The invention provides a heat-sealing film for packaging an electronic element, comprising: a base layer; at least one intermediate layer which is provided on the base layer and comprises a mixture comprising, in terms of 100% by weight of the total weight of the intermediate layer, 5-70% by weight of a vinyl acetate copolymer, wherein the units derived from vinyl acetate compose more than 10% by mole of the copolymer, 20-90% by weight of a styrene-butadiene copolymer, and 0-40% by weight of a conductive polymer; and at least a heat-sealing layer which is provided on the surface of the intermediate layer opposite to the base layer. The invention further provides a cover tape made of the heat-sealing film as described above.
HEAT-SEALING FILM AND COVER TAPE FOR PACKAGING ELECTRONIC COMPONENTS

Technical Field

The present invention relates to a heat-sealing film and a cover tape which is made from the same and heat-sealable to a plastic carrier tape having storing pockets formed therein, which carrier tape is one of the packages having such a function that when electronic components are stored, transported or mounted, the electronic components are protected from contamination, and they are arranged and taken out for assembling on an electronic circuit substrate.

Background Art

Recently, surface mount electronic components such as IC, transistor, diode, condenser, piezoelectric element resistor and the like have been packed into a package composed of a plastic carrier tape having successively formed therein emboss-molded pockets into which the electronic components can be received in conformity with the shapes of them, and a cover tape heat sealed to the carrier tape, and then supplied. The electronic components packed are automatically taken out from the package after the cover tape has been peeled from the carrier tape, and then surface mounted on an electronic circuit substrate.

The strength for peeling the cover tape from the carrier tape is called "peel-off strength", and when this strength is too low, there is such a problem that the cover tape gets off during the transportation of the package and the electronic components packed fall off.

On the other hand, when the strength is too high, there has been caused such a phenomenon that the carrier tape vibrates when the cover tape is peeled and the electronic components jump out of the storing pockets just before they are mounted, that is, a jumping trouble has been caused. Moreover, it is
required to maintain the peel-off strength of a certain cover tape within a range. If the variation of the peel-off strength is too large, it is difficult to stably peel off the cover tape by using a mounting machine.

Antistatic property is another key property because the static could damage the electronic units, and could cause difficulties in the process. Transparency of the cover tape is also important because people need to check the status of the electronic component through the cover tape. Moreover, the cover tape should not contaminate the electronic component.

The mechanism by which the cover tape now on the market peels from the carrier tape is classified into three types of interfacial peeling type, transfer-peeling type and cohesive failure type. The interfacial peeling type refers to such a type that the cover tape and the carrier tape are peeled from each other at the sealing face, the transfer peeling type refers to such a type that the bonding layer per se is transferred to the carrier tape during the peeling, and the cohesive failure type refers to such a type that a layer different from the bonding layer or the bonding layer per se (the two being referred to hereinafter as the cohesive failure layer) is broken to cause peeling.

Each of these types has both merits and demerits; however, when they are compared only in respect of the state in which the cover tape sealed to the carrier tape is peeled, the interfacial peeling type tends to be affected by the shape, material and properties of the carrier tape because the sealing face and the peeling face are the same, and hence the peel-off strength tends to become instable.

In the case of the transfer-peeling type, the bonding layer must be a thin film in view of the mechanism and the so-called heat-sealing lacquer must be used. Therefore, the peel-off strength tends to become sensitive to sealing temperature, and hence sealing conditions for suitable peel-off strength are hardly obtained.

In the case of the cohesive failure type, the sealing face and the peeling layer are different, and hence the dependency of the peel-off strength upon the
sealing conditions is low. Also, the cohesive failure type has such a great advantage that the peel-off strength is not affected by the shape, material and properties of the carrier tape. However, in some cases, during the peeling, the cohesive failure layer is affected by a layer other than the cohesive failure layer including the bonding layer and interfacial peeling takes place without causing cohesive failure.

Also, it is difficult to decide the position at which the cohesive failure layer is broken, and hence the cohesive failure layer remains on the surface of the carrier tape during the peeling and there is brought about such a state that the contents cannot be taken out.

The cohesive failure layer per se is designed so as to be easily broken, and hence in many cases, it is composed of a mixture of a plurality of resins which are hardly miscible with one another and these resins are not mixed uniformly. This results in a deterioration of the transparency of the cover tape and in a disadvantage due to agglomerates in some cases. Also, in such uses, a resin inferior in heat resistance is contained in the resin mixture in some cases. For these reasons, the agglomerates or degradation products appear during the formation of the cohesive failure layer and decrease the productivity in many cases.

Therefore, it is necessary to develop a transparent cover tape with stable peel-off strength, excellent antistatic property and would not contaminate the electronic components.

**Summary of the Invention**

An object of the invention is to develop a heat-sealing film which can be cut into cover tapes, has stable peel-off strength, good antistatic performance, does not contaminate the electronic component and has a transparent appearance.

Another object of the invention is to provide a cohesive failure type or transfer-peeling type cover tape made of the heat-sealing film.
According to the invention, it provided a heat-sealing film for packaging an electronic element, comprising:

- a base layer;

at least one intermediate layer which is provided on the base layer and comprises a mixture comprising, in terms of 100% by weight of the total weight of the intermediate layer,

- 5-70 % by weight of a vinyl acetate copolymer, wherein the units derived from vinyl acetate comprise more than 10% by mole of the copolymer;

- 20-90 % by weight of a styrene-butadiene copolymer; and

- 0-40 % by weight of a conductive polymer; and

at least a heat-sealing layer which is provided on the surface of the intermediate layer opposite to the base layer.

The invention further provides a cover tape for heat-sealing to a carrier tape that comprises an electronic element, the cover tape comprising:

- a base layer;

- an intermediate layer disposed on the base layer; and

- a heat-sealing layer disposed on the intermediate layer, the cover tape having an average optical transmittance of at least 75%, an optical haze of no more than about 50%, and a surface resistivity of no more than about 1 x 10\(^{11}\); such that when the cover tape is heat-sealed to a carrier tape to form an article, an average peel strength of the cover tape to the carrier tape is at least 20 gf/mm, the peel strength reducing by no more than about 10% when the article is subjected to a temperature of no less than about 50 °C and a relative humidity of no less than about 90% for at least 5 days.

The antistatic heat-sealing film of the invention has an excellent electrostatic dissipation performance, a good optical performance, a good mechanical performance, as well as an excellent heat-sealing performance for the surfaces of the substrates of polycarbonate, polystyrene, polypropylene or the like. The thermosensitive cover tape made from the heat-sealing film of the
invention has many advantages, such as, a permanent antistatic performance for both sides, a high light transmittancy, a low haze, a stable peel-off force with a carrier tape and an excellent sealing aging performance. In the case where the thermosensitive cover tape is utilized, the adhesive face after aging under high temperature and high humidity is not prone to adhere to the surface of the carrier tape, and a tape-opening problem is unlikely to be produced after the thermosensitive cover tape is sealed with the carrier tape. After the cover tape made from the heat-sealing film is sealed with a carrier tape, the adhesive layer will be left on the supporting tape upon peeling, and the adhesive layer can be separated from the functional layer. As compared with the case for the cover tapes on market where the adhesive layer is separated from the carrier tape layer, because the producing process has controlled the surface of the functional layer and the adhesive layer excellently, the excellent controllable peel-off effect of the cover tape product made by the method can be ensured. Additionally, the roughness of the surface of the carrier tape is relatively high, if the adhesive layer is separated from the carrier tape layer upon peeling, the stability of the peel-off force will be inferior.

Description of Figures

Figure 1 is a cross-section view of an antistatic heat-sealing film of the invention;

Figure 2 is a cross-section view of another antistatic heat-sealing film of the invention; and

Figure 3 is a cross-section view of a still another antistatic heat-sealing film of the invention.

Specific Mode of Carrying out the Invention

In the invention, unless specified otherwise, the term "thermosensitive adhesive" means a heat sealable polymeric resin. The term "addition type cationic antistatic coating" means a coating with antistatic performance
obtained by adding a cationic antistatic agent into a coating.

The present invention provides a heat-sealing film for packaging an electronic element, comprising:

a base layer;

at least one intermediate layer which is provided on the base layer and comprises a mixture comprising, in terms of 100% by weight of the total weight of the intermediate layer,

5-70% by weight of a vinyl acetate copolymer, wherein the units derived from vinyl acetate comprise more than 10% by mole of the copolymer;

20-90% by weight of a styrene-butadiene copolymer; and

0-40% by weight of a conductive polymer; and

at least a heat-sealing layer which is provided on the surface of the intermediate layer opposite to the base layer.

The base layer is mainly used to provide the mechanical strength of the film. In the invention, the base layer is not particularly limited and the base layers commonly used to produce the heat-sealing films can be used in the invention. Preferably, the base layer is selected from biaxial stretched polyesters, polyolefins or nyons. Preferably, the base layer has a thickness of about 10-30 μm. The film preferably has an optical transmittance not less than 85%, and a tensile strength not less than 50 MPa.

The intermediate layer used in the heat-sealing film of the invention is relatively soft and can be conductive, which can be composed of a material in one layer or a plurality of layers. The polyethylene applicable to the intermediate layer is preferably a linear low density polyethylene (LLDPE), more preferably, a linear low density polyethylene with a weight-average molecular weight above 100,000 and a melt index (the testing condition is 190 °C, 2.16 kilograms, ASTM D1238) of 1-100 g/10 minutes. An applicable polyethylene is, for example, LLDPE(1002-YB) from Exxon Mobil. The polyethylene has a content of 0-60 wt%, preferably, 10-60%, more preferably,
20-60%, and most preferably, 50-60% in the intermediate layer.

In the intermediate layer, a suitable vinyl acetate copolymer is a vinyl acetate copolymer wherein the molar percentage of the vinyl acetate-derived units is at least 10%, preferably above 15%, most preferably above 20%. The suitable comonomer is preferably selected from olefins, more preferably, ethylene. The suitable vinyl acetate copolymer has a melt index (the testing condition is 190°C, 2.16 kilograms, ASTM D1238) of preferably 1-250 g/10 minutes, more preferably 1-100 g/10 minutes, and most preferably 2-50 g/10 minutes. The vinyl acetate copolymer has a content of 5-70 wt%, preferably 5-50%, more preferably 10-60%, more preferably 10-40%, further preferably 20-40% and most preferably 20-30% in the intermediate layer.

The styrene-butadiene copolymer applicable to the intermediate layer is preferably a block copolymer wherein the styrene-derived units comprise above 50 mole %, more preferably above 60 mole %, and most preferably above 70 mole % of the total units of the copolymer. Preferably, the suitable styrene-butadiene copolymer has a weight-average molecular weight of preferably 20000-500000, more preferably 40000-300000, and most preferably 50000-150000, as well as a molecular weight distribution of preferably 1-2. The styrene-butadiene copolymer comprises 20-90%, preferably 30-70% of the total weight of the intermediate layer.

The intermediate layer has a thickness of preferably 10-50 microns and the surface thereof can be conductive by adding a conductive polymer as desired. For example, the surface resistivity thereof can be less than 1X 10^{11} ohm/D, more preferably less than 1X 10^{10} ohm/D, and most preferably less than 1X 10^{9} ohm/D. The suitable conductive polymers include, but not limited to polyacetylene, polypyrrole, polythiophene, polyaniline, polyether amides-based or polyester amides-based intrinsic antistatic polymers or the like, or combinations thereof.

In the case where a separate polyethylene layer is not provided, optionally, an adhesion layer can be provided between the intermediate layer and the base.
layer. In the case where a separate polyethylene layer is provided, optionally, an adhesion layer is provided between the polyethylene layer and the base layer. The adhesion layer can be a common curable polyurethane type adhesive.

According to some embodiments, the intermediate layer is mainly a polymer alloy formed by blend-extruding an ethylene-vinyl acetate copolymer, a styrene-butadiene block copolymer and a certain amount of an intrinsic conductive or antistatic polymer by an extruder. The surface resistivity of the layer is preferably $1 \times 10^6$-$1 \times 10^{14}$ ohm/□. The ethylene type copolymer used in the intermediate layer can be poly (vinyl acetate). The poly (vinyl acetate) has a VA chain segment content above 10% and comprises 10-60 wt% of the polymer alloy in the whole functional layer. The styrene-butadiene copolymer to be used has a polystyrene chain segment content above 50%. The block copolymer has a weight average molecular weight of 20000-500000, as well as a molecular weight distribution of 1-2. The copolymer comprises 30-90 wt% of the polymer alloy in the whole functional layer. The intrinsic conductive or antistatic polymer to be used can be ICP (inherently conductive polymer) or IDP (inherently dissipative polymer), including polyacetylene, polypyrrole, polythiophene, polyaniline, polyether amides-based or polyester amides-based intrinsic antistatic polymers or the like, or combinations thereof, which comprises 0-40 wt% of the polymer alloy in the whole functional layer.

A heat-sealing layer (in the invention, it is also referred to as "thermosensitive adhesive layer") is provided on the surface of the intermediate layer opposite to the base layer. This heat-sealing layer can be composed of a material in one layer or a plurality of layers, and can be conductive or non-conductive as desired. Preferably, the heat-sealing layer is composed of a material selected from polyacrylate or the copolymers thereof and the glass-transition temperature of the polymer should be above 30°C, more preferably above 60°C, and most preferably 70-90°C. As desired, if the intermediate layer is not added with a conductive or antistatic polymer, a
certain amount of conductive particles can be added into the heat-sealing layer, for example, the heat-sealing layer can be a coating of polyacrylate or the copolymers thereof added with a certain amount of a conductive filler. The heat-sealing layer can have a thickness of 0.01-10 microns and a surface resistivity of \(1 \times 10^{7} - 1 \times 10^{12} \text{ ohm} / \text{a} \), more preferably \(1 \times 10^{7} - 1 \times 10^{11} \text{ ohm} / \text{a} \). The conductive filler can be a nanometer oxide, for example, titanium dioxide, silica, alumina, zinc oxide, tin oxide, antimony oxide, indium tin oxide or the like. The conductive filler can also be carbon nanotubes, carbon powder, metal powder or the like. The conductive filler particles added in the layer comprise preferably 0-60 wt%, more preferably 0-30 wt% of the whole thermosensitive adhesive layer. The polyacrylate or the copolymers thereof to be used in the heat-sealing layer has a preferable glass-transition temperature of 30-90°C and a preferable heat activation temperature of 90°C or more.

Optionally, an antistatic coating can be coated on a surface of the base layer. The dry film thickness of the antistatic coating can be, for example, 0.01-2 microns, preferably, 0.05-1 microns, and most preferably, 0.1-0.8 microns. The surface resistivity of the antistatic coating can be \(1 \times 10^{6} - 1 \times 10^{12} \text{ ohm} / \text{n} \), more preferably, \(1 \times 10^{9} - 1 \times 10^{11} \text{ ohm} / \text{n} \). The antistatic coating on the base layer can be realized by a gravure coating process. Even in the case where the environmental humidity is 50%, the surface resistivity of the antistatic coating is not higher than \(1 \times 10^{12} \text{ ohm} / \text{n} \). This coating can be an addition type cationic antistatic coating or a polymer grafting type cationic antistatic agent coating, and it can also be a polymer coating with relatively good temperature resistance added with a conductive filler. The conductive filler can be selected from metal oxides, carbon nanotubes or other conductive particles.

Figure 1 is a cross-section view of a cover tape of an embodiment according to the invention. 2 is a base layer with a thickness of about 10-30 microns and is mainly used to provide the mechanical strength of the film. A surface of the base layer 2 is coated with an antistatic coating 1 with a dry film.
thickness of 0.01-2 microns and a surface resistivity of $1 \times 10^6$\textasciitilde$1 \times 10^{12}$ ohm/D. The surface of the base layer 2 opposite to the antistatic coating 1 is cast with a functional layer 3 (in the invention, the functional layer means the intermediate layer) with a conductive surface. The functional layer 3 has a thickness of 10-50 microns and a surface resistivity of $1 \times 10^5$\textasciitilde$1 \times 10^{10}$ ohm/D. The surface of the functional layer 3 opposite to the base layer 2 is coated with a thermosensitive adhesive layer 4 (in the invention, the thermosensitive adhesive layer is equal to the heat-sealing layer) with a thickness of 0.01-10 microns and a surface resistivity of $1 \times 10^5$\textasciitilde$1 \times 10^{12}$ ohm/D.

In the structure of Figure 1, the base layer 2 can be a plastic film with a certain mechanical strength selected from biaxial stretched polyesters, polyolefins or nylons. This film has a optical transmittance not less than 85%, and a tensile strength not less than 50 MPa. The antistatic coating 1 on the base layer is realized by a gravure coating process. When the environmental humidity is 50%, the surface resistivity of the surface is not higher than $1 \times 10^{12}$ ohm/D. This coating can be an addition type cationic antistatic coating or a polymer grafting type cationic antistatic agent coating, and it can also be a polymer coating with relatively good temperature resistance added with a conductive filler. The conductive filler can be selected from metal oxides, carbon nanotubes or other conductive particles. The functional layer 3 is mainly a polymer alloy formed by blend-extruding an ethylene copolymer, a styrene-butadiene block copolymer and a certain amount of an intrinsic conductive or antistatic polymer by an extruder. The surface resistivity of the layer is $1 \times 10^6$\textasciitilde$1 \times 10^{14}$ ohm/D. The thermosensitive adhesive layer 4 is mainly a coating of polyacrylate or the copolymers thereof added with a certain amount of conductive particles, which has a thickness of 0.01-10 microns and a surface resistivity of $1 \times 10^6$\textasciitilde$1 \times 10^{12}$ ohm/D.

The ethylene type copolymer used in the functional layer 3 can be poly(vinyl acetate). The poly(vinyl acetate) has a VA chain segment content above 10% and comprises 10-60 wt% of the polymer alloy in the whole functional
layer 3. The styrene-butadiene copolymer to be used has a polystyrene chain segment content above 50%. The block copolymer has a weight average molecular weight of 20000-500000, as well as a molecular weight distribution of 1-2. The copolymer comprises 30-90 wt% of the polymer alloy in the whole functional layer. The intrinsic conductive or antistatic polymer to be used can be ICP or IDP, including polypyrrole, polythiophene, polyaniline, polyether amides-based or polyester amides-based intrinsic antistatic polymers or the like, or combinations thereof, which comprises 0-40 wt% of the polymer alloy in the whole functional layer.

The polyacrylate or the copolymers thereof to be used in the thermosensitive adhesive layer 4 has a glass-transition temperature of 30-90°C and a heat activation temperature of 90°C or more. The conductive filler particles added in the layer comprise 0-60 wt% of the whole thermosensitive adhesive layer. The conductive filler can be a nanometer oxide, for example, titanium dioxide, silica, alumina, zinc oxide, tin oxide, antimony oxide, indium tin oxide or the like. The conductive filler can also be carbon nanotubes, carbon powder, metal powder or the like.

Figure 2 is a cross-section view of another cover tape of the invention. A surface of a base layer 2 is coated with an antistatic coating 1. The surface of the base layer 2 opposite to the antistatic coating 1 is coated with a functional layer 3 via an adhesion layer 5. The surface of the functional layer 3 opposite to the adhesion layer 5 is coated with a thermosensitive adhesive layer 4.

Figure 3 is a cross-section view of still another cover tape of the invention. A surface of a base layer 2 is coated with an antistatic coating 1. A polyethylene layer 6 and a functional layer 3 (the polyethylene layer 6 constitutes a part of the functional layer 3) are blowing formed by coextrusion. A surface of the polyethylene layer 6 is combined with the base layer 2 via an adhesion layer 5. The surface of the functional layer 3 opposite to the polyethylene layer 6 is coated with a thermosensitive adhesive layer 4.

The invention further provides a cover tape for heat-sealing to a carrier
tape that comprises an electronic element, the cover tape comprising:

- a base layer;
- an intermediate layer disposed on the base layer; and
- a heat-sealing layer disposed on the intermediate layer, the cover tape having an average optical transmittance of at least 75%, an optical haze of no more than about 50%, and a surface resistivity of no more than about $1 \times 10^{11}$; such that when the cover tape is heat-sealed to a carrier tape to form an article, an average peel strength of the cover tape to the carrier tape is at least 20 gf/mm, the peel strength reducing by no more than about 10% when the article is subjected to a temperature of no less than about 50 °C and a relative humidity of no less than about 90% for at least 5 days.

The thermosensitive cover tape of the invention has many advantages, such as, a permanent antistatic performance for both sides, a high light transmittance, a low haze, a stable peel-off force with a carrier tape and an excellent sealing aging performance. In the case where the thermosensitive cover tape is utilized, the adhesive face after aging under high temperature and high humidity is not prone to adhere to the surface of the carrier tape, and a tape-opening problem is unlikely to be produced after the thermosensitive cover tape is sealed with the carrier tape. After the cover tape made from the heat-sealing film is sealed with a carrier tape, the adhesive layer will be left on the supporting tape upon peeling, and the adhesive layer can be separated from the functional layer. As compared with the case for the cover tapes on market where the adhesive layer is separated from the carrier tape layer, because the surface of the functional layer and the adhesive formulation are controlled well through controlling the production processes, the stable peel-off effect of the cover tape product made by the method can be ensured. Additionally, the surface roughness of the carrier tape is relatively high and different carrier tape has different surface roughness, if the adhesive layer is separated from the carrier tape layer upon peeling, the stability of the peel-off force will be inferior.
The invention is described below in more detail by means of examples. It should be noted that these examples in no case limit the invention and the scope of the invention is determined by the appended claims. In the invention, unless specified otherwise, all of the parts, percentages, contents, proportions are based on weight, all of the temperatures are based on centigrade scale, and all of the numbers with unspecified unit are based on the most common-used units in the field.

Example

Testing methods:

Surface resistivity: A test is carried out under a certain condition for temperature and humidity according to ESD S1111 Standard Testing Method:

After a resistivity meter is put on the surface of an article to be measured, a switch is adjusted to a desired voltage position (10 V or 100 V) and a testing button is pressed persistently with a pressure of about 5 pounds. Then a LCD screen will show the measured surface resistivity. The unit of the surface resistivity is ohm/D.

Optical transmittance and haze: they are measured by a haze meter HM-150.

Peel-off force at 180°: A 5.4 mm-wide cover tape and a 8 mm-wide carrier tape are sealed at 160°C by a heat-sealing machine. Then, the peel-off force at 180° is measured by a peel-off force testing meter PT-45.

Aging test for peel-off force at 180°: A 5.4 mm-wide cover tape and a 8 mm-wide carrier tape are sealed at 160°C by a heat-sealing machine. Then, the peel-off force at 180° is measured by a peel-off force testing meter PT-45; Put the sample into an aging chamber at 52°C/95rh%, after 5days aging, the sample is taken out and do the peel-off force test.

Aging test for anti-sticking property at 60°C: A sample to be tested is adhered to a surface of a polycarbonate sheet and both sides thereof are fixed by an adhesive tape. The obtained sample is put into an aging box at 60°C.
After a period of time, the sample is taken out and observed whether an adhesion phenomenon occurs on the heat-sealing film and the surface of the polycarbonate sheet.

Example 1:
Preparation of the material for the functional layer:

67.5 kg of a styrene-butadiene block copolymer (CHI MEI, PB-5903), 37.5 kg of a poly(vinyl acetate) (HyunDai, VA60), 45 kg of an intrinsic antistatic polymer (IDP:PolyNova PNC300R-M) and 0.6 kg of an antioxidant A5 (Jinhai Albemarle, Shanghai Jinhai Albemarle Fine Chemicals Co., Ltd.) were uniformly stirred, and melt mixed at 180°C, and then subjected to cooling and granulation for further application.

Preparation of the heat-sealing film and cover tape:

1. A 16 µη-thick single side corona discharge treated biaxial stretched polyester thin film was prepared. The corona discharge treated surface was coated with a primer coating of polyurethane type with a thickness of about 0.2 µη, and then baked in an oven. At the same time, a prepared polymer alloy for a functional layer was melt-coated on the polyester thin film coated with the primer coating, and then the obtained product was subjected to cooling and winding. The functional layer had a thickness of 30µη and a surface resistivity of $1 \times 10^9$ ohm/D.

2. Under stirring, 2 kg of a polyacrylate copolymer (DSM, with a glass-transition temperature of 42°C) powder was dissolved into 16 kg of a solvent of ethyl acetate, and then added with 2 kg of toluene, and further stirred for 5 minutes for further application. The solid content of acrylic resin in the solution was 10%. The solution was coated on the surface with the functional layer and the obtained product was dried in an oven to remove the solvent and wound. The acrylic resin layer was the thermosensitive adhesive layer, which had a thickness of about 1µπη. The surface of the thermosensitive
adhesive layer had a surface resistivity of $1 \times 10^{10}$ ohm/□.

3. An antistatic coating solution with a solid content of 5% (K104A-2, Qingdao Trade Import and Export Co., Ltd.) was coated on a PET surface of the heat-sealing film opposite to the functional layer, and was baked on an oven for curing. The antistatic coating had a dry film thickness of 0.2 µη and a surface resistivity of $1 \times 10^{11}$ ohm/□ under an environment of normal temperature and normal humidity.

As to the prepared heat-sealing film, the optical transmittance thereof was 85%, the haze value thereof was 10%, the surface resistivity on the surface of the thermosensitive adhesive was $1 \times 10^{10}$ ohm/D, and the surface resistivity on the other surface was $1 \times 10^{11}$ ohm/□. After a cover tape made from this heat-sealing film was sealed with a carrier tape at 170°C, the average value for the peel-off force was 50 g and the fluctuating scope of the peel-off force was about 20 g. When the cover tape and the carrier tape were peeled off, the heat-sealing layer at the sealing position left on the carrier tape completely, and a little of the functional layer also resided on the carrier tape, therefore, the peeling was virtually a peeling due to the cohesion failure of the functional layer. After an aging was performed for 1 week under a condition of 52°C /95rh%, the average value for the peel-off force and the fluctuating scope of the peel-off force were substantially unchanged.

Example 2:
Preparation of the material for the functional layer:

67.5 kg of a styrene-butadiene block copolymer (CHI MEI, PB-5903), 37.5 kg of a polyvinyl acetate (HyunDai, VA60), 45 kg of an intrinsic antistatic polymer (IDP:PolyNova PNC300R-M) and 0.6 kg of an antioxidant A5 (Jinhai Albemarle, Shanghai Jinhai Albemarle Fine Chemicals Co., Ltd.) were uniformly stirred, and melt mixed at 180°C, and then subjected to cooling and granulation for further application.
Preparation of the heat-sealing film and cover tape:

1. A 16 µm-thick single side corona discharge treated biaxial stretched polyester thin film was prepared. The corona discharge treated surface was coated with a primer coating of polyurethane type with a thickness of about 0.2 µm, and then baked in an oven. At the same time, a prepared polymer alloy for a functional layer was melt-coated on the polyester thin film coated with the primer coating, and then the obtained product was subjected to cooling and winding. The functional layer had a thickness of 30µm and a surface resistivity of 1X 10^9 ohm/a.

2. Under stirring, 2 kg of a polyacrylate copolymer (3M, with a glass-transition temperature of 80°C) powder was dissolved into 16 kg of a solvent of ethyl acetate, and then added with 2 kg of toluene, and further stirred for 5 minutes for further application. The solid content of acrylic resin in the solution was 10%. The solution was coated on the surface with the functional layer and the obtained product was dried in an oven to remove the solvent and wound. The acrylic resin layer was the thermosensitive adhesive layer, which had a thickness of about 1µm. The surface of the thermosensitive adhesive layer had a surface resistivity of 1X 10^10 ohm/a.

3. An antistatic coating solution with a solid content of 5% (K104A-2, Qingdao Trade Import and Export Co., Ltd.) was coated on a PET surface of the heat-sealing film opposite to the functional layer, and was baked on an oven for curing. The antistatic coating had a dry film thickness of 0.2µm and a surface resistivity of 1X 10^11 ohm/Ω under an environment of normal temperature and normal humidity.

As to the prepared heat-sealing film, the optical transmittance thereof was 85%, the haze value thereof was 10%, the surface resistivity on the surface of the thermosensitive adhesive was 1X 10^10 ohm/D, and the surface resistivity on the other surface was 1X 10^11 ohm/D. After a cover tape made from this heat-sealing film was sealed with a carrier tape at 170°C, the average value for the peel-off force was 50 g and the fluctuating scope of the peel-off force was
about 20 g. When the cover tape and the carrier tape were peeled off, the heat-sealing layer at the sealing position left on the carrier tape completely, and a little of the functional layer also resided on the carrier tape, therefore, the peeling was virtually a peeling due to the cohesion failure of the functional layer. After an aging was performed for 1 week under a condition of 52°C /95rh%, the average value for the peel-off force and the fluctuating scope of the peel-off force were substantially unchanged.

Example 3:
Preparation of the material for the functional layer:

80 kg of a styrene-butadiene block copolymer (CHI MEI, PB-5903), 20 kg of a poly(vinyl acetate) (HyunDai, VA60), and 0.4 kg of an antioxidant A5 (Jinhai Albemarle, Shanghai Jinhai Albemarle Fine Chemicals Co., Ltd.) were uniformly stirred, and melt mixed at 180°C, and then subjected to cooling and granulation for further application.

Preparation of the heat-sealing film and cover tape:

1. A prepared material for a functional layer was formed into a film by blow molding and wound for further application. The thickness of the thin film was 35 μm.

2. A 12 μm-thick single side corona discharge treated biaxial stretched polyester thin film was prepared. The corona discharge treated surface was coated with a polyurethane glue (35%, adhesive from MITSUI TAKEDA CHEMICALJNC, A-969V/A-5 is 3/1). The glue had a thickness of about 2 μm after baking. A prepared functional layer thin film was combined with a surface of the polyester thin film coated with the glue and then cured at room temperature.

3. Under stirring, 2 kg of a polyacrylate copolymer (DSM) powder was dissolved into 16 kg of a solvent of ethyl acetate, and then added with 1 kg of a 15% conductive carbon black solution (PC AUTO carbon black, Nippon
Paint Co., Ltd, China) and 2 kg of toluene, and further stirred for 5 minutes for further application. In the solution, the solid content of the acrylic resin was 9.5% and the ratio of the conductive carbon black to the acrylic resin was 1/13.3. The solution was coated on the surface of the polyester thin film combined with the functional layer and the obtained product was dried in an oven to remove the solvent and wound. The acrylic resin layer was the thermosensitive adhesive layer, which had a thickness of about 0.5 µm. The surface of the thermosensitive adhesive layer had a surface resistivity of 1X 10^9 ohm/a.

4. An antistatic coating solution with a solid content of 5% (K104A-2, Qingdao Trade Import and Export Co., Ltd.) was coated on a PET surface of the heat-sealing film opposite to the functional layer, and was baked on an oven for curing. The antistatic coating had a dry film thickness of 0.2 µm and a surface resistivity of 1X 10^{11} ohm/D under an environment of normal temperature and normal humidity.

As to the prepared heat-sealing film, the optical transmittance thereof was 75%, the haze value thereof was 10%, the surface resistivity on the surface of the thermosensitive adhesive was 1X 10^9 ohm/□, and the surface resistivity on the other surface was 1X 10^{11} ohm/a. After a cover tape made from this heat-sealing film by cutting was sealed with a carrier tape at 160 °C, the average value for the peel-off force was 50 g and the fluctuating scope of the peel-off force was about 20 g. When the cover tape and the carrier tape were peeled off, the heat-sealing layer at the sealing position left on the carrier tape completely, and there was no functional layer left on the carrier layer, and therefore, the peeling was virtually an interfacial peeling between the heat-sealing layer and the functional layer.

Example 4:
Preparation of the material for the functional layer:

60 kg of a styrene-butadiene block copolymer (CHI MEI, PB-5903), 40
kg of a poly(vinyl acetate) (HyunDai, VA60), and 0.4 kg of an antioxidant A5 (Jinhai Albemarle, Shanghai Jinhai Albemarle Fine Chemicals Co., Ltd.) were uniformly stirred, and melt mixed at 180 °C, and then subjected to cooling and granulation for further application.

Preparation of the heat-sealing film and cover tape:

1. A prepared material for a functional layer and a linear low density polyethylene LLDPE (1002-YB, Exxon Mobil) were coextruded and formed into a film by a specific method and then wound for further application. The thin film had a total thickness of 35 µm, wherein the thickness of the functional layer was 12 µm and the thickness of the polyethylene layer was 23 µm.

2. A 12 µm-thick single side corona discharge treated biaxial stretched polyester thin film was prepared. The corona discharge treated surface was coated with a polyurethane glue (35%, adhesive from MITSUI TAKEDA CHEMICAL, INC, A-969V/A-5 is 3/1). The glue had a thickness of about 2 µH after baking. The polyethylene surface of the two-layered thin film as described above was combined with a surface of the polyester thin film coated with the glue and then cured at room temperature.

3. Under stirring, 2 kg of a polyacrylate copolymer (DSM) powder was dissolved into 16 kg of a solvent of ethyl acetate, and then added with 2 kg of a 20% ATO solution (a nano-tin oxide/antimony oxide solution) and 1 kg of toluene, and further stirred at high speed for 5 minutes for further application. In the solution, the solid content of the acrylic resin was 9.5% and the ratio of the ATO to the acrylic resin was 1/5. The solution was coated on the surface of the polyester thin film combined with the functional layer and the obtained product was dried in an oven to remove the solvent and wound. The acrylic resin layer was the thermosensitive adhesive layer, which had a thickness of about 0.5 µm. The surface of the thermosensitive adhesive layer had a surface resistivity of 1 X 10⁹ ohm/a.
4. An antistatic coating solution with a solid content of 5% (K104A-2, Qingdao Trade Import and Export Co., Ltd.) was coated on a PET surface of the heat-sealing film opposite to the functional layer, and was baked on an oven for curing. The antistatic coating had a dry film thickness of 0.2 µm and a surface resistivity of $1 \times 10^{11}$ ohm/cm under an environment of normal temperature and normal humidity.

As to the prepared heat-sealing film, the optical transmittance thereof was 85%, the haze value thereof was 15%, the surface resistivity on the surface of the thermosensitive adhesive was $1 \times 10^9$ ohm/cm, and the surface resistivity on the other surface was $1 \times 10^{11}$ ohm/cm. After a cover tape made from this heat-sealing film by cutting was sealed with a carrier tape at 160°C, the average value for the peel-off force was 40 g and the fluctuating scope of the peel-off force was about 20 g. When the cover tape and the carrier tape were peeled off, the heat-sealing layer at the sealing position left on the carrier tape completely, and there was no functional layer left on the carrier layer, and therefore, the peeling was virtually an interfacial peeling between the heat-sealing layer and the functional layer.

Comparative Example 1:
Preparation of the material for the functional layer:

30 kg of a styrene-butadiene block copolymer (CHI MEI, PB-5903), 75 kg of a poly(vinyl acetate) (HyunDai, VA60), 45 kg of an intrinsic antistatic polymer (IDP:PolyNova PNC300R-M) and 0.6 kg of an antioxidant A5 (Jinhai Albemarle, Shanghai Jinhai Albemarle Fine Chemicals Co., Ltd.) were uniformly stirred, and melt mixed at 180°C, and then subjected to cooling and granulation for further application.

Preparation of the heat-sealing film and cover tape:

1. A 16 µm-thick single side corona discharge treated biaxial stretched polyester thin film was prepared. The corona discharge treated surface was
coated with a primer coating of polyurethane type with a thickness of about 0.2 µη, and then baked in an oven. At the same time, a prepared polymer alloy for a functional layer was melt-coated on the polyester thin film coated with the primer coating, and then the obtained product was subjected to cooling and winding. The functional layer had a thickness of 30µη and a surface resistivity of 1X 10^9 ohm/D.

2. Under stirring, 2 kg of a polyacrylate copolymer (DSM, with a glass-transition temperature of 42°C) powder was dissolved into 16 kg of a solvent of ethyl acetate, and then added with 2 kg of toluene, and further stirred for 5 minutes for further application. The solid content of acrylic resin in the solution was 10%. The solution was coated on the surface with the functional layer and the obtained product was dried in an oven to remove the solvent and wound. The acrylic resin layer was the thermosensitive adhesive layer, which had a thickness of about 1µη. The surface of the thermosensitive adhesive layer had a surface resistivity of 1X 10^10 ohm/D.

3. An antistatic coating solution with a solid content of 5% (K104A-2, Qingdao Trade Import and Export Co., Ltd.) was coated on a PET surface of the heat-sealing film opposite to the functional layer, and was baked on an oven for curing. The antistatic coating had a dry film thickness of 0.2µη and a surface resistivity of 1X 10^11 ohm/a under an environment of normal temperature and normal humidity.

As to the prepared heat-sealing film, the optical transmittance thereof was 85%, the haze value thereof was 10%, the surface resistivity on the surface of the thermosensitive adhesive was 1X 10^10 ohm/a, and the surface resistivity on the other surface was 1X 10^11 ohm/□. After a cover tape made from this heat-sealing film was sealed with a carrier tape at 170°C, the average value for the peel-off force was 50 g and the fluctuating scope of the peel-off force was about 20 g. When the cover tape and the carrier tape were peeled off, the heat-sealing layer at the sealing position left on the carrier tape completely, and a little of the functional layer also resided on the carrier tape, therefore,
the peeling was virtually a peeling due to the cohesion failure of the functional layer. After an aging was performed for 1 week under a condition of 52°C /95rh%, the average value for the peel-off force and the fluctuating scope of the peel-off force were substantially unchanged.

Comparative Example 2:
Preparation of the material for the functional layer:

30 kg of a styrene-butadiene block copolymer (CHI MEI, PB-5903), 70 kg of a poly(vinyl acetate) (HyunDai, VA60), and 0.4 kg of an antioxidant A5 (Jinhai Albemarle, Shanghai Jinhai Albemarle Fine Chemicals Co., Ltd.) were uniformly stirred, and melt mixed at 180°C, and then subjected to cooling and granulation for further application.

Preparation of the heat-sealing film and cover tape:

1. A prepared material for a functional layer and a linear low density polyethylene LLDPE (1002-YB, Exxon Mobil) were coextruded and formed into a film by a specific method and then wound for further application. The thin film had a total thickness of 35 µm, wherein the thickness of the functional layer was 12 µm and the thickness of the polyethylene layer was 23 µm.

2. A 12 µm-thick single side corona discharge treated biaxial stretched polyester thin film was prepared. The corona discharge treated surface was coated with a polyurethane glue (35%, adhesive from MITSUI TAKEDA CHEMICAL, INC, A-969V/A-5 is 3/1). The glue had a thickness of about 2 µm after baking. The polyethylene surface of the two-layered thin film as described above was combined with a surface of the polyester thin film coated with the glue and then cured at room temperature.

3. Under stirring, 2 kg of a polyacrylate copolymer (DSM) powder was dissolved into 16 kg of a solvent of ethyl acetate, and then added with 2 kg of a 20% ATO solution (a nano-tin oxide/antimony oxide solution) and 1 kg of
toluene, and further stirred at high speed for 5 minutes for further application. In the solution, the solid content of the acrylic resin was 9.5% and the ratio of the ATO to the acrylic resin was 1/5. The solution was coated on the surface of the polyester thin film combined with the functional layer and the obtained product was dried in an oven to remove the solvent and wound. The acrylic resin layer was the thermosensitive adhesive layer, which had a thickness of about 0.5 μm. The surface of the thermosensitive adhesive layer had a surface resistivity of $1 \times 10^9$ ohm/a.

4. An antistatic coating solution with a solid content of 5% (K104A-2, Qingdao Trade Import and Export Co., Ltd.) was coated on a PET surface of the heat-sealing film opposite to the functional layer, and was baked on an oven for curing. The antistatic coating had a dry film thickness of 0.2 μm and a surface resistivity of $1 \times 10^{11}$ ohm/a under an environment of normal temperature and normal humidity.

As to the prepared heat-sealing film, the optical transmittance thereof was 85%, the haze value thereof was 15%, the surface resistivity on the surface of the thermosensitive adhesive was $1 \times 10^9$ ohm/a, and the surface resistivity on the other surface was $1 \times 10^{11}$ ohm/□. After a cover tape made from this heat-sealing film by cutting was sealed with a carrier tape at 160°C, the average value for the peel-off force was less than 30 g. Too small peel-off force will weaken the sealing between the cover tape and the carrier tape, which is prone to cause tape-opening.

The results of Examples were summarized in the following table.
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<tr>
<th></th>
<th>Example 1</th>
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<th>Example 3</th>
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<th>Comparative example 1</th>
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<td>Poly(vinyl acetate)/kg</td>
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<td>ATO/conductive carbon black/kg</td>
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<td>0.4 (ATO powder )</td>
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<td>Surface resistivity of the heat-sealing layer/ ohm/o</td>
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<td>Ix10¹⁰</td>
<td>Ix10¹⁰</td>
<td>Ix10¹¹</td>
<td>1x10¹²</td>
<td>1*10¹²</td>
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<td>Peel-off force at 180°/g/mm</td>
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<td>45</td>
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<td>Peel-off force at 52°C-95rh%</td>
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<td>45</td>
<td>90</td>
<td>50</td>
<td>25</td>
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<td>V</td>
<td>√</td>
<td>x</td>
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The data indicate that the formulation of the functional layer has a crucial influence on the magnitude of the peel-off force. Because the peeling in the invention when the cover tape is peeled off is an interfacial peeling between the heat-sealing layer and the functional layer, or a peeling due to the cohesion failure of the functional layer, in the case where the formulation of the basic resin for the heat-sealing layer is constant, the peel-off force or the cohesion of the functional layer when the heat-sealing layer is peeled from the functional layer can be adjusted by changing the content of the styrene-butadiene block copolymer in the formulation for the functional layer. It can be seen from the data analysis that the peel-off force at 180\(^\circ\) can be increased by increasing the content of the styrene-butadiene block copolymer, while the fluctuating scope of the peel-off force is kept constant substantially. If a conductive polymer is added into the functional layer, because the heal-sealing layer is very thin, the surface resistivity of the surface will change a little and will still remain in \(1 \times 10^{12}\) ohm/n. If the glass-transition temperature of the heat-sealing layer is increased adequately, the anti-sticking effect of the cover tape can be improved. If inorganic filler is added into the heat-sealing layer, the cover tape can be provided with an antistatic property and increased anti-sticking effect, but the haze value thereof is increased at the same time.
What is claimed is:

1. A heat-sealing film for packaging an electronic element, comprising:
   a base layer;
   at least one intermediate layer which is provided on the base layer and comprises a mixture comprising, in terms of 100% by weight of the total weight of the intermediate layer,
   5-70% by weight of a vinyl acetate copolymer, wherein the units derived from vinyl acetate comprises more than 10% by mole of the copolymer;
   20-90% by weight of a styrene-butadiene copolymer; and
   0-40% by weight of a conductive polymer; and
   at least a heat-sealing layer which is provided on the surface of the intermediate layer opposite to the base layer.

2. The heat-sealing film as claimed in claim 1, wherein the base layer is composed of a material selected from the group consisting of biaxial stretched polyesters, polyolefins or nylons.

3. The heat-sealing film as claimed in claim 1, wherein the base layer has a thickness of 10-30 µm.

4. The heat-sealing film as claimed in claim 1, wherein the base layer has an optical transmittance not less than 85%, and a tensile strength not less than 50 MPa.

5. The heat-sealing film as claimed in claim 1, wherein in the vinyl acetate copolymer, the units derived from vinyl acetate at least comprise 20% by mole of the copolymer.

6. The heat-sealing film as claimed in claim 1, wherein the styrene-butadiene copolymer is a block copolymer.

7. The heat-sealing film as claimed in any one of claims 1-6, wherein in the styrene-butadiene copolymer, the units derived from styrene comprise more than 60% by mole of the total unit number of the
copolymers.

8. The heat-sealing film as claimed in any one of claims 1-6, wherein the styrene-butadiene copolymer has a weight average molecular weight of 40,000-300,000.

9. The heat-sealing film as claimed in claim 1, wherein the vinyl acetate copolymer comprises 10-60% by weight of the total weight of the intermediate layer.

10. The heat-sealing film as claimed in claim 1, wherein the styrene-butadiene copolymer comprises 30-70% by weight of the total weight of the intermediate layer.

11. The heat-sealing film as claimed in claim 1, wherein the conductive polymer comprises 0-30% by weight of the total weight of the intermediate layer.

12. The heat-sealing film as claimed in claim 1, wherein the vinyl acetate copolymer is a copolymer of vinyl acetate and ethylene.

13. The heat-sealing film as claimed in claim 1, wherein the conductive polymer is selected from the group consisting of polyacetylene, polypyrrole, polythiophene, polyaniline, polyether amides-based or polyester amides-based intrinsic antistatic polymers, or combinations thereof.

14. The heat-sealing film as claimed in claim 1, wherein the intermediate layer has a thickness of 10~50 µm.

15. The heat-sealing film as claimed in claim 1, wherein the intermediate layer has a surface resistivity of $1 \times 10^6$-$1 \times 10^{14}$ ohm/□.

16. The heat-sealing film as claimed in claim 1, wherein the intermediate layer further contains a polyethylene comprising 10-60% by weight of the total weight of the intermediate layer.

17. The heat-sealing film as claimed in claim 16, wherein all of the polyethylene exists in the intermediate layer as a polyethylene sub-layer.

18. The heat-sealing film as claimed in claim 16, wherein the
Polyethylene has a weight average molecular weight of 100,000-1,000,000.

19. The heat-sealing film as claimed in claim 16, wherein the polyethylene has a melt index of 1-100 g/10 minutes.

20. The heat-sealing film as claimed in claim 16, wherein the polyethylene sub-layer has a thickness of 10-30 \( \mu m \).

21. The heat-sealing film as claimed in claim 1 or claim 16, wherein the heat-sealing layer is composed of a material selected from the group consisting of poly(meth)acrylates or copolymers thereof.

22. The heat-sealing film as claimed in claim 1 or claim 16, wherein the heat-sealing layer further contains a conductive filler with a content of no more than 60% in terms of the total weight of the whole heat-sealing layer.

23. The heat-sealing film as claimed in claim 22, wherein the heat-sealing layer has a thickness of 0.01-10 \( \mu m \).

24. The heat-sealing film as claimed in claim 22, wherein the heat-sealing layer has a surface resistivity of \( 1 \times 10^7 \) to \( 1 \times 10^{12} \) ohm/rf.

25. The heat-sealing film as claimed in claim 22, wherein the conductive filler is selected from the group consisting of nano-oxides, carbon nanotubes, carbon powders, metal powders, or mixtures thereof.

26. The heat-sealing film as claimed in claim 21, wherein the poly(meth)acrylate or poly(meth)acrylate copolymers have a glass transition temperature of 30-90°C.

27. The heat-sealing film as claimed in claim 21, wherein the poly(meth)acrylate or poly(meth)acrylate copolymers have a heat activation temperature of at least 90°C.

28. The heat-sealing film as claimed in claim 1 further comprising an adhesion layer situated between the intermediate layer and the base layer.

29. The heat-sealing film as claimed in claim 1 further comprising an antistatic coating which is located on the surface of the base layer.
opposite to the intermediate layer.

30. The heat-sealing film as claimed in claim 29, wherein the dry film of the antistatic coating has a thickness of 0.01-2 μη.

31. The heat-sealing film as claimed in claim 29, wherein the antistatic coating has a surface resistivity of $1 \times 10^6 \sim 1 \times 10^{12}$ ohm/D.

32. A cover tape for heat-sealing to a carrier tape that comprises an electronic element, the cover tape comprising:

   a base layer as defined in any one of claims 1-31;

   an intermediate layer disposed on the base layer for dissipating charge, as defined in any one of claims 1-31;

   a heat-sealing layer disposed on the intermediate layer, as defined in any one of claims 1-31; and

   an optional antistatic coating which is located on the surface of the base layer opposite to the intermediate layer, as defined in any one of claims 29-31,

   the cover tape having an average optical transmittance of at least 75%, an optical haze of no more than about 50%, and a surface resistivity of no more than about $1 \times 10^{11}$; such that when the cover tape is heat-sealed to a carrier tape to form an article, an average peel strength of the cover tape to the carrier tape is at least 20 gf/mm, the peel strength reducing by no more than about 10% when the article is subjected to a temperature of no less than about 50°C and a relative humidity of no less than about 90% for at least 5 days.
Fig. 1

Fig. 2

Fig. 3
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B32B27/-; B65D43/-; H05K/-; H01I/-

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

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

CNKI CNPAT WPI EPDOC: conduct+, electro+, heat+, thermal, seal, carrier tape, vinyl acetate, EVA, styrene butadiene

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<td>A</td>
<td>CN1277275C (DAINIPPON PRINTING CO., LTD.) 27 Sep. 2006 (27.09.2006), Fig. 1-3, description page 5 line 22 to page 8 line 18</td>
<td>1-32</td>
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<td>A</td>
<td>US5846652A (DAINIPPON PRINTING CO., LTD.) 08 Dec. 1998 (08.12.1998), the whole document</td>
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<td>A</td>
<td>US2005/0 192404A1 (DENKI KAGAKU KOGYO KK.) 01 Sep. 2005 (01.09.2005), the whole document</td>
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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search: 30 Aug. 2011 (30.08.2011)
Date of mailing of the international search report: 29 Sep. 2011 (29.09.2011)

Name and mailing address of the ISA/CN
The State Intellectual Property Office, the P.R. China
6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088
Facsimile No. 86-10-62019451

Form PCT/ISA/210 (second sheet) (July 2009)

Authorized officer: LINQYufei
Telephone No. (86-10) 62414074
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A. CLASSIFICATION OF SUBJECT MATTER

B32B27/00(2006.01)i;
B65D43/00(2006.01)i;
H05K7/00(2006.01)n;