), 90 mass% of an ethylene-vinyl acetate copolymer resin ("Evaflex EV360", manufactured by Du Pont-Mitsui Polychemicals, Co., Ltd.) was pre-blended with 10 mass% of a potassium ionomer ("MK440", manufactured by DuPont-Mitsui Co., Ltd.) in a tumbler, then kneaded at 200 °C using a single-screw extruder having a diameter of 40 mm, thereby obtaining a resin composition at a line speed of 20 m per minute. This resin composition and a linear low-density polyethylene ("Umerit 2040F", manufactured by Ube-Maruzen Polyethylene Co., Ltd.) for forming the intermediate layer (C)

were separately extruded from single-screw extruders, and during lamination and extrusion from a multi-manifold T-die, subjected to casting with a touch roller and a transfer roller having hemispherical recesses with a diameter of 56 μm and a depth of 10 μm formed on the surface thereof, by laser engraving, so as to be evenly staggered at intervals such that the distance between the diametric centers of the recesses was 125 μm , thereby obtaining a two-layer film in which bumps were formed on the surface of the heat-sealable layer (D). The temperature of the transfer roller and the touch roller was controlled to be 25 °C, and the touch pressure was set at 0.25 MPa.

Next, on the surface of a biaxially stretched polyethylene terephthalate film (16 μm thick), i.e., the substrate layer (A), to be bonded to the intermediate layer (C), the adhesive layer (B) was formed, by a gravure method, by mixing a two-part curable adhesive comprising a polyether polyol ("TM-319", manufactured by Toyo-Morton Co., Ltd.) as the primary agent, and diphenylmethane diisocyanate ("CAT-11B", manufactured by Toyo-Morton Co., Ltd.) as the primary component in the curing agent, at a ratio of 50 (primary agent) : 50 (curing agent) in terms of solids, so that the thickness after drying was 3 μm . The intermediate layer (C) surface of the two-layer film was bonded thereto by dry lamination, then the bonded film was stored for one day at 40 °C to obtain a cover film for electronic component carrier tape having the structure illustrated in Fig. 1.

[0051]

(Examples 2 to 10)

Cover films were obtained by methods similar to those in Example 1, aside from the fact that the adhesive layer (B) and the heat-sealable layer (D) were formed by using raw materials such as the resins indicated in Table 1.

[0052]

(Comparative Example 1)

As the raw material of the heat-sealable layer (D), 90 mass% of an ethylene-vinyl acetate copolymer resin ("Evaflex EV360", manufactured by Du Pont-Mitsui Polychemicals, Co., Ltd.) was pre-blended with 10 mass% of a potassium ionomer ("MK440", manufactured by DuPont-Mitsui Co., Ltd.) in a tumbler, then kneaded at 200 °C using a single-screw extruder having a diameter of 40 mm, thereby obtaining a resin composition at a line speed of 20 m per minute. This resin composition and a linear low-density polyethylene ("Umerit 2040F", manufactured by Ube-Maruzen Polyethylene Co., Ltd.) for forming the intermediate layer (C) were separately extruded from single-screw extruders, and during lamination and extrusion from a multi-manifold T-die, subjected to casting with a touch roller and a metallic roller not having

recesses on the surface thereof, thereby obtaining a two-layer film. A cover film was obtained by the same method as that in Example 1, aside from the method for preparing the two-layer film.

[0053]

(Comparative Example 2)

As the resin constituting the heat-sealable layer (D), 90 mass% of an ethylene-vinyl acetate copolymer resin ("Evaflex EV360", manufactured by Du Pont-Mitsui Polychemicals, Co., Ltd.) was pre-blended with 10 mass% of a potassium ionomer ("MK440", manufactured by DuPont-Mitsui Co., Ltd.) in a tumbler, then kneaded at 200 °C using a single-screw extruder having a diameter of 40 mm, thereby obtaining a resin composition at a line speed of 20 m per minute. This resin composition and a linear low-density polyethylene ("Umerit 2040F", manufactured by Ube-Maruzen Polyethylene Co., Ltd.) for forming the intermediate layer (C) were separately extruded from single-screw extruders, and during lamination and extrusion from a multi-manifold T-die, subjected to casting with a touch roller and a transfer roller having hemispherical recesses with a diameter of 56 μm and a depth of 10 μm formed on the surface thereof, by laser engraving, so as to be evenly arrayed in a grid at intervals such that the distance between the diametric centers of the recesses was 125 μm , thereby obtaining a two-layer film in which bumps were formed on the surface of the heat-sealable layer (D). The temperature of the recessed transfer roller and the touch roller was controlled to be 25 °C, and the touch pressure was set at 0.25 MPa. A cover film was obtained by the same method as that in Example 1, aside from the method for preparing the two-layer film.

[0054]

<Evaluation method>

The cover films for electronic component carrier tape manufactured in the respective examples and the respective comparative examples were evaluated as indicated below. The results thereof are summarized, respectively, in Tables 1 and 2.

[0055]

(1) Sealing properties

A taping machine (NK-600; Nagata Seiki Co., Ltd.) was used to heat-seal 21.5 mm-wide cover films onto 24 mm-wide polycarbonate carrier tape (manufactured by Denka Co., Ltd.) and polystyrene carrier tape (manufactured by Denka Co., Ltd.) with a sealing head width of 0.5 mm $\times$ 2, a sealing head length of 24 mm, a sealing pressure of 0.5 kgf, and a feeding length of 12 mm, for a sealing time of 0.3 s $\times$ 2 times, with sealing iron temperatures from 140 °C to 190 °C, at intervals of 10 °C. After leaving the cover films for 24 hours in an atmosphere with a temperature

of 23 °C and a relative humidity of 50%, the cover films were peeled with a peel angle of 170°-180° at a speed of 300 mm per minute in the same atmosphere with a temperature of 23 °C and a relative humidity of 50%. The sealing properties were evaluated on the basis of the average peel strength when heat-sealed at sealing iron temperatures of 140-190 °C at 10 °C intervals. The number of samples in which the peel strength was measured for each temperature was three.

"3": The average peel strength at all temperatures was within the range 0.3-0.9 N.

"2": The average peel strength was outside the range 0.3-0.9 N for one to five different temperatures.

"1": The average peel strength was outside the range 0.3-0.9 N for all temperatures.

The results are indicated in the "Sealing properties" rows in Tables 1 and 2.

[0056]

(2) Variation in peel strength

Cover films were heat-sealed onto polystyrene carrier tape (manufactured by Denka Co., Ltd.) so that the peel strength was 0.4 N. After leaving the cover films for 24 hours in an atmosphere with a temperature of 23 °C and a relative humidity of 50%, the cover films were peeled with a peel angle of 170°-180° at a speed of 300 mm per minute in the same atmosphere with a temperature of 23 °C and a relative humidity of 50%. The variation in the peel strength was derived from charts obtained when 100 mm of the cover films were peeled in the peel direction. Cover films in which the variation in peel strength was less than 0.2 N were graded "3", those in which the variation was 0.2-0.4 N were graded "2", and those in which the variation was greater than 0.4 N were graded "1". The results are indicated in the "Peel strength variation" rows in Tables 1 and 2.

[0057]

(3) Anti-blocking properties

Cover films were heat-sealed onto polystyrene carrier tape (manufactured by Denka Co., Ltd.) so that the peel strength was 0.4 N, then the taped carrier tape was wound onto paper tubes having a diameter of 95 mm so that the cover films were facing in the outer circumferential direction, then left for 24 hours in a 60 °C environment. At this time, cover films in which adhesion was not observed in flange portions between adjacent pockets formed in the carrier tape were graded "3", and those in which adhesion was observed were graded "1". The results are indicated in the "Anti-blocking properties" rows in Tables 1 and 2.

[0058]

(4) Stability of interlayer adhesive strength

Cover films were cut to a width of 15 mm and a length of 300 mm to obtain 50 samples, then the substrate layers (A) and the intermediate layers (C) were preliminarily peeled, the respective peeled ends were installed in a tension testing machine (EZ Test, manufactured by Shimadzu Corp.), and the interlayer adhesive strengths were evaluated by T-shaped peeling at a speed of 200 mm per minute under 23 °C conditions. Cover films for which the difference between the maximum value and the minimum value of the interlayer adhesive strength between the 50 samples was less than 3 N were graded "3" and those for which the difference in adhesive strength was 3 N or greater were graded "1". The results are indicated in the "Stability of interlayer adhesive strength" rows in Tables 1 and 2.

[0059]

(5) Productivity

Substrate layers (A) were bonded with intermediate layers (C) by means of dry lamination, then stored at 40 °C, and at this time, the number of days at which the interlayer adhesive strength between the substrate layer (A) and the intermediate layer (C) became the greatest was evaluated.

"3": Less than two days

"2": At least two days and less than four days

"1": At least four days

The results are indicated in the "Productivity" rows in Tables 1 and 2.

[0060]

(5) Antistatic properties

A Hiresta UP MCP-HT450 by Mitsubishi Chemical Corp. was used to evaluate the surface resistivities at the surfaces of the heat-sealable layers at an atmospheric temperature of 23 °C, an atmospheric humidity of 50% RH, and with an applied voltage of 500 V, in accordance with the method defined by JIS K 6911.

"3": Surface resistivity was less than 1.0×10^{12}

"2": Surface resistivity was at least 1.0×10^{12} and less than 1.0×10^{14}

"1": Surface resistivity was at least 1.0×10^{14}

The results are indicated in the "Antistatic properties" rows in Tables 1 and 2.

[0061]

As is clear from Tables 1 and 2, the cover films in Examples 1 to 10 all had excellent sealing properties, variation in peel strength, anti-blocking properties, stability of the interlayer adhesive strength, productivity, and antistatic properties.

[0062] Conversely, Comparative Example 1, which did not have bumps, had poor anti-blocking properties. Additionally, Comparative Example 2, in which the bumps were arranged in a grid rather than being staggered, had poor variation in peel strength.

[0063]

[Table 1]

				Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8	Ex. 9	Ex. 10
Substrate layer	o-PET	a-1	E-5100	100	100	100	100	100	100	100	100	100	100
Adhesive layer	Primary agent	b-1	TM-319	50		50	50		50	50	50	50	50
	Primary agent	b-2	In-house product		50								
	Primary agent	b-3	Liostar 1000					91					
	Curing agent	b-4	CAT-11B	50	50				50	50	50	50	50
	Curing agent	b-5	Coronate 2067			50							
	Curing agent	b-6	Coronate L-45E				50						
	Curing agent	b-7	Liostar 500H					9					
Intermediate layer	m-LLDP E	c-1	2040F	100	100	100	100	100	100	100	100	100	100
Heat-sealable layer	Resin	d-1	Evaflex EV360	90	90	90	90	90	60	95	50	98	85
	Resin	d-2	Clearen 335A										5
	Antistatic agent	d-3	Entira MK440	10	10	10	10	10	40	5	50	2	10
Surface	Shape			bumps	bumps	bumps	bumps	bumps	bumps	bumps	bumps	bumps	bumps
	Arrangement			stag	stag	stag	stag	stag	stag	stag	stag	stag	stag
Structure thickness	Substrate layer μm			16	16	16	16	16	16	16	16	16	16
	Adhesive layer μm			3	3	3	3	3	3	3	3	3	3
	Intermediate layer μm			20	20	20	20	20	20	20	20	20	20
	Heat-sealable layer μm			13	13	13	13	13	13	13	13	13	13
	Cover film μm			52	52	52	52	52	52	52	52	52	52
Evaluated physical properties	Sealing properties			3	3	3	3	3	3	3	2	3	3
	Variation in peel strength			3	3	3	2	2	3	3	2	3	3
	Anti-blocking properties			3	3	3	3	3	3	3	3	3	3
	Stability of interlayer adhesive strength			3	3	3	3	3	3	3	3	3	3
	Productivity			3	3	3	3	2	3	3	3	3	3
	Antistatic properties			3	3	3	3	3	3	3	3	2	3

[0064]

[Table 2]

				Comp. Ex. 1	Comp. Ex. 2
Substrate layer	o-PET	a-1	E-5100	100	100
Adhesive layer	Primary agent	b-1	TM-319	50	50
	Primary agent	b-2			
	Primary agent	b-3	Liostar 1000		
	Curing agent	b-4	CAT-11B	50	50
	Curing agent	b-5	Coronate 2067		
	Curing agent	b-6	Coronate L-45E		
	Curing agent	b-7	Liostar 500H		
Intermediate layer	m-LLDPE	c-1	2040F	100	100
Heat-sealable layer	Resin	d-1	Evaflex EV360	90	90
	Resin	d-2	Claren 335A		
	Antistatic agent	d-3	Entira MK440	10	10
Surface	Shape			no bumps	bumps
	Arrangement			none	grid
Structure thickness	Substrate layer μm			16	16
	Adhesive layer μm			3	3
	Intermediate layer μm			20	20
	Heat-sealable layer μm			13	13
	Cover film μm			52	52
Evaluated physical properties	Sealing properties			3	3
	Variation in peel strength			3	1
	Anti-blocking properties			1	3
	Stability of interlayer adhesive strength			3	3
	Productivity			3	3
	Antistatic properties			3	3

REFERENCE SIGNS LIST

[0065]

- 1 Cover film
- 2 Substrate layer
- 3 Adhesive layer
- 4 Intermediate layer
- 5 Heat-sealable layer

CLAIMS

1. A cover film that is a laminated film having at least a substrate layer (A), an adhesive layer (B), an intermediate layer (C), and a heat-sealable layer (D), wherein:
a surface of the heat-sealable layer (D) not contacting the intermediate layer (C) has bumps, and the bumps are arranged so as to be staggered with respect to a widthwise direction and a lengthwise direction of the laminated film.
2. The cover film according to claim 1, wherein the adhesive layer (B) is a urethane adhesive having a backbone comprising at least one component selected from the group consisting of a polyether polyol and a polyester polyol, and at least one component selected from the group consisting of diphenylmethane diisocyanate, 2,4-tolylene diisocyanate, and isophorone diisocyanate.
3. The cover film according to claim 1 or 2, wherein the resin constituting the heat-sealable layer (D) contains:
60-98 mass% of an ethylene-vinyl acetate copolymer (d-1), and
2-40 mass% of a potassium ionomer of an ethylene (meth)acrylic acid copolymer (d-2).
4. The cover film according to claim 3, wherein the resin constituting the heat-sealable layer (D) further contains a styrene-butadiene copolymer.
5. The cover film according to any one of claims 1 to 4, wherein the substrate layer (A) comprises a polyethylene terephthalate film.
6. The cover film according to claim 5, wherein the polyethylene terephthalate film is a biaxially stretched polyethylene terephthalate film.
7. The cover film according to any one of claims 1 to 6, wherein the intermediate layer (C) comprises a linear low-density polyethylene.
8. The cover film according to claim 7, wherein the linear low-density polyethylene includes m-LLDPE.

9. The cover film according to any one of claims 1 to 8, wherein the bumps that are arranged so as to be staggered have a height of 2 μm or more.
10. An electronic component package in which the cover film according to any one of claims 1 to 9 is used as a lid material for carrier tape comprising a thermoplastic resin.