

DESCRIPTION

TITLE OF INVENTION

COVER TAPE AND ELECTRONIC COMPONENT PACKAGING BODY INCLUDING
SAME

TECHNICAL FIELD

[0001]

The present invention relates to a cover tape and an electronic component packaging body including the same.

BACKGROUND

[0002]

Accompanying the miniaturization of electronic devices, the miniaturization and performance of electronic components used therein have also progressed, with components also being automatically mounted on printed boards in assembly processes for electronic devices. Electronic components to be surface-mounted are stored in a carrier tape having pockets, which match the shapes of the electronic components, continuously formed therein by thermoforming. After the electronic components are stored therein, a cover tape is laid as a covering material on an upper surface of the carrier tape and both edges of the cover tape are continuously heat-sealed in the longitudinal direction with a heated seal bar to form a packaging body.

[0003]

In recent years, various electronic components such as capacitors, resistors, ICs, LEDs, connectors, and switching elements, etc., have become remarkably small, lightweight, and thin, and thus, the performance requirements for cover tapes when peeled in order to extract stored electronic components from the packaging bodies have become stricter than what was conventionally required.

Further, there is an increased likelihood of trouble occurring in the mounting step wherein due to static electricity, etc., produced when a cover tape is peeled from a carrier tape in order to extract an electronic component, the electronic component adheres to the cover tape and suddenly pops out. Accordingly, static electricity countermeasures for carrier tapes and cover tapes were considered to be an important problem.

[0004]

In cover tapes currently available on the market, as a static electricity countermeasure, component adherence is suppressed by adding a conductive agent such as conductive tin oxide, etc., to the heat seal layer (Patent Document 1).

[0005]

Patent Document 1: WO 2019/087999 A

SUMMARY OF INVENTION

[0006]

However, in methods in which a conductive agent is added to a heat seal layer, due to triboelectric charging of electronic components, inductive charging occurs in the heat seal layer and a charge is generated in the heat seal layer surface. When a charge is generated, an electrostatic attractive force is produced which may cause electronic components to adhere, and therefore, there were cases in which the static electric countermeasures were insufficient. The present invention was made in consideration of the above circumstances and addresses a problem of providing a cover tape for which there is a low risk of an electronic component adhering to the cover tape when the cover tape is peeled in order to extract the electronic component.

[0007]

As a result of diligent investigation into the problem described above, the present inventors discovered that an electrostatic attractive force between a heat seal layer and an electronic component is suppressed by configuring a cover tape which has, provided to one surface, an insulating heat seal layer rather than a heat seal layer including a conductive agent, and has a conductive layer laminated directly on the heat seal layer, wherein the heat seal layer-side surface resistivity is $1 \times 10^{10} \Omega/\square$ or less and the thickness of the heat seal layer is less than 600 nm, and thus, achieved the present invention.

[0008]

The present invention, which solves the above problem, is configured as described below.

(1) A cover tape having an insulating heat seal layer provided on one surface and a conductive layer laminated directly on the heat seal layer, wherein:

the surface resistivity on the heat seal layer side is $1 \times 10^{10} \Omega/\square$ or less;
and

the average thickness of the heat seal layer is less than 600 nm.

(2) The cover tape described in (1), wherein the conductive layer contains a resin and a conductive agent.

(3) The cover tape described in (1) or (2), wherein the conductive agent is selected from the group consisting of conductive tin oxide particles, conductive polymers, and carbon nanomaterials.

(4) The cover tape described in (2) or (3), wherein the conductive layer contains 65-95 mass% of the conductive agent, and the conductive agent is conductive tin oxide particles.

(5) The cover tape described in (3) or (4), wherein the conductive tin oxide particles are antimony-doped tin oxide (ATO).

(6) The cover tape described in any one of (1) to (5) having, in the following order, a heat seal layer, a conductive layer, and a substrate layer.

(7) The cover tape described in any one of (1) to (6) having, in the following order, a heat seal layer, a conductive layer, an intermediate layer, and a substrate layer.

(8) The cover tape described in any one of (1) to (7), wherein the thickness of the heat seal layer is 30-250 nm.

(9) The cover tape described in any one of (1) to (8), wherein the cover tape is to be used as a covering material for an electronic component packaging body.

(10) An electronic component packaging body including a carrier tape and the cover tape described in any one of (1) to (9).

[0009]

According to the present invention, it is possible to obtain a cover tape for which there is a low risk of an electronic component adhering to the cover tape when the cover tape is peeled to extract the electronic component.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

Fig. 1 is a cross-sectional view showing the layer configuration of a cover tape of a first embodiment of the present invention.

Fig. 2 is a cross-sectional view showing the layer configuration of a cover tape of a second embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0011]

Below, various embodiments of the cover tape are described, followed by a description of the method for producing the cover tape. However, in cases where the specific description provided for one embodiment applies to another embodiment, the corresponding description for the other embodiment is omitted.

[0012]

[First embodiment]

A cover tape according to a first embodiment of the present invention is a cover tape that has an insulating heat seal layer provided on one surface and a conductive layer laminated directly on the heat seal layer, wherein: the surface resistivity on the heat seal layer side is $1 \times 10^{10} \Omega/\square$ or less; and the average thickness of the heat seal layer is less than 600 nm.

Fig. 1 shows the configuration of the cover tape of the present embodiment. A cover tape 1 shown in fig. 1 has a heat seal layer 2, a conductive layer 3, and a substrate layer 4 provided in that order. In the cover tape 1, the heat seal layer 2 constitutes one surface and the substrate layer 4 constitutes the other surface.

[0013]

(Heat seal layer)

A heat seal layer is a layer that has a function of welding with another resin by heat and, as shown in fig. 1 is one layer that constitutes one surface of a cover tape.

The heat seal layer preferably has a thermoplastic resin as a main component. Here, "as a main component" means contained in a resin at 50 mass% or more. In one embodiment, a thermoplastic resin may be contained at 70 mass% or more or at 90 mass% or more in the resin of the heat seal layer.

As a thermoplastic resin constituting the heat seal layer, it is possible to use a polyolefin-based resin, an acrylic resin, a styrene-acrylic copolymer, etc.

Acrylic resins are resins having, in a repeating unit, at least a structure derived from an acrylic monomer. Specific examples of the acrylic monomer include acrylic acid esters such as methyl acrylate, ethyl acrylate, propyl acrylate, and butyl acrylate, etc., and methacrylic acid esters such as methyl methacrylate, ethyl methacrylate, propyl methacrylate, butyl methacrylate, and cyclohexyl methacrylate, etc. These acrylic monomers may be used alone or as a combination of two or more.

A styrene-acrylic copolymer is a copolymer in which a styrene-based monomer and a (meth)acrylic monomer are essential components. Examples of the styrene-based monomer include styrene, α -methylstyrene, o-methylstyrene, m-methylstyrene, p-methylstyrene, and p-phenylstyrene, etc., with styrene being particularly preferable. These styrene-based monomers may be used alone or in a combination of two or more. Examples of the (meth)acrylic monomer include acrylic acid esters such as methyl acrylate, ethyl acrylate, propyl acrylate, and butyl acrylate, etc., and methacrylic acid esters such as methyl methacrylate, ethyl methacrylate, propyl methacrylate, butyl methacrylate, and cyclohexyl methacrylate, etc. These (meth)acrylic monomers may be used alone or as a combination of two or more. Further, in addition to the styrene-based monomer and the (meth)acrylic monomer, a small amount of another monomer that is copolymerizable with said monomers may be copolymerized therewith.

[0014]

A resin having the styrene-acrylic copolymer as a main component has extremely good heat seal properties with respect to polystyrenes and polycarbonates, etc., which are the materials constituting cover tapes. In particular, the resin used has, as a main

component, a styrene-acrylic copolymer having a mass average molecular weight of 5,000-80,000 and preferably 10,000-50,000. If the mass average molecular weight is 5,000 or more, mounting trouble in which tackiness occurs and a stored component adheres to a heat seal layer is suppressed. Meanwhile, if the mass average molecular weight is 80,000 or less, occurrences of breakage are suppressed due to a remarkable increase in peeling strength when peeling speed is raised. Further, the glass transition temperature of the styrene-acrylic copolymer is preferably 50°C-90°C. By setting the glass transition temperature so as to be 50°C or more, there is a lower risk of stored components adhering to a heat seal surface of a cover tape in a shipping environment such as surface mail.

Note that the mass average molecular weight is measured using the GPC measurement device and under the conditions described below.

Device name:	high-spced GPC device HLC-8220 (manufactured by Tosco Corporation)
Column:	three columns of PL gel MIXED- B in series
Temperature:	40°C
Detection:	differential refraction
Solvent:	tetrahydrofuran
Concentration:	2 wt%
Calibration curve:	created using standard polystyrene (manufactured by Polymer Laboratories), with mass average molecular weight (Mw) calculated as polystyrene equivalent molecular weight.

[0015]

The heat seal layer in the present embodiment has insulating properties. Insulating means, for example, that the surface resistivity, measured in accordance with JIS K 6911 at an atmospheric temperature of 23°C, an atmospheric humidity of 50% RH, and an applied voltage of 10 V, is $10^{11} \Omega/\square$ or more, preferably $10^{13} \Omega/\square$ or more, and more preferably $10^{14} \Omega/\square$ or more. In a further embodiment of the present invention, the content, in the heat seal layer, of an additive (for example, a conductive agent, or the like) which imparts conductivity is preferably less than 0.01 mass% in the heat seal layer, and more preferably a conductive agent is not included.

[0016]

A polyolefin-based resin means a resin formed from a polymer including an α -olefin as a monomer. Polyolefin-based resins include polyethylene-based resins and polypropylene-based resins. A high-density polyethylene, a low-density polyethylene, a linear low-density polyethylene, or a linear medium-density polyethylene, etc., can be used as the polyethylene resin. Further, it is possible to use, not only a monomer, but also a copolymer, graft, or blend having these structures. Examples of the latter resins include products of copolymerizing or blending a resin having a polar group in a

polyethylene chain, such as blends with an ethylene-propylene copolymer, an ethylene-1-butene copolymer, an ethylene-1-pentene copolymer, an ethylene-1-hexene copolymer, an ethylene-1-octene copolymer, an ethylene-vinyl acetate copolymer, an ethylene-acrylic acid ester copolymer, an ethylene-maleic acid copolymer, a styrene-ethylene graft copolymer, a styrene-propylene graft copolymer, a styrene-ethylene-butadiene block copolymer, or a terpolymer with a further acid anhydride.

[0017]

Further, a homopolypropylene, a random polypropylene, a block polypropylene, or the like, can be used as the polypropylene resin. When a homopolypropylene is used, the structure of the homopolypropylene may be any of isotactic, atactic, or syndiotactic. When a random polypropylene is used, a substance preferably having a carbon number of 2-20 and more preferably having a carbon number of 4-12, for example, ethylene, 1-butene, 1-pentene, 1-hexene, 1-heptene, 1-octene, 1-nonene, or 1-decene can be used as the α -olefin to be copolymerized with propylene. When using a block polypropylene, it is possible to use a block copolymer (block polypropylene), a graft copolymer or a block copolymer including a rubber component, etc. These olefin-based resins can be used alone and can also be used in combination with other olefin-based resins.

[0018]

The average thickness of the heat seal layer is less than 600 nm, and is preferably 580 nm or less, more preferably 400 nm or less, even more preferably 250 nm or less, and further preferably 200 nm or less. Although not particularly limited within an implementable range, the lower limit of the average thickness of the heat seal layer can be set so as to be 5 nm or more, 10 nm or more, 20 nm or more, 30 nm or more, or 50 nm or more. Examples of the preferred range of the average thickness of the heat seal layer include 5 nm or more and less than 600 nm, 10 nm or more and 580 nm or less, 20 nm or more and 400 nm or less, 30 nm or more and 250 nm or less, and 50 nm or more and 200 nm or less. By setting the average thickness of the heat seal layer so as to be above a certain level, it is possible to achieve insulating properties. By setting the average thickness of the heat seal layer so as to be less than 600 nm, it is possible to suppress the generation of an electrostatic attractive force.

As described later, the heat seal layer is normally formed by coating, and in a case of being formed by a coating method, the thickness described herein is the thickness after drying. The method for measuring the average thickness is described later.

[0019]

Furthermore, in the cover tape in one embodiment of the present invention, an inorganic filler is added to the heat seal layer. The cover tape of the present embodiment, in a state of being heat sealed to a surface of a carrier tape with electronic components included therein, may be subjected to a baking treatment under conditions of approximately 72 hours in an environment of 60°C or 24 hours in an environment of 80°C in order to remove moisture included in the sealing resin. In such a case, if the contents, i.e., the electronic components, adhere to the cover tape, there will be problems

during a step in which the cover tape is peeled to mount the electronic components. With the cover tape of the present embodiment, there is little variation in peeling strength when the cover tape is peeled, and it is also possible to control adhesiveness of the heat seal layer to the contained electronic components at high temperatures such as 60-80°C, and therefore, such an electronic component adherence problem is largely overcome. However, when an inorganic filler is added to the heat seal layer, adherence is prevented with more certainty. Here, as long as the adherence described above is meaningfully prevented, any inorganic filler may be used. However, inorganic fillers that do not impart conductivity are preferred. Examples thereof include spherical or crushed talc particles, silica particles, alumina particles, mica particles, calcium carbonate, and magnesium carbonate, etc. Further, in order to maintain the transparency of the cover tape, the inorganic filler has a median diameter (D50) of less than 400 nm and is included at, for example, 10-30 mass%.

[0020]

(Conductive layer)

The conductive layer is, as shown in fig. 1, one layer constituting the cover tape and is a layer that is laminated directly on the heat seal layer.

The conductive layer in the present embodiment has conductive properties. Conductive means, for example, that the surface resistivity, measured in accordance with JIS K 6911 at an atmospheric temperature of 23°C, an atmospheric humidity of 50% RH, and an applied voltage of 10 V, is $10^{10} \Omega/\square$ or less, preferably $10^9 \Omega/\square$ or less, and more preferably $10^8 \Omega/\square$ or less.

[0021]

The average thickness of the conductive layer is preferably 0.005 μm -100 μm , more preferably 0.01 μm -1 μm , and even more preferably 0.05 μm -0.1 μm . By setting the thickness of the conductive layer so as to be 0.005 μm or more, it is possible to suppress coating gaps when coating the conductive layer. Meanwhile, by setting the thickness of the conductive layer so as to be 100 μm or less, it is possible to suppress costs.

Note that, as described later, the conductive layer is normally formed by coating and in the case of being formed by a coating method, the thickness described herein is the thickness after drying.

[0022]

The conductive layer preferably includes a thermoplastic resin. As the thermoplastic resin constituting the conductive layer, it is possible to use a resin in which an olefin forms a component thereof, for example, a low-density polyethylene, a linear low-density polyethylene, an ultra low density polyethylene, an ethylene-propylene copolymer, an ethylene-1-butene copolymer, an ethylene-1-pentene copolymer, an ethylene-1-hexene copolymer, an ethylene-1-octene copolymer, an ethylene-vinyl acetate copolymer, an ethylene-acrylic acid ester copolymer, an ethylene-maleic acid copolymer, a styrene-ethylene graft copolymer, a styrene-propylene graft copolymer,

a styrene-ethylene-butadiene block copolymer, propylene, or the like. The foregoing polyolefins may be used alone or two or more thereof may be combined as a mixture and used.

[0023]

In one embodiment of the present invention, the conductive layer contains a conductive agent. Examples of the conductive agent include conductive tin oxide particles, conductive zinc oxide particles, and conductive titanium oxide particles, etc. Among the foregoing, tin oxide doped with antimony, phosphorus, or gallium exhibit high conductivity and have little decrease in transparency, and therefore, can be used more suitably. For the conductive tin oxide particles, the conductive zinc oxide particles, and the conductive titanium oxide particles, it is possible to use particles having a spheroidal shape or needle shape or mixtures thereof. In particular, in the case of using needle-shaped tin oxide particles doped with antimony, a cover tape having particularly good antistatic performance is obtained.

The amount of the conductive agent added is, with respect to the material constituting the conductive layer, preferably 65-95 mass%, more preferably 67-93 mass%, and even more preferably 70-90 mass%. By setting the added amount of conductive particles to be 65 mass% or more, the surface resistivity on the heat seal layer-side of the cover tape is suppressed from becoming $10^{10} \Omega/\square$ or more, and by setting the added amount of conductive particles to be 95 mass% or less, the relative amount of the thermoplastic resin decreases and thereby a decrease in peeling strength due to the heat seal is suppressed.

[0024]

As a conductive agent, it is also possible to include a carbon nanomaterial such as carbon nanotubes or carbon nanofibers, etc. Among the foregoing, carbon nanotubes with an aspect ratio of 10-10,000 are preferable. The amount of the carbon nanomaterial added is, with respect to the material constituting the conductive layer, 1-50 mass% and preferably 5-45 mass%. A conductivity imparting effect due to the addition of a carbon nanomaterial is obtained by setting the added amount of the carbon material so as to be 1 mass% or more, and by setting the added amount of the carbon material so as to be 50 mass% or less, it is possible to suppress an increase in costs and a decrease in the transparency of the cover tape.

Further, as a conductive agent, it is also possible to include a conductive polymer such as a water-soluble polymer hydrous gel, a polythiophene-based conductive polymer, a polyaniline-based conductive polymer, and a polypyrrole-based conductive polymer, etc. The added amount of the conductive polymer is, with respect to the material constituting the conductive layer, 1-50 mass% and preferably 5-45 mass%.

[0025]

(Substrate layer)

The substrate layer preferably includes a thermoplastic resin. As the thermoplastic resin constituting the substrate layer, it is possible to use a resin containing at least

one of a polyester-based resin, a polyolefin-based resin, and a super-engineering plastic.

[0026]

Examples of the polyester-based resin include polyester-based resins having, in a molecule thereof, two or more active hydrogens such as a hydroxyl group or an amino group, and specific examples include polyester polyols and polyester polyamines, etc. As the polyester polyol, a polyester polyol having a hydroxyl value (mgKOH/g) of 1-200 and a number average molecular weight of 1,000-50,000 is preferred. Note that the number average molecular weight as used herein is a value measured in accordance with JIS K 7252. Examples of the polyester polyol include condensation reaction products of a polyvalent hydroxyl group-containing compound and a polycarboxylic acid or an anhydride and an ester-forming derivative thereof such as lower alkyl (an alkyl group having a carbon number of 1-4) ester, etc.

More specifically, examples include polyethylene terephthalate, polyethylene naphthalate, polyarylate, polyethylene-2,6-naphthalate, polymethylene terephthalate, and polyester resins in which, as copolymerization components, for example, a diol component such as diethylene glycol, neopentyl glycol, or polyalkylene glycol, etc., is copolymerized with a dicarboxylic acid component such as adipic acid, sebacic acid, phthalic acid, isophthalic acid, or 2,6-naphthalene dicarboxylic acid, etc.

The content of the polyester-based resin when the polyester-based resin is combined with another resin is not particularly limited. For example, the polyester-based resin can be set so as to be 50 mass% or more, 70 mass% or more, or 90 mass% or more in the thermoplastic resin.

[0027]

Examples of polyolefin-based resins include polyethylene-based resins and polypropylene-based resins.

As the polyethylene-based resin, it is possible to use a high-density polyethylene, a low-density polyethylene, a linear low-density polyethylene, or a linear medium-density polyethylene, etc. Further, it is possible to use, not only a monomer, but also a copolymer, graft, or blend having these structures. Examples of the latter resin include resins in which a monomer having a polar group in a polyethylene chain is copolymerized, and blends thereof. Examples of the resins in which a monomer having a polar group in a polyethylene chain is copolymerized include ethylene-vinyl acetate copolymers, ethylene-acrylic acid copolymers, ethylene-acrylic ester copolymers, ethylene methacrylic ester copolymers, ethylene-vinyl acetate-vinyl chloride copolymers, and terpolymers including the foregoing copolymers and a further acid anhydride.

[0028]

Further, as the polypropylene-based resin, it is possible to use a homopolypropylene, a random polypropylene, or a block polypropylene, etc. When a homopolypropylene is used, the structure of the homopolypropylene may be any of isotactic, atactic, or

syndiotactic. When a random polypropylene is used, a substance preferably having a carbon number of 2-20 and more preferably having a carbon number of 4-12, for example, ethylene, 1-butene, 1-pentene, 1-hexene, 1-heptene, 1-octene, 1-nonene, or 1-decene can be used as the α -olefin to be copolymerized with propylene. When using a block polypropylene, it is possible to use a block copolymer (block polypropylene), a block copolymer including a rubber component, or a graft copolymer, etc. These olefin-based resins can be used alone and can also be used in combination with other olefin-based resins.

The content of the polyolefin-based resin when the polyolefin-based resin is combined with another resin is not particularly limited. For example, the polyolefin-based resin can be set so as to be 50 mass% or more, 70 mass% or more, or 90 mass% or more in the thermoplastic resin.

[0029]

Examples of the super-engineering plastic include fluorine-based resins such as polytetrafluoroethylene and polyvinylidene fluoride, etc., polyphenylene sulfides, liquid crystal polymers, polyacrylates, thermoplastic polyimides, ketone-based resins, and sulfone-based resins, etc.

The content of the super-engineering plastic when the super-engineering plastic is combined with another resin is not particularly limited. For example, the super-engineering plastic can be set so as to be 50 mass% or more, 70 mass% or more, or 90 mass% or more in the resin.

[0030]

The film to be used as the substrate may be a non-stretched film, a uniaxially stretched film or a biaxially stretched film.

[0031]

The average thickness of the substrate layer is preferably 5-50 μm and more preferably 8-30 μm . By setting the thickness of the substrate layer so as to 5 μm or more, the tensile strength of the cover tape itself becomes low, making it possible to suppress occurrences of "film breakage" when the cover tape is peeled. Meanwhile, by setting the thickness of the substrate layer so as to be 50 μm or less, it is possible to suppress reductions in heat seal properties, with respect to the carrier tape, and increases in costs. The method for measuring the average thickness is as described above.

[0032]

(Cover tape)

For the cover tape of the present embodiment, the surface resistivity of the heat seal layer-side surface, measured in accordance with JIS K 6911 at an atmospheric temperature of 23°C, an atmospheric humidity of 50% RH, and an applied voltage of 10 V, is $1 \times 10^{11} \Omega/\square$ or more, and is preferably 1×10^6 to $5 \times 10^9 \Omega/\square$ and more preferably 1×10^6 to 2×10^8 . Meanwhile, although not particularly limited within an implementable range, the lower value of the surface resistivity of the heat seal-side surface can be set

so as to be $1 \times 10^4 \text{ } \Omega/\square$, $1 \times 10^5 \text{ } \Omega/\square$, or $1 \times 10^6 \text{ } \Omega/\square$. Examples of preferred ranges of the surface resistivity of the heat seal layer-side surface include 1×10^4 to $1 \times 10^{10} \text{ } \Omega/\square$, 1×10^5 to $1 \times 10^9 \text{ } \Omega/\square$, and 1×10^6 to $1 \times 10^8 \text{ } \Omega/\square$. The value of the surface resistivity of the cover tape of the present embodiment is lower than a value obtained by measuring the surface resistivity of a single heat seal layer. However, the lower value is thought to be due to the effect of the directly-laminated conductive layer. The surface resistivity on the heat seal layer side of the cover tape can be adjusted by changing the content of the conductive agent in the heat seal layer and the conductive layer, and the thickness of the heat seal layer.

Further, in the cover tape in one embodiment of the present invention, it is preferable for layers other than the conductive layer to be conductive. It is more preferable for the content of an additive (for example, a conductive agent, or the like) which imparts conductivity to be less than 0.01 mass% in each of the other layers, and it is even more preferable for a conductive agent not to be included.

[0033]

In one embodiment of the present invention, the average thickness of the cover tape is preferably 20-80 μm and more preferably 40-60 μm . By setting the average thickness of the cover tape so as to be 20 μm or more, it is possible to prevent tearing when the cover tape is peeled. Meanwhile, by setting the average thickness of the cover tape so as to be 80 μm or less, not only is it possible to suppress an increase in costs but it is also possible to improve productivity by shortening sealing time.

The thickness of the layer is measured by using a laser microscope (VK-8510 manufactured by Keyence Corporation) after cutting 20 mm square sections from five locations spaced evenly in the width direction of the cover tape and smoothing the end surfaces such that the layer configuration can be judged. The average thickness of the cover tape means the average value of the thickness from one surface of the cover tape to the other surface. The average thickness of each layer of the cover tape is obtained by measuring the thickness at five locations and taking the arithmetic mean thereof for each layer.

[0034]

[Second embodiment]

As shown in fig. 2, the cover tape according to a second embodiment of the present invention has an intermediate layer provided between the substrate layer and the conductive layer. A cover tape 1 shown in fig. 2 has a heat seal layer 2, a conductive layer 3, an intermediate layer 5, and a substrate layer 4 provided in that order. In the cover tape 1, the heat seal layer 2 constitutes one surface and the substrate layer 4 constitutes the other surface.

[0035]

(Intermediate layer)

The intermediate layer preferably includes a thermoplastic resin. Linear low-density polyethylene (hereafter indicated as LLDPE), which has flexibility and appropriate

stiffness and also has excellent tear strength at ordinary temperatures, can suitably be used as the thermoplastic resin constituting the intermediate layer. In particular, by using a resin having a density in the range of 0.900-0.925 ($\times 10^3 \text{ kg/m}^3$), not only is less likely for heat-seal iron contamination to occur when heat sealing since the intermediate resin layer is unlikely to protrude from a cover tape end section due to heat or pressure when heat sealing, but it is also easy to achieve a stable peeling strength when peeling the cover tape because contact unevenness with the heat seal iron is mitigated due to the intermediate layer softening when heat sealing the cover tape.

[0036]

LLDPEs include those that are polymerized by a Ziegler type catalyst and those that are polymerized by a metallocene-based catalyst (hereafter indicated as m-LLDPE). m-LLDPEs have a tightly controlled molecular weight distribution, and therefore, have a particularly high tear strength and can be suitably used as the intermediate layer in the present invention.

[0037]

The m-LLDPE described above is a copolymer of ethylene and, as a comonomer, an olefin having a carbon number of three or more, preferably a linear or branched aromatic core-substituted α -olefin with a carbon number of 3-18. Examples of linear monoolefins include propylene, 1-butene, 1-pentene, 1-hexene, 1-octene, 1-nonene, 1-decene, 1-dodecene, 1-tetradecene, 1-hexadecene, and 1-octadecene, etc. Further, examples of branched monoolefins include 3-methyl-1-butene, 3-methyl-1-pentene, 4-methyl-1-pentene, and 2-ethyl-1-hexene, etc. Further, examples of aromatic core-substituted monoolefins include styrene, etc. The foregoing comonomers can be copolymerized with ethylene alone or in a combination of two or more. In this copolymerization, copolymerization with a polyene such as butadiene, isoprene, 1,3-hexadiene, dicyclopentadiene, or 5-ethylidene-2-norbornene may be performed. Among the foregoing, those using 1-hexene or 1-octene as the comonomer have a high tensile strength and are also excellent in terms of costs, and thus, can be suitably used.

[0038]

The average thickness of the intermediate layer is preferably 5-60 μm , more preferably 10-50 μm , and most preferably 15-40 μm . By setting the thickness of the intermediate layer so as to be 5 μm or more, breakage of a heat-sealed cover tape when the cover tape is peeled at a high speed is suppressed. Further, there is more likely to be obtained an effect of mitigating contact unevenness of a hot iron when heat-sealing the cover tape to the carrier tape. Meanwhile, by setting the thickness of the intermediate layer so as to be 60 μm or less, since the overall thickness of the cover tape is thick, it is possible ensure that sufficient peeling strength is obtained when heat-sealing the cover tape to the carrier tape. The method for measuring the average thickness is as described above.

[0039]

In one embodiment of the present invention, an anchor coat layer is provided between the substrate layer and the intermediate layer. In other words, a substrate layer, an anchor coat layer, an intermediate layer, a conductive layer, and a heat seal layer are provided in that order. As the adhesive to be used the anchor layer, it is possible to use polyurethane-based adhesives, polyvinyl acetate-based adhesives, polyacrylic acid ester-based adhesives, reactive (meth)acrylic adhesives, cyanoacrylate-based adhesives, ethylene copolymer adhesives including copolymers, etc., with monomers such as ethylene and vinyl acetate, ethyl acrylate, acrylic acid, and methacrylic acid, etc., polyester adhesives, polyamide adhesives, polyimide adhesives, amino resin adhesives including a urea resin or melamine resin, etc., phenol resin adhesives, epoxy adhesives, rubber adhesives including chloroprene rubber or styrene-butadiene rubber, etc., and other adhesives, etc. The composition system of the above adhesives may take the composition form of any of aqueous, solution, emulsion, and dispersion, etc. Further, the properties thereof may take the form of any of a film/sheet, a powder, and a solid, etc. Furthermore, the adhesion mechanism may be in the form of any of a chemical reaction using a curing agent, solvent volatilization, thermal fusion, or hot pressing, etc.

[0040]

The average thickness of the anchor coat layer is normally 50-7,000 nm and is preferably in the range of 100-5,000 nm. By setting the thickness of the peeling layer so as to be 50 nm or more, coating gaps in the anchor coat are suppressed. Meanwhile, by setting the thickness of the anchor coat so as to be 7,000 nm or less, the influence of residual solvent after drying is suppressed. The method for measuring the average thickness is as described above.

The adhesives described above can be applied by, for example, roll coating, gravure roll coating, kiss coating, or other coating methods, or can be applied by printing, etc. The coating amount is desirably 0.1-10 g/m² (dry state).

[0041]

[Other embodiments]

In the cover tape according to another embodiment of the present invention, a peeling layer having a thermoplastic resin as a main component is provided between the intermediate layer and the conductive layer. Examples of the thermoplastic resin used in the peeling layer include acrylic resins, polyester-based resins, ethylene-vinyl acetate copolymer resins (hereinafter indicated as EVA), ethylene-acrylic acid copolymer resins, ethylene-methacrylic acid copolymer resins, styrene-isoprene diblock copolymer resins, hydrogenated resins of styrene-isoprene diblock copolymers, styrene-butadiene diblock copolymer resins, hydrogenated resins of styrene-butadiene diblock copolymers, hydrogenated resins of styrene-isoprene-styrene triblock copolymers (hereinafter indicated as SEPS), hydrogenated resins of styrene-butadiene-styrene triblock copolymers (hereinafter indicated as SEBS), hydrogenated resins of styrene-butadiene random copolymers, and hydrogenated resins of styrene-isoprene random copolymers, etc. Among the foregoing, SEPS and SEBS having a styrene ratio of 15-35 mass% exhibit little variation in peeling strength when the cover tape is peeled, and thus, can be suitably used.

[0042]

The average thickness of the peeling layer is normally 0.1-3 μm and is preferably in the range of 0.1-1.5 μm . By setting the thickness of the peeling layer so as to be 0.1 μm or more, it is possible to suppress the peeling strength from becoming insufficient when a carrier tape is heat-sealed to the cover tape. Meanwhile, by setting the thickness of the peeling layer so as to be 3 μm or less, it is possible to suppress the occurrence of variations in peeling strength when the cover tape is peeled. Note that, as described later, the peeling layer is normally formed by coating and, in the case of being formed by a coating method, the thickness described herein is the thickness after drying. The method for measuring the average thickness is as described above.

[0043]

[Method for producing cover tape]

The method for fabricating the cover tape is not particularly limited and any general method can be used. For example, a laminated film having a substrate layer and an intermediate layer may be obtained by applying an anchor coat agent, as necessary, to a surface of a film-formed substrate layer, and dry-laminating thereon a film-formed intermediate layer or an intermediate layer extruded from a T-die. Furthermore, a conductive layer may be formed by coating, on the intermediate layer, a resin composition that is to constitute the conductive layer using, for example, a gravure coater, a reverse coater, a kiss coater, an air knife coater, a Mayer bar coater, or dip coater, etc. Furthermore, a heat seal layer may be formed by coating, on the conductive layer, a resin composition that is to constitute the heat seal layer to obtain a desired cover tape.

[0044]

As another method, a film having a conductive layer and a heat seal layer can also be obtained by film-forming the conductive layer by a T-die casting method or an inflation method, etc., and coating thereon a resin composition that is to constitute the heat seal layer.

[0045]

[Use]

The cover tape can be used as a covering material of a carrier tape which is a storage container for electronic components. A carrier tape is a belt-like article which has a width of about 8 to 100 mm and has pockets for storing electronic components. In cases in which the cover tape is heat-sealed as a covering material, the material constituting the carrier tape is not particularly limited and commercially available materials can be used. For example, it is possible to use a polystyrene, polyester, polycarbonate, or polyvinyl chloride thermoplastic resin, etc. In cases in which an acrylic resin is used in the heat seal layer, a combination with a carrier tape of polystyrene or polycarbonate, etc., is suitably used. For the carrier tape, it is also possible to use: a material to which conductivity has been imparted by kneading carbon black or carbon nanotubes in a resin; a material in which an anti-static agent or

conductive material has been kneaded; or a material to which anti-static properties have been imparted by applying to the surface thereof a coating liquid in which a surfactant-type anti-static agent or an electrically conductive substance such as polypyrrole or polythiophene, etc., is dispersed in an organic binder such as acrylic.

[0046]

Electronic component packaging bodies having electronic components stored therein are obtained by, for example, storing an electronic component, or the like, in an electronic component storage part of a carrier tape, then using a cover tape as a covering material, packaging by continuously heat-sealing both longitudinal-direction edges of the cover tape, and winding on a reel. Electronic components, etc., are stored by packaging in this form and transported. While a packaging body having electronic components, etc., stored therein is transported using holes called sprocket holes for carrier tape transportation that are provided at the longitudinal-direction edges of the carrier tape, the cover tape is intermittently peeled and a component mounting device extracts the electronic components while confirming the presence, orientation, and position thereof, and mounts the electronic components, etc., on substrates.

[0047]

Furthermore, when the cover tape is peeled away, if the peeling strength is too low, there is a risk of peeling completely from the carrier tape and the stored components falling out. If the peeling strength is too high, there is a risk that peeling from the carrier tape will be difficult and also that breakage will occur when the cover tape is peeled. Therefore, in the case of being heat-sealed at 120-220°C, a cover tape having a peeling strength of 0.15 N or more and less than 1.5 N is preferable, with 0.2 N or more and less than 0.8 N being more preferable.

EXAMPLES

[0048]

The present invention is explained in detail below using examples. However, the present invention is not limited thereby.

[0049]

The raw materials used in the examples, etc., are as described below.

(Heat seal layer)

- Resin: acrylic resin Dianal BR-106 (manufactured by Mitsubishi Chemical Group Corporation), mass average molecular weight 30,000, glass transition temperature 50°, acid value 3.5 mgKOH/g
- Conductive agent: antimony-doped tin oxide (ATO) FSS-10M (manufactured by Ishikawa Sangyo Kaisha, Ltd.), needle-shaped antimony-doped tin oxide, median diameter (D50) average long diameter 2 µm, average short diameter 0.1 µm, MEK dispersion type

(Conductive layer)

- Resin: styrene-ethylene-butadiene copolymer resin Tuftec H1272 (manufactured by Asahi Kasei Corporation)
- Conductive agent: antimony-doped tin oxide (ATO) FSS-10M (manufactured by Ishikawa Sangyo Kaisha, Ltd.), needle-shaped antimony-doped tin oxide, median diameter (D50) average long diameter 2 μm , average short diameter 0.1 μm , MEK dispersion type

(Substrate layer)

- Biaxially stretched polyethylene terephthalate film T6142 (manufactured by Toyobo Co., Ltd.), thickness 12 μm

(Anchor coat layer)

- Main agent: polyurethane-based adhesive (polyether polyol) TM-319 (manufactured by Toyo-Morton Co., Ltd), ethyl acetate solution, solid content concentration 70 mass%
- Curing agent: polyisocyanate-based curing agent (diphenylmethane diisocyanate-based) CAT-11B (manufactured by Toyo-Morton, Co., Ltd.), ethyl acetate solution, solid concentration 60 mass%

(Intermediate layer)

- Polyethylene film TCS (manufactured by Mitsui Chemicals Tohcello, Inc.), thickness 30 μm

[0050]

(Example 1)

As the substrate layer, an anchor coat agent and a curing agent (thickness 4,000 nm) were coated on a biaxially stretched polyethylene terephthalate film (thickness 12 μm), and then, as the intermediate layer, a polyethylene film (thickness 30 μm) was dry-laminated. Next, as the conductive layer, a styrene-ethylene-butadiene copolymer resin dissolved in toluene had an ATO dispersion liquid blended therein to make the ATO 80 mass%, and this was coated on the intermediate layer surface using a bar coater and dried (thickness 800 nm). In addition, as the heat seal layer, an acrylic resin dissolved in MEK was coated on the conductive layer surface and dried so as to have a thickness of 50 nm.

[0051]

(Example 2)

Other than coating the acrylic resin with a bar coater and drying so that the thickness of the heat seal layer was 100 nm, fabrication was performed using the same method as Example 1.

[0052]

(Example 3)

Other than coating the acrylic resin with a bar coater and drying so that the thickness of the heat seal layer was 200 nm, fabrication was performed using the same method as Example 1.

[0053]

(Example 4)

Other than coating the acrylic resin with a bar coater and drying so that the thickness of the heat seal layer was 300 nm, fabrication was performed using the same method as Example 1.

[0054]

(Example 5)

Other than coating the acrylic resin with a bar coater and drying so that the thickness of the heat seal layer was 400 nm, fabrication was performed using the same method as Example 1.

[0055]

(Example 6)

Other than, for the conductive layer, blending an ATO dispersion liquid in the styrene-ethylene-butadiene copolymer resin to make the ATO 90 mass%, fabrication was performed using the same method as Example 3.

[0056]

(Example 7)

Other than, for the conductive layer, blending an ATO dispersion liquid in the styrene-ethylene-butadiene copolymer resin to make the ATO 70 mass%, fabrication was performed using the same method as Example 3.

[0057]

(Example 8)

Other than coating the acrylic resin with a bar coater and drying so that the thickness of the heat seal layer was 500 nm, fabrication was performed using the same method as Example 1.

[0058]

(Comparative Example 1)

Other than, for the heat seal layer, blending an ATO dispersion liquid in an acrylic resin dissolved in MEK to make the ATO 80 mass%, fabrication was performed using the same method as Example 3.

[0059]

(Comparative Example 2)

Other than, for the conductive layer, blending an ATO dispersion liquid in the styrene-ethylene-butadiene copolymer resin to make the ATO 60 mass%, fabrication was performed using the same method as Example 3.

[0060]

(Comparative Example 3)

Other than coating the acrylic resin with a bar coater and drying so that the thickness of the heat seal layer was 600 nm, fabrication was performed by the same method as Example 1.

[0061]

<Evaluation Method>

The cover tapes fabricated in the examples and comparative examples were evaluated as shown below. The results are shown in Table 1.

(1) Surface resistivity of cover tape

A Hiresta UP MCP-HT450 manufactured by Nittoseiko Analytech Co., Ltd. was used to evaluate the heat seal layer-side surface resistivity of the cover tape at an atmospheric temperature of 23°C, an atmospheric humidity of 50% RH, and with an applied voltage of 10 V using a method of JIS K 6911.

[0062]

(2) Component adherence rate to cover tape

In an environment with an atmospheric temperature of 23°C and an atmospheric humidity of 50 RH%, a cover tape, a carrier tape, and 15 components underwent electrostatic elimination using an ionizer and, after being packaged, were secured so that the heat seal layer of the cover tape and the components were in contact, and vibrated for ten minutes at a rotation speed of 2,000 rpm using a cute mixer (manufactured by Tokyo Rikakikai Co., Ltd.). The number of components that adhered to the cover tape when the cover tape was peeled at a peeling speed of 600 mm/min and a peeling angle of 170-180 degrees was evaluated and a component adherence rate was calculated.

A conductive polystyrene carrier tape was used as the carrier tape.

The following components were used as the components.

(Component 1) DFN package measuring 0.8 mm in width × 0.8 mm in depth × 0.4 mm in thickness and having a weight of 0.6 mg

(Component 2) BGA package measuring 1.0 mm in width × 1.0 mm in depth × 0.4 mm in thickness and having a weight of 1.5 mg

If less than 5%, the adherence rate was evaluated as “excellent”, if 5% or more and less than 15%, the evaluation was “good”, and if 15% or more, the evaluation was “poor”.

[0063]

(3) Electrostatic voltage of components

In an environment with an atmospheric temperature of 23°C and an atmospheric humidity of 50 RH%, a cover tape, a carrier tape, and 15 components underwent electrostatic elimination using an ionizer and, after being packaged, were secured so that the heat seal layer of the cover tape and the components were in contact, and vibrated for ten minutes at a rotation speed of 2,000 rpm using a cutter mixer (manufactured by Tokyo Rikakikai Co., Ltd.). In addition, after peeling the carrier tape with the heat seal layer of the cover tape in contact with the components, the components were gripped using electrostatic-eliminated ceramic tweezers and the electrostatic voltage of the side contacting the heat seal layer was measured. An electrostatic voltmeter (manufactured by Monroe Electronics) was used to determine the average value of the electrostatic voltages of the 15 components.

A conductive polystyrene carrier tape was used as the carrier tape.

The following components were used as the components.

(Component 1) DFN package measuring 0.8 mm in width × 0.8 mm in depth × 0.4 mm in thickness and having a weight of 0.6 mg

(Component 2) BGA package measuring 1.0 mm in width × 1.0 mm in depth × 0.4 mm in thickness and having a weight of 1.5 mg

[0064]

TABLE 1

	EX 1	EX 2	EX 3	EX 4	EX 5	EX 6	EX 7	EX 8	COMP EX 1	COMP EX 2	COMP EX 3
Content of conductive material in conductive layer (mass%)	80	80	80	80	80	90	70	80	80	60	80
Content of conductive material in heat seal layer (mass%)	0	0	0	0	0	0	0	0	80	0	0
Thickness of heat seal layer (nm)	50	100	200	300	400	200	200	500	200	200	600
Surface resistivity of cover tape ($\Omega/\square$)	8E+07	9E+07	1E+08	3E+08	6E+08	1E+07	1E+09	8E+08	3E+07	3E+10	9E+08
Adherence rate of component 1 to cover tape (%)	0	0	0	6	13	0	0	13	53	33	20
Electrostatic voltage of component 1 (V)	-80	-90	-92	-101	-100	-48	-110	-105	-100	-115	-110
Adherence rate of component 2 to cover tape (%)	0	0	0	0	0	0	0	0	40	26	0
Electrostatic voltage of component 2 (V)	-30	-39	-47	-52	-60	-45	-65	-63	-55	-90	-72
Evaluation	EXCELLENT	EXCELLENT	EXCELLENT	GOOD	GOOD	EXCELLENT	EXCELLENT	GOOD	POOR	POOR	POOR

[0065]

The following is clear from the results shown in Table 1.

For all of the cover tapes of Examples 1-8, the electronic component adherence rate to the cover tape due to static electricity was 15% or less, and thus, adherence to the cover tape was suppressed. The foregoing result infers that an electrostatic attractive force from the heat seal layer surface with respect to the outside was suppressed due to an electrostatic attractive force being generated in the cover tape.

Meanwhile, the adherence rate for the cover tapes of Comparative Examples 1 and 2 was a high value, being at least 25%, and thus, it could not be said that adherence was sufficiently suppressed. In particular, in the cover tape of Comparative Example 1, it is inferred that due to the heat seal layer containing a conductive agent, inductive charging occurs in the heat seal layer, and an electrostatic attractive force arises due to a charge being generated. Further, in the cover tape of Comparative Example 2, it is inferred that the content of the conductive agent in the conductive layer is low, and thus, it is unlikely for inductive charging to occur in the conductive layer and it was not possible to suppress an electrostatic attractive force from the heat seal surface with respect to the outside.

At 20%, the adherence rate for the cover tape of Comparative Example 3 was a high value in the case of component 1, and thus, it could not be said that adherence was sufficiently suppressed.

[0066]

The present invention was described above using various embodiments, but it goes without saying that the technical scope of the present invention is not limited to the scope described in the abovementioned embodiments. It is clear to a person skilled in the art that various modifications or improvements can be added to the above embodiments. Further, it is clear from the recitations of the claims that aspects in which such modifications or improvements are added may also be included in the technical scope of the present invention.

INDUSTRIAL APPLICABILITY

[0067]

The cover tape of the present embodiment suppresses the generation of an electrostatic attractive force between the heat seal layer and electronic components, and therefore, it is possible to provide a cover tape for which there is a low risk of electronic components adhering to the cover tape when the cover tape is peeled in order to extract the electronic components, and thus, the cover tape of the present embodiment is industrially applicable.

REFERENCE SIGNS LIST

[0068]

- 1 Cover tape
- 2 Heat seal layer
- 3 Conductive layer
- 4 Substrate layer
- 5 Intermediate layer

CLAIMS

[Claim 1]

A cover tape having an insulating heat seal layer provided on one surface and a conductive layer laminated directly on the heat seal layer, wherein:

the surface resistivity on the heat seal layer-side is $1 \times 10^{10} \Omega/\square$ or less; and

the average thickness of the heat seal layer is less than 600 nm.

[Claim 2]

The cover tape according to claim 1, wherein the conductive layer contains a resin and a conductive agent.

[Claim 3]

The cover tape according to claim 2, wherein the conductive agent is selected from the group consisting of conductive tin oxide particles, conductive polymers, and carbon nanomaterials.

[Claim 4]

The cover tape according to claim 2 or 3, wherein the conductive layer contains 65-95 mass% of the conductive agent, and the conductive agent is conductive tin oxide particles.

[Claim 5]

The cover tape according to claim 4, wherein the conductive tin oxide particles are antimony-doped tin oxide (ATO).

[Claim 6]

The cover tape according to claim 1 or 2 having, in the following order, a heat seal layer, a conductive layer, and a substrate layer.

[Claim 7]

The cover tape according to claim 1 or 2 having, in the following order, a heat seal layer, a conductive layer, an intermediate layer, and a substrate layer.

[Claim 8]

The cover tape according to claim 1 or 2, wherein the thickness of the heat seal layer is 30-250 nm.

[Claim 9]

The cover tape according to claim 1 or 2, wherein the cover tape is to be used as a covering material for an electronic component packaging body.

[Claim 10]

An electronic component packaging body comprising a carrier tape and the cover tape according to claim 1 or 2.