

[Document Name] Specification

[Invention Title] CONDUCTIVE SHEET AND EMBOSSED CARRIER TAPE

[Technical Field]

[0001]

The present invention relates to a conductive sheet and an embossed carrier tape formed by embossing the conductive sheet, and particularly, to a conductive sheet and an embossed carrier tape used for mounting (also referred to as “packaging” or “housing”), storage, delivery, and the like of IC, LSI, and other electronic components.

[Background Art]

[0002]

Conventionally, for example, an embossed carrier tape is widely known as a container for mounting IC, LSI, and other electronic components, but the embossed carrier tape is formed by embossing a sheet made of a synthetic resin. Here, as a container for mounting electronic components, in order to prevent electrostatic damage to the electronic components to be mounted, a sheet having a certain conductivity or a sheet having an antistatic effect in the above-mentioned synthetic resin sheet is used. As a material for such a conductive sheet, a material in which carbon black is dispersed in a polystyrene-based resin is widely known, and hereinafter, Patent Documents 1 and 2 show conventional examples of a conductive sheet formed by dispersing carbon black in a polystyrene-based resin.

[0003]

Patent Document 1 discloses “a conductive composite plastic sheet which is a composite plastic sheet including (A-1) one or more thermoplastic resins selected from polyphenylene ether-based resins and polystyrene-based resins, (A-2) a sheet substrate which is incompatible

with the thermoplastic resin and includes one or more selected from thermoplastic resins and thermoplastic elastomers which have no styrene unit as a repeating unit, and a conductive resin layer formed on the surface of the sheet substrate, in which the sheet substrate includes a blend of 1 to 20 parts by mass of the component (A-2) with respect to 100 parts by mass of the component (A-1), the conductive resin layer is a layer formed of a conductive resin composition including one or more selected from (B) one or more thermoplastic resins selected from polyphenylene ether-based resins and polystyrene-based resins, (C) carbon black, and (D) thermoplastic elastomers, a thickness ratio between the sheet substrate and the conductive resin layer is in a range of 4/1 to 20/1, and a total thickness of the conductive composite plastic sheet is in a range of 0.1 to 1.0 mm" (see claim 1), as "a challenge to provide a conductive composite plastic sheet and a conductive plastic container in which when a sheet is slit, burrs or the like do not occur on a slit surface" (see paragraph [0006]).

[0004]

Further, Patent Document 2 discloses that "a sheet in which carbon black is simply dispersed in a polystyrene resin has a good antistatic effect, but its mechanical strength such as impact resistance and pocket strength when formed into an embossed carrier tape are insufficient" (see paragraph [0003]), and for the purpose of "providing a surface conductive composite plastic sheet having excellent pocket strength and formability when formed into an embossed carrier tape, even in the case of being processed into embossed carrier tapes of various shapes, by laminating a sheet substrate layer of a certain thermoplastic resin composition and a surface conductive layer having conductivity" (see paragraph [0004]), "a surface conductive composite plastic sheet formed by laminating a surface conductive layer on both surfaces of a sheet substrate layer including a thermoplastic resin which is a polystyrene-based resin and/or an

ABS-based resin or a polymer alloy thereof, in which a surface resistance value is $1 \times 10^3 \Omega/\square$ or more and less than $1 \times 10^{10} \Omega/\square$, a tensile modulus of the sheet substrate layer is 1350 MPa or less, the tensile modulus of the surface conductive layer is larger than that of the tensile modulus of the sheet substrate layer, and a pocket strength is 93.3 N or more" (see claim 1).

[Prior Art Document]

[Patent Document]

[0005]

[Patent Document 1] JP 2004-255774 A

[Patent Document 2] JP 4047659

[Summary of the Invention]

[Problem to be Solved by the Invention]

[0006]

Here, there is a problem that when electronic components are mounted on an embossed carrier tape formed by embossing a conductive sheet in which carbon black is dispersed in polystyrene-based resin, carbon black on the surface thereof falls off and the electronic components are contaminated, due to rubbing between the electronic components and a surface portion of a side wall or a bottom of an embossing pocket with which the electronic components come into contact. However, the above-described Patent Document 1 and Patent Document 2 do not disclose the problem of falling-off of carbon black and its solution, at all.

[0007]

Further, when simply trying to solve only reduction of falling-off of carbon black, there is a concern about occurrence of side effects such as deterioration of physical properties of an embossed carrier tape formed by processing a conductive sheet, for example, buckling strength,

which is an important parameter for physical properties. In addition, buckling strength is generally tested in a state in which the conductive sheet is processed and formed into an embossed carrier tape, and falling-off of carbon black is tested in a state of an embossed carrier tape or in a state of a conductive sheet.

[0008]

Further, in a conductive sheet formed by laminating a substrate layer and a surface layer having conductivity, including the inventions described in Patent Document 1 and Patent Document 2, a resin used in the substrate layer and a resin used in the surface layer are used by combining a plurality of kinds of resins, respectively, and the kinds and blending ratios of the resins to be combined are generally different between the substrate layer and the surface layer, but when the kinds and blending ratios of the resins to be combined are different, there is a concern that manufacturing process management and quality management are complicated and it is difficult to reduce a manufacturing cost.

[0009]

Therefore, it is an object of the present invention to provide a conductive sheet and an embossed carrier tape which can reduce falling-off of carbon black and prevent deterioration of buckling strength.

[0010]

Further, it is another object of the present invention to provide a conductive sheet and an embossed carrier tape formed by using common materials having the common kinds and blending ratios of a combination of resins (in particular, polystyrene-based resins) used in a core layer (substrate layer) and a surface layer having conductivity.

[Means for Solving the Problem]

[0011]

In order to achieve the above objects, the invention described in claim 1 is characterized by a conductive sheet for an embossed carrier tape to mount an electronic component, wherein the conductive sheet includes a surface layer having conductivity laminated on at least one surface of a core layer, each of the core layer and the surface layer includes common materials formed of only a combination of three kinds of polystyrene-based resins of a styrene-butadiene copolymer resin, a general-purpose polystyrene resin, and an impact-resistant polystyrene resin, the common materials forming the core layer and the common materials forming the surface layer have the same blending ratio, the surface layer is formed by kneading carbon black with the common materials, and the blending ratios of the common materials are 35% by weight of the styrene-butadiene copolymer resin and 10% by weight to 15% by weight of the impact-resistant polystyrene resin, when a total amount of the common materials is 100% by weight.

[0012]

Further, the invention of claim 2 is characterized by a conductive sheet for an embossed carrier tape to mount an electronic component, wherein the conductive sheet includes a surface layer having conductivity laminated on at least one surface of a core layer, each of the core layer and the surface layer includes common materials formed of only a combination of three kinds of polystyrene-based resins of a styrene-butadiene copolymer resin, a general-purpose polystyrene resin, and an impact-resistant polystyrene resin, the common materials forming the core layer and the common materials forming the surface layer have the same blending ratio, the surface layer is formed by kneading carbon black with the common materials, and the blending ratios of the common materials are 35% by weight of the styrene-butadiene copolymer resin, 10% by weight to 15% by weight of the impact-resistant polystyrene resin, and 50% by

weight to 55% by weight of the general-purpose polystyrene resin, when a total amount the common materials is 100% by weight.

[0013]

Further, the invention described in claim 3 is characterized by an embossed carrier tape obtained by processing and forming an embossed pocket on the conductive sheet of claim 1 or 2.

[Effect of the Invention]

[0014]

When the conductive sheet and the embossed carrier tape of the present invention are used as a container for mounting an electronic component and the like, the conductive sheet and the embossed carrier tape have a significant effect of significantly reducing falling-off of carbon black and avoiding deterioration of buckling strength.

[0015]

Further, according to the conductive sheet and the embossed carrier tape of the present invention, since the combination of the kinds of resins used in the core layer and the combination of the kinds of resins used in the surface layer having conductivity are common and the blending ratios thereof are also common, the conductive sheet and the embossed carrier tape have a significant effect of simplifying manufacturing process management and quality management and reducing a manufacturing cost.

[Brief Description of Drawings]

[0016]

[FIG. 1] FIG. 1 shows evaluation results of carbon falling-off on a slit surface (a cut surface of a conductive sheet) of an embossed carrier tape.

[FIG. 2] FIG. 2 is comparison results of an opened state of a sprocket hole opened on an

embossed carrier tape.

[Best Mode for Carrying Out the Invention]

[0017]

Hereinafter, the present invention will be described in more detail, using preferred embodiments. However, the following embodiments are merely examples of embodying the present invention, and the present invention is not limited thereto.

[0018]

The conductive sheet of the present invention is formed by laminating a core layer (also referred to as a “substrate layer”) and a surface layer (also referred to as a “conductive layer”). The surface layer may be laminated on one surface or both surfaces of the core layer. In the present invention, a plurality of polystyrene-based resins are used in combination, but a combination of the kinds of polystyrene-based resins used in the core layer and a combination of the kinds of polystyrene-based resins used in the surface layer are made common, and the combination of polystyrene-based resins used in common is defined as common materials. It is because changing the kinds of materials used in the core layer and the surface layer may cause the quality management of materials to be complex, the manufacturing cost to be increased, and the like. Therefore, the applicant of the present application conducted a study so that common materials and common blending ratios of the core layer and the surface layer can be used as much as possible. As a result, it has been found that a combination of a styrene-butadiene copolymer resin, a general-purpose polystyrene resin (also referred to as “GPPS”), and an impact-resistant polystyrene resin (also referred to as “HIPS”) is used as common materials. Each of the styrene-butadiene copolymer resin, the general-purpose polystyrene resin, and the impact-resistant polystyrene resin is a known material, but the applicant of the

present invention implemented that in an embossed carrier tape formed by processing a conductive sheet, falling-off of carbon black is reduced and simultaneously, buckling strength is not deteriorated, by combining the three materials and optimizing blending ratios of the common materials. In addition, it is known that the styrene-butadiene copolymer resin and the impact-resistant polystyrene resin have a rubber component, and the general-purpose polystyrene resin has no rubber component.

[0019]

First, the surface layer will be described. The surface layer is formed by kneading carbon black with the common materials, that is, there are only a total of four kinds of materials used in the surface layer, which are three kinds, a styrene-butadiene copolymer resin, a general-purpose polystyrene resin, and an impact-resistant polystyrene resin as the common materials, and one kind, carbon black. Carbon black is one selected from those widely known as a conductive filler such as furnace black, channel black, acetylene black, and Ketjen black. As carbon black of the present invention, so-called micro carbon having a particle diameter of 20 to 50 nm is used. In the present invention, by selecting these three kinds of polystyrene-based resins as common materials, reduction of falling-off of carbon black can be implemented in the conductive sheet and the embossed carrier tape formed by adding carbon black.

[0020]

In the present invention, blending ratios of a styrene-butadiene copolymer resin, a general-purpose polystyrene resin (also referred to as "GPPS"), and an impact-resistant polystyrene resin (also referred to as "HIPS") were individually evaluated and examined in the core layer and the surface layer. First, the first object of the present invention is to reduce falling-off of carbon black from the conductive sheet. In addition, if the falling-off of carbon black from the

conductive sheet can be reduced, falling-off of carbon black from the embossed carrier tape formed by embossing the conductive sheet can also be reduced. In order to achieve the object, the applicant of the present application conducted extensive research, and first focused on using a styrene-butadiene copolymer resin, a general-purpose polystyrene resin (also referred to as "GPPS"), and an impact-resistant polystyrene resin (also referred to as "HIPS"), as a combination of polystyrene resins. Then, the applicant of the present application realized reduction in carbon falling-off of a conductive sheet which is formed by kneading carbon black with common materials having blending ratios of 35% by weight of a styrene-butadiene copolymer resin and 15% by weight or less of an impact-resistant polystyrene resin, when a total amount of the common materials (sum of the styrene-butadiene copolymer resin, the general-purpose polystyrene resin, and the impact-resistant polystyrene resin) is 100% by weight, to form a surface layer, and laminating the surface layer and a core layer formed of the above-described common material. In addition, when the conductive sheet is formed, when a total amount of the surface layer is 100% by weight, about 10% by weight of carbon black is added and kneaded, and thus, the blending ratios of the common materials in the state of the conductive sheet are expressed as 90% of the numerical values, that is, in the surface layer, 10% by weight of carbon black, 31.5% by weight of the styrene-butadiene copolymer resin, and 13.5% by weight or less of the impact-resistant polystyrene resin, respectively. As a result, it can be said that even in the case in which the impact-resistant polystyrene resin is not included (0% by weight), the effect of reducing carbon falling-off can be achieved.

[0021]

Next, the core layer will be described. In addition to the above-described examination results of the common materials of the surface layer, considering the purpose of using the kinds

and blending ratios of resins used in the surface layer and the core layer, as for the blending ratios of the common materials of the core layer having no carbon black added, first, when a total amount of the common materials (sum of the styrene-butadiene copolymer resin, the general-purpose polystyrene resin, and the impact-resistant polystyrene resin) is 100% by weight, the blending ratios thereof may be 35% by weight of a styrene-butadiene copolymer resin and 15% by weight or less of an impact-resistant polystyrene resin.

[0022]

However, if the common materials of the core layer are only the styrene-butadiene copolymer resin and the general-purpose polystyrene resin, when the core layer is hardened and the conductive sheet is embossed to form an embossed pocket of an embossed carrier tape, the thickness of a side wall of the embossed pocket becomes non-uniform and portions where the thickness of a side wall is small occur. When the side wall of the embossed pocket becomes thin, there occurs a problem that buckling strength deteriorates. That is, in order for the embossed carrier tape to maintain a certain buckling strength, it is necessary to add an impact-resistant polystyrene resin containing a rubber component so that the embossed carrier tape (conductive sheet) exhibits a certain softness. On the other hand, if the embossed carrier tape is excessively soft, the buckling strength naturally deteriorates.

[0023]

Therefore, as a result of extensive study by the applicant of the present application, it has been found that in order to prevent deterioration of the buckling strength of the embossed carrier tape, in the blending ratios of the common materials of the core layer, when a total amount of the common materials (sum of the styrene-butadiene copolymer resin, the general-purpose polystyrene resin, and the impact-resistant polystyrene resin) is 100% by weight and

the styrene-butadiene copolymer resin is 35% by weight, the impact-resistant polymer is required to be 10% by weight to 20% by weight. When the impact-resistant polystyrene resin is less than 10% by weight, the core layer is hardened so that the buckling strength of the embossed carrier tape is deteriorated as described above, and when the impact-resistant polystyrene resin is more than 20% by weight, the core layer is softened (that is, the side wall of the embossed pocket is softened) so that the buckling strength of the embossed carrier tape is deteriorated. In general, since the general-purpose polystyrene resin does not contain a rubber component, it is very hard, and since the styrene-butadiene copolymer resin and the impact-resistant polystyrene resin contain a rubber component, they are soft, but since a molecular diameter of the styrene-butadiene copolymer resin is much smaller than a molecular diameter of the impact-resistant polystyrene resin, it is known that the styrene-butadiene copolymer resin is softer than the impact-resistant polystyrene resin.

[0024]

That is, when the total amount of the common materials is 100% by weight, and the blending ratios of the three polystyrene-based resins included in the common materials are 35% by weight of the styrene-butadiene copolymer resin and 10% by weight to 15% by weight of the impact-resistant polystyrene resin, preferably 35% by weight of the styrene-butadiene copolymer resin, 10% by weight to 15% by weight of the impact-resistant polystyrene resin, and 50% by weight to 55% by weight of the general-purpose polystyrene resin, then a conductive sheet and an embossed carrier tape in which falling-off of carbon black is reduced and buckling strength is not deteriorated, even when forming the core layer and the styrene-butadiene copolymer resin at the same blending ratios, can be prepared. In addition, as described above, in order to have conductivity in the surface layer, 10% by weight of carbon black is added,

when a total amount of the surface layer is 100% by weight. At this time, since the total of the common materials increases with the addition of the weight of carbon black, the above-described preferred example as the blending ratios of the common materials is expressed as 31.5% by weight of the styrene-butadiene copolymer resin, 9% by weight to 13.5% by weight of the impact-resistant polystyrene resin, and 45% by weight to 49.5% by weight of the general-purpose polystyrene resin.

[0025]

As such, in the core layer and the surface layer of the conductive sheet, the kinds of the combination of a plurality of polystyrene-based resins to be used are made common and are common materials, and the blending ratios of the common materials are optimized and made common to the core layer and the surface layer, thereby reducing carbon falling-off from the conductive sheet and not reducing buckling strength of the embossed carrier tape.

[Examples]

[0026]

As an example, an example in which a surface layer having a thickness of 0.01 mm was laminated on both surfaces of a core layer having a thickness of 0.38 mm, to form a conductive sheet having a thickness of 0.4 mm, is shown. As common materials, a styrene-butadiene copolymer resin, a general-purpose polystyrene resin, and an impact-resistant polystyrene resin were used. Each resin of the common materials was pelletized, these were kneaded with a mixer to form a conductive sheet using a known device such as a twin-screw extruder. In the surface layer, carbon black was added to the common material. The formed conductive sheet was cut into a predetermined width after being once wound, heated at a predetermined temperature, and pressed with upper and lower molds to form an embossed pocket, sprocket

holes were opened, and finally winding around a reel was performed. In molding of the embossed pocket, there are a pneumatic method, a vacuum rotary method, and the like, in addition to the pressing method of the present example, and these are all well-known techniques.

[0027]

Table 1 shows blending ratios of the common materials and evaluation results of falling-off of carbon black. Evaluation of falling-off of carbon black was performed by pressing a cotton cloth against a plurality of conductive sheets cut into 24 mm×250 mm with a weight of 200 g, 300 times and 500 times reciprocally, and then reading carbon black attached to the cotton cloth with a scanner, using a personal computer to perform black and white binarization processing, and counting the number of black dots, in accordance with the standards of dyeing fastness test method (JIS L-0849), using a general tester of dyeing fastness to rubbing. A greater number of black dots counted shows that more carbon black fell off. This test may be also referred to as an academic wave abrasion test.

[0028]

Table 1 shows that evaluation of falling-off of carbon black was performed for three conductive sheets having different blending ratios of the common materials. In Table 1, in Reference Example 1, the blending ratios of common materials of a surface layer are, when the common materials are 100% by weight, 35% by weight of a styrene-butadiene copolymer resin, 20% by weight of an impact-resistant polystyrene resin, and 45% by weight of a general-purpose polystyrene resin, in Example 1, the blending ratios of the common materials of the surface layer are, when the common materials are 100% by weight, 35% by weight of the styrene-butadiene copolymer resin, 15% by weight of the impact-resistant polystyrene resin,

and 50% by weight of the general-purpose styrene resin, and in Example 2, the blending ratios of the common materials of the surface layer are, when the common materials of the surface layer 3 are 100% by weight, 35% by weight of the styrene-butadiene copolymer resin, 0% by weight of the impact-resistant polystyrene resin, and 65% by weight of the general-purpose polystyrene resin. In addition, in the surface layer, when a total amount of the surface layer is 100% by weight, 10% by weight of carbon black is added to the common materials, and thus, the % by weight of each polystyrene-based resin forming the common materials is converted into a value by multiplying each by 0.9, in terms of the surface layer. In addition, the core layer has the blending ratios having the same values as the common materials of the surface layer. Table 5 shows each of % by weight (wt%) and parts by weight indications of each of the common materials (same as the core layer), the surface layer (carbon black was added to the common materials).

[0029]

As shown in Table 1, after reciprocating 500 times, the number of black dots was counted as 1184 in Reference Example 1, 770 in Example 1, and 15 in Example 2. Here, the applicant of the present application confirmed that a degree of falling-off of carbon black was good in an embossed carrier tape formed of a conductive sheet in which the number of black dots was 1000 or less after reciprocating 500 times. Therefore, according to the present examples, it can be said that when the blending ratios of the common materials are 35% by weight of the styrene-butadiene copolymer resin and 15% by weight or less of the impact-resistant polystyrene resin, falling-off of carbon black is reduced.

[0030]

Table 1 shows evaluation of carbon falling-off from the surface of the conductive sheet

(corresponding to the surface of the embossed carrier tape), but FIG. 1 shows evaluation results of carbon falling-off on a slit surface of the embossed carrier tape (a cut surface of the conductive sheet). Carbon falling-off was confirmed and evaluated by rubbing a waste cloth against a slit surface of the embossed carrier tape and magnifying a degree of carbon transfer to the waste cloth with a microscope at 500 times. As shown in FIG. 1, for the initial state of the waste cloth, almost no carbon transfer was seen in Example 1, while carbon transfer was seen in Comparative Examples 1 to 3. Comparative Examples 1 to 3 were commercially available products having the same sheet thickness, sheet width, embossed carrier tape size, pocket size, pocket pitch, and the like as Example 1.

[0031]

Further, the buckling strength of the embossed carrier tape formed by embossing the conductive sheet was tested. As the test device, a commercially available force gauge (also referred to as “push pull gauge”) was used. Similarly to the evaluation of falling-off of carbon black, as a result of performing a buckling strength test of the embossed carrier tape formed by the conductive sheet in which the styrene-butadiene copolymer resin was 35% by weight and the blending ratios of the impact-resistant polystyrene resin and the general-purpose polystyrene resin were changed, it was confirmed that the impact-resistant polystyrene resin was good in the range of 10% by weight to 20% by weight. At this time, the general-purpose polystyrene resin was 45% by weight to 55% by weight. As an example, when a total amount of the common materials of the core layer is 100% by weight, the styrene-butadiene copolymer resin is 35% by weight, the impact-resistant polystyrene resin is 15% by weight, and the general-purpose polystyrene resin is 50% by weight. In the surface layer, when a total amount of the surface layer is 100% by weight, 10% by weight of carbon black is added to the common

material.

[0032]

From this result, if the core layer and the surface layer are formed of common materials formed of a combination of the same kinds of resins at the same blending ratios, when the resins forming the common materials are a combination of only three polystyrene-based resins of a styrene-butadiene copolymer resin, an impact-resistant polystyrene resin, and a general-purpose polystyrene resin and a total amount of the common materials is 100% by weight, the styrene-butadiene copolymer resin is 35% by weight, the impact-resistant polystyrene resin is 10% by weight to 15% by weight, and the general-purpose polystyrene resin is 50% by weight to 55% by weight, then significant effects that falling-off of carbon black from the conductive sheet and the embossed carrier tape is reduced, and the buckling strength of the embossed carrier tape is not deteriorated, can be achieved.

[0033]

Table 2 is comparison results of buckling strength. Though the appearance of the front and back are all not different in Comparative Example 1, Comparative Example 2, and Example 1, the buckling strength of Example 1 is better than that of Comparative Example 1 and Comparative Example 2.

[0034]

Table 3 shows the evaluation results of the physical properties other than the buckling strength of the conductive sheet of the present invention. Table 3 shows the test results for a tensile yield strength, a tensile fracture strength, a tensile fracture elongation, and a tear strength of the conductive sheet with respect to the sheet thickness. For the conductive sheet thickness of 0.3 mm to 0.5 mm, the physical properties of all items clear the standard setting line.

In addition, the thickness of the surface layer is 0.01 mm on one side and 0.02 mm on both sides, regardless of the thickness of the conductive sheet. The case of the sheet thickness of 0.4 mm (the core layer thickness of 0.38 mm, the both surface layer thickness of 0.02 mm) corresponds to Example 1.

[0035]

Table 4 shows comparison results for the sheet thickness of 0.4 mm, that is, Example 1. As shown in Table 4, for the items of a tensile strength yield point, a tensile breaking strength, and a tear strength, Example 1 is better than Comparative Examples 1 to 3, and for other items, the characteristics of Example 1 and Comparative Examples 1 to 3 are equivalent.

[0036]

FIG. 2 is comparison results of an opened state of a sprocket hole opened on an embossed carrier tape. In Comparative Example 1, crown-shaped burrs occur, and in Comparative Example 3, fibrous burrs occur, but Example 1 is in a good state.

[0037]

[Table 1]

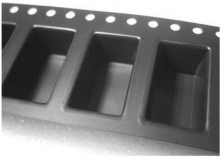
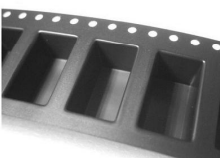
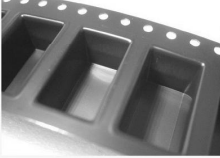
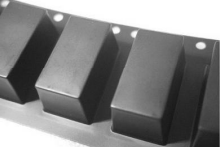
Evaluation results of falling-off of carbon black
(Measurement results of black dots after binarizing test of fastness to rubbing)

	Kind of resins	Blending ratios of common materials (wt%)	Number of dots after reciprocating 500 times	Number of dots after reciprocating 300 times
Reference Example 1	Styrene-butadiene copolymer resin	35	1184	477
	General-purpose polystyrene resin	45		
	Impact-resistant polystyrene resin	20		
Example 1	Styrene-butadiene copolymer resin	35	770	252
	General-purpose polystyrene resin	50		
	Impact-resistant polystyrene resin	15		
Example 2	Styrene-butadiene copolymer resin	35	15	6
	General-purpose polystyrene resin	65		
	Impact-resistant polystyrene	0		

[0038]

[Table 2]

Comparison results of buckling strength

Item		Comparative Example 1	Comparative Example 2	Example 1
Appearance	Front			
	Back			
Buckling strength	kg	1.43	1.27	1.51

[0039]

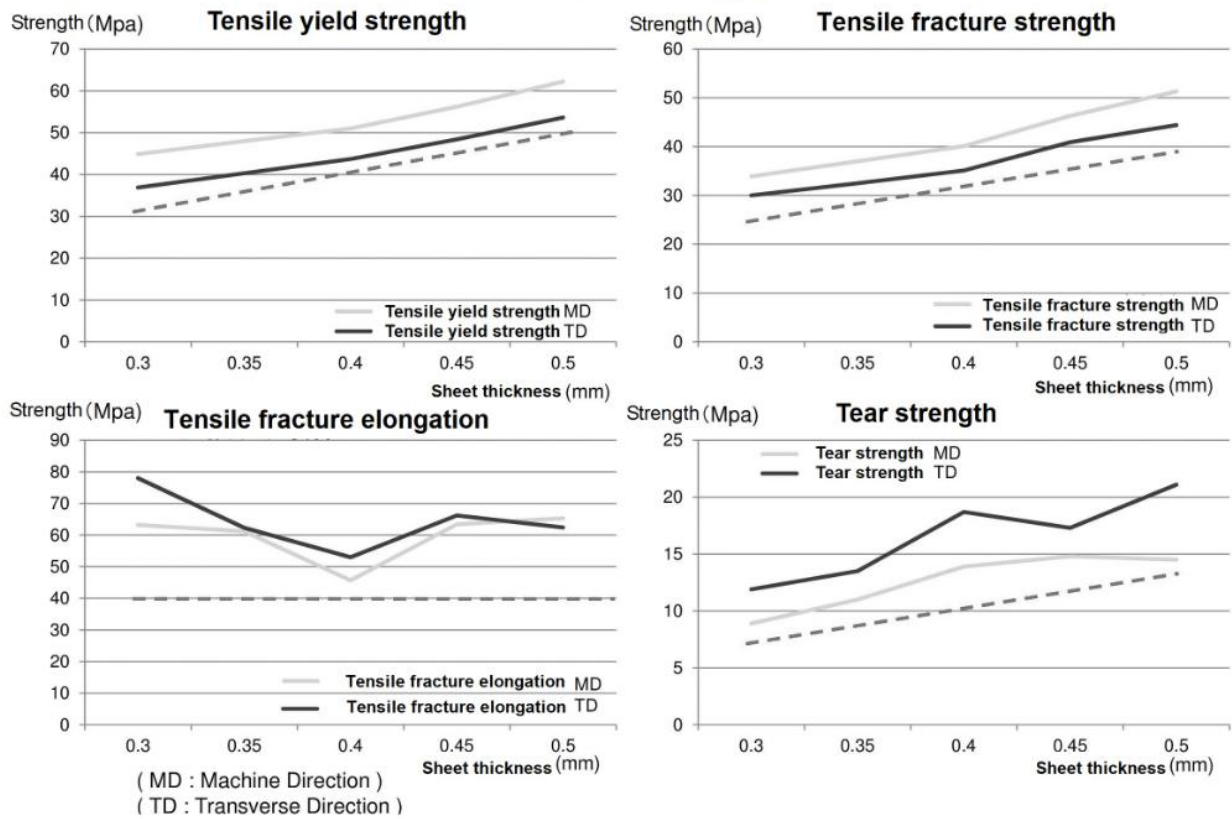
[Table 3]

**Test results of physical properties
of conductive sheet**

Sheet thickness and standard value setting

--- Standard setting line

JISK7127



[0040]

[Table 4]

Comparison results of physical properties Thickness of 0.4 mm

Item	Unit	Comparative Example 1	Comparative Example 2	Comparative Example 3	Example 1
Single layer/ multi layer	—	Two kinds, three layers	Two kinds, three layers	Two kinds, three layers	Two kinds, three layers
Surface layer	—	Conductive PS resin	Conductive PS resin	Conductive PS resin	Conductive PS resin
Core layer	—	PS resin	PS resin	PS resin	PS resin
Surface resistance value	Ω	10^6	$10^{5\sim6}$	$10^{4\sim6}$	$10^{5\sim6}$
Tensile strength yield point	MPa	26~28	18~23	23.3	42~51 (2 times)
Tensile breaking strength	MPa	19~24	20~25	20.8	34~42 (1.5 times)
Elongation at break	%	63.8~66.4	65~67	65.3	55~66
Tear strength	MPa	4.1~7.3	4~6.6	5.3~6.6	14~20 (2 times)

PS: polysilicon

[0041]

[Table 5]

% by weight indication and parts by weight indication

	Kinds	% by weight (wt%) indication		Parts by weight indication	
		Common materials/ core layer	Surface layer	Common materials/ core layer	Surface layer
Reference Example 1	Carbon black	0	10	0	32
	Styrene-butadiene copolymer resin	35	31.5	100	100
	General-purpose polystyrene resin	45	40.5	129	129
	Impact-resistant polystyrene resin	20	18	57	57
	Total	100	100	286	318
Example 1	Carbon black	0	10	0	32
	Styrene-butadiene copolymer resin	35	31.5	100	100
	General-purpose polystyrene resin	50	45	143	143
	Impact-resistant polystyrene resin	15	13.5	43	43
	Total	100	100	286	318
Example 2	Carbon black	0	10	0	32
	Styrene-butadiene copolymer resin	35	31.5	100	100
	General-purpose polystyrene resin	65	58.5	186	186
	Impact-resistant polystyrene resin	0	0	0	0
	Total	100	100	286	318

[Document Name] Claims

[Claim 1]

A conductive sheet for an embossed carrier tape to mount an electronic component, wherein the conductive sheet is formed by laminating a surface layer having conductivity on at least one surface of a core layer,

each of the core layer and the surface layer includes common materials formed of only a combination of three polystyrene-based resins of a styrene-butadiene copolymer resin, a general-purpose polystyrene resin, and an impact-resistant polystyrene resin,

the common materials forming the core layer and the common materials forming the surface layer have the same blending ratios,

the surface layer is formed by kneading carbon black with the common materials, and

the blending ratios of the common materials are, when a total amount of the common materials is 100% by weight, 35% by weight of the styrene-butadiene copolymer resin and 10% by weight to 15% by weight of the impact-resistant polystyrene resin.

[Claim 2]

A conductive sheet for an embossed carrier tape to mount an electronic component, wherein the conductive sheet is formed by laminating a surface layer having conductivity on at least one surface of a core layer,

each of the core layer and the surface layer includes common materials formed of only a combination of three polystyrene-based resins of a styrene-butadiene copolymer resin, a general-purpose polystyrene resin, and an impact-resistant polystyrene resin,

the common materials forming the core layer and the common materials forming the surface layer have the same blending ratios,

the surface layer is formed by kneading carbon black with the common materials, and the blending ratios of the common materials are, when a total amount of the common materials is 100% by weight, 35% by weight of the styrene-butadiene copolymer resin, 10% by weight to 15% by weight of the impact-resistant polystyrene resin, and 50% by weight to 55% by weight of the general-purpose polystyrene resin.

[Claim 3]

An embossed carrier tape obtained by processing and forming an embossed pocket on the conductive sheet of claim 1 or 2.