

DESCRIPTION

TITLE OF THE INVENTION: SEPARATOR-ATTACHED RESIN SHEET GROUP
FOR SEALING ELECTRONIC DEVICE, AND METHOD FOR SELECTING
SEPARATOR-ATTACHED RESIN SHEET FOR SEALING ELECTRONIC DEVICE

TECHNICAL FIELD

[0001]

The present invention relates to a separator-attached resin sheet group for sealing electronic device, and a method for selecting a separator-attached resin sheet for sealing electronic device.

BACKGROUND ART

[0002]

As a method for producing an electronic device package, known has been hitherto a method of sealing one or more electronic devices fixed onto, e.g., a substrate with a sealing resin. As the sealing resin, for example, a resin sheet is known (see, for example, Patent Document 1).

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0003]

Patent Document 1: JP-A-2006-19714

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004]

In factories for producing electronic device packages, resin sheets of many sorts or thicknesses are used. However, the resin sheets are generally black so that their external appearances resemble each other even when the sheets are different from each other in sort or thickness. Thus, it is difficult to select a resin sheet of a desired sort or thickness based on the external appearances. A mistake of the resin sheet selection may be caused.

[0005]

Usually, separators are laminated onto both surfaces of a resin sheet. However, the two separators are equivalent in external appearance to each other, so that it may not be easily distinguished which of the separators should be peeled off.

[0006]

An object of the present invention is to solve the problem, and to provide a separator-attached resin sheet group for sealing electronic device from which a desired resin sheet can be easily selected, and a method for selecting a separator-attached resin sheet for sealing electronic device.

MEANS FOR SOLVING THE PROBLEMS

[0007]

A first aspect of the present invention relates to a separator-attached resin sheet group for sealing electronic device, wherein separators are classified by using colors according to thickness or sort of resin sheets for sealing electronic device. In other words, the separator-attached resin sheet group for sealing electronic device of the first aspect comprises a plurality of separator-attached resin sheets, in which each of the separator-attached resin sheets has a separator and a resin sheet for sealing electronic device arranged over the separator, and the separator has a color in accordance with the thickness or sort of the resin sheet for sealing electronic device arranged over the separator.

[0008]

In the separator-attached resin sheet group for sealing electronic device of the first aspect, the separators are classified using their colors according to the thickness or sort of the resin sheets for sealing electronic device. Accordingly, any worker can easily select a desired separator-attached resin sheet for sealing electronic device based on the colors. Thus, selection mistakes can be decreased.

[0009]

In the separator-attached resin sheet group for sealing electronic device of the first aspect, the separators are classified using their colors, so that the resin sheets do not need to be classified using any colorant. In other words, a

colorant does not need to be incorporated into the resin sheets, and no consideration needs to be given to any effect onto electronic devices by a colorant in the resin sheets. Thus, the resin sheets are easily designed.

[0010]

The first aspect of the invention also relates to a method for selecting a separator-attached resin sheet for sealing electronic device, the method comprising the steps of: providing a separator-attached resin sheet group for sealing electronic device in which separators are classified by using colors according to the thickness or sort of resin sheets for sealing electronic device; and selecting a separator-attached resin sheet for sealing electronic device from the separator-attached resin sheet group for sealing electronic device based on the respective colors of the sheets.

[0011]

A second aspect of the present invention is a separator-attached resin sheet group for sealing electronic device, comprising a plurality of separator-attached resin sheets for sealing electronic device to which marks are attached, the marks being in accordance with the thickness or sort of the resin sheets for sealing electronic device. In other words, the separator-attached resin sheet group for sealing electronic device of the second aspect comprises a plurality of separator-attached resin sheets, in which each of the

separator-attached resin sheets has a separator and an resin sheet for sealing electronic device arranged over the separator, and the separator has a mark in accordance with the thickness or sort of the resin sheet for sealing electronic device arranged over the separator.

[0012]

The separator-attached resin sheet group for sealing electronic device of the second aspect comprises the plurality of separator-attached resin sheets for sealing electronic device having the mark-attached separators, the marks being in accordance with the thickness or sort of the resin sheets for sealing electronic device, so that any worker can easily select a desired separator-attached resin sheet for sealing electronic device based on the marks. Thus, selection mistakes can be decreased.

[0013]

In the separator-attached resin sheet group for sealing electronic device of the second aspect, the marks in accordance with the thickness or sort are attached to the separators, so that the resin sheets do not need to be classified using any colorant. In other words, a colorant does not need to be incorporated into the resin sheets, and no consideration needs to be given to any effect onto electronic devices by a colorant in the resin sheets. Thus, the resin sheets are easily designed.

[0014]

The second aspect of the invention also relates to a method for selecting a separator-attached resin sheet for sealing electronic device , the method comprising the steps of: providing a separator-attached resin sheet group for sealing electronic device comprising a plurality of separator-attached resin sheets for sealing electronic device to which marks are attached, the marks being in accordance with the thickness or sort of the resin sheets for sealing electronic device; and selecting a separator-attached resin sheet for sealing electronic device from the separator-attached resin sheet group for sealing electronic device based on the marks.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a schematic sectional view of a separator-attached resin sheet constituting a separator-attached resin sheet group.

Fig. 2 is a view schematically illustrating a situation that electronic devices are sealed with a resin sheet.

Fig. 3 is a view schematically illustrating a situation that an electronic device package is diced.

Fig. 4 is a view schematically illustrating a situation that electronic devices are sealed with a resin sheet.

Fig. 5 is a view schematically illustrating a situation

that a pressure-sensitive adhesive sheet is peeled off from a sealed body.

Fig. 6 is a view schematically illustrating a cross section of the sealed body after the body is polished.

Fig. 7 is a view schematically illustrating a situation that re-wiring and bumps are formed onto the sealed body.

Fig. 8 is a view schematically illustrating a situation that the sealed body is diced.

MODE FOR CARRYING OUT THE INVENTION

[0016]

Hereinafter, the present invention will be described in detail by way of embodiments thereof. However, the invention is not limited only to the embodiments.

[0017]

[First Aspect of the Invention]

(Embodiment 1)

A separator-attached resin sheet group 101 is composed of separator-attached resin sheets the number of which is n (n is an integer of 2 or more). The separator-attached resin sheet group 101 is composed of the separator-attached resin sheets 1 to n .

[0018]

Fig. 1 is a schematic sectional view of the separator-attached resin sheets 1 to 3, which constitute the

separator-attached resin sheet group 101. The separator-attached resin sheet 1 has a first separator 1-a, a resin sheet 1-b arranged on the first separator 1-a, and a second separator 1-c arranged on the resin sheet 1-b. In other words, the separator-attached resin sheet 1 has a structure in which the first separator 1-a, the resin sheet 1-b and the second separator 1-c are laminated from above. The separator-attached resin sheet 2 has a first separator 2-a, a resin sheet 2-b arranged on the first separator 2-a, and a second separator 2-c arranged on the resin sheet 2-b. In other words, the separator-attached resin sheet 2 has a structure in which the first separator 2-a, the resin sheet 2-b and the second separator 2-c are laminated from above. In the same manner as in the separator-attached resin sheet 1, the separator-attached resin sheets 3 to n are each a structure in which a first separator, a resin sheet and a second separator are laminated from the above. The resin sheets of the separator-attached resin sheets 1 to n are usually black.

[0019]

The separator-attached resin sheets 1 to n each have the first separator that is a separator having a color according to the thickness of the resin sheet. Accordingly, when a worker searches, for example, the separator-attached resin sheet for sealing electronic device 1, the worker can easily select the separator-attached resin sheet 1 by paying attention to the

color of the first separator 1-a.

[0020]

The respective colors of the second separators in the separator-attached resin sheets 1 to n are not particularly limited.

[0021]

Example of the classification of the separator-attached resin sheets 1 to n using the colors thereof are described in Table 1 below as examples.

[0022]

[Table 1]

(Resin sheet group 101)

		Example 1	Example 2	Example 3	Example 4	Example 5
Separator-attached resin sheet 1	Thickness (μm) of resin sheet 1-b	200	200	200	200	200
	Color of first separator 1-a	White	Transparent and colorless	White	White	White
	Color of second separator 1-c	Transparent and colorless	Transparent and colorless	White	Gray	Transparent and colorless
Separator-attached resin sheet 2	Thickness (μm) of resin sheet 2-b	150	150	150	150	200
	Color of first separator 2-a	Yellow	Yellow	Yellow	Yellow	White
	Color of second separator 2-c	Transparent and colorless	Transparent and colorless	Yellow	Gray	Transparent and colorless
Separator-attached resin sheet 3	Thickness (μm) of resin sheet 3-b	100	100	100	100	100
	Color of first separator 3-a	Red	Red	Red	Red	Red
	Color of second separator 3-c	Transparent and colorless	Transparent and colorless	Red	Gray	Transparent and colorless

[0023]

In Example 1 and Examples 3 to 5, the color corresponding

to a resin sheet thickness of 200 μm is white; the color corresponding to a resin sheet thickness of 150 μm is yellow; and the color corresponding to a resin sheet thickness of 100 μm is red.

[0024]

In Example 2, the color corresponding to a resin sheet thickness of 200 μm is transparent and colorless; the color corresponding to a resin sheet thickness of 150 μm is yellow; and the color corresponding to a resin sheet thickness of 100 μm is red.

[0025]

In each of Example 1, and Examples 4 and 5, the respective second separators of the separator-attached resin sheets 1 to n are consistent with each other in color. Thus, a worker can easily distinguish the first and second separators from each other.

[0026]

In Example 3, the color of the first separator in each of the separator-attached resin sheets 1 to n is the same as that of the second separator.

[0027]

The first separator of each of the separator-attached resin sheets 1 to n may be, for example, a plastic substrate such as a plastic sheet; a rubbery substrate such as a rubber sheet; a foam substrate such as a foamed sheet; a metallic

substrate such as a metal foil piece or a metal plate; a fibrous substrate such as a cloth piece, a nonwoven cloth piece, a felt, or a net; a paper type substrate such as a paper sheet; or a laminate made of two or more of these substrates. It is preferred to use, out of these examples, a plastic substrate. Examples of a material for the plastic substrate include olefin resins such as polyethylene (PE), polypropylene (PP), and ethylene/propylene copolymer; copolymers containing ethylene as a monomer component, such as ethylene-vinyl acetate copolymer (EVA), ionomer resin, ethylene-(meth)acrylic acid copolymer, and ethylene-(meth)acrylate (random or alternating) copolymer; polyesters such as polyethylene terephthalate (PET), polyethylene naphthalate (PEN), and polybutylene terephthalate (PBT); acrylic resins; polyvinyl chloride (PVC); polyurethanes; polycarbonates; polyphenylene sulfide (PPS); polyamides (nylon); amide resins such as fully aromatic polyamides (aramids); polyetheretherketones (PEEKs); polyimides; polyetherimides; polyvinylidene chloride; ABS (acrylonitrile-butadiene-styrene copolymer); cellulose resins; silicone resins; and fluororesins.

[0028]

The first separator of each of the separator-attached resin sheets 1 to n is preferably a separator subjected to peeling treatment. Examples of a releasing agent used for the peeling treatment may include fluorine-containing releasing

agents, long-chain alkyl acrylate releasing agents, and silicone releasing agents.

[0029]

The second separator of each of the separator-attached resin sheets 1 to n may be the separator described about the first separator.

[0030]

The resin sheet of each of the separator-attached resin sheets 1 to n usually contains an epoxy resin, a phenolic resin, a thermoplastic resin, a filler, a silane coupling agent, a curing promoter, carbon black, a flame retardant, etc.

[0031]

A worker selects any separator-attached resin sheet (for example, the separator-attached resin sheet 1) from the separator-attached resin sheet group 101, and then seals electronic devices 12 with this separator-attached resin sheet (see Fig. 2).

[0032]

Examples of the electronic device 12 include electronic devices having a hollow structure (hollow type electronic devices), such as sensors, MEMS (micro electro mechanical systems) and a SAW (surface acoustic wave) filter; semiconductor elements such as semiconductor chips, ICs (integrated circuits) and transistors; capacitors; and resistors. The hollow structure denotes a structure in which

a hollow is present between an electronic device and a substrate on which the electronic device is mounted.

[0033]

The method for sealing the electronic devices 12 with the separator-attached resin sheet 1 may be, for example, a method of peeling off the first separator 1-a or the second separator 1-c from the separator-attached resin sheet 1, or peeling off the first and second separators 1-a and 1-c from the separator-attached resin sheet 1, and then covering the electronic devices 12 mounted on a substrate 11 with the resin sheet 1-b. In this way, an electronic device package 21 is obtained in which the electronic devices 12 are covered with the resin sheet 1-b. The substrate 11 is not particularly limited, and is, for example, a printed circuit board, a ceramic substrate, a silicon substrate, or a metal substrate.

[0034]

After the electronic devices 12 are covered with the resin sheet 1-b, the resin sheet 1-b of the electronic device package 21 is thermally cured as required. Moreover, as required, the resin sheet 1-b of the electronic device package 21 is polished to make the electronic devices 12 naked. When the electronic devices 12 are SAW filters, the polishing is not usually performed. Furthermore, as required, the electronic device package 21 is diced (see Fig. 3). This dicing can yield electronic device packages 31, which are each in a chip form.

This process is generally called a chip-on-wafer (COW) process.

[0035]

A worker selects any separator-attached resin sheet (for example, the separator-attached resin sheet 2) from the separator-attached resin sheet group 101, and then electronic devices 12 are sealed with this separator-attached resin sheet (see Fig. 4).

[0036]

The method for sealing the electronic devices 12 with the separator-attached resin sheet 2 may be, for example, a method of peeling off the first separator 2-a or the second separator 2-c from the separator-attached resin sheet 2, or peeling off the first and second separators 2-a and 2-c from the separator-attached resin sheet 2, and then covering the electronic devices 12 fixed onto a pressure-sensitive adhesive sheet 41 with the resin sheet 2-b. In this way, a sealed body 51 is obtained in which the electronic devices 12 are covered with the resin sheet 2-b.

[0037]

The pressure-sensitive adhesive sheet 41 usually has a support 42, and a pressure-sensitive adhesive layer 43 laminated onto the support 42 (see Fig. 4).

[0038]

The pressure-sensitive adhesive layer 43 is not

particularly limited, and is usually, for example, a thermally peelable pressure-sensitive adhesive layer or a radial ray curable pressure-sensitive adhesive layer since the layer is easily peelable. The material of the support 42 is not particularly limited, and is, for example, a metal material such as SUS, or a plastic material such as polyimide, polyamideimide, polyetheretherketone or polyethersulfone.

[0039]

After the electronic devices 12 are covered with the resin sheet 2-b, an electronic device package can be obtained by performing, for example, steps described below. The following steps are preferred for producing fan-out type wafer level packages (WLPs).

[0040]

The sealed body 51 is thermally cured (the resin sheet 2-b of the sealed body 51 is thermally cured). Next, the pressure-sensitive adhesive sheet 41 is peeled off from the sealed body 51 (see Fig. 5). The method for the peeling is not particularly limited. It is preferred to lower the pressure-sensitive adhesive layer 43 in adhesive strength and subsequently perform the peeling. When the pressure-sensitive adhesive layer 43 is, for example, a thermally peelable pressure-sensitive adhesive layer, the pressure-sensitive adhesive layer 43 is heated to be lowered in adhesive strength, and is subsequently peeled.

[0041]

Next, the sealed body 51 is polished as required to make the electronic devices 12 naked (see Fig. 6). The method for the polishing is, for example, a grinding method.

[0042]

Next, for example, a semi-additive method is used to form re-wiring 52 (see Fig. 7) in the sealed body 51.

[0043]

Thereafter, an insulating layer of, for example, polyimide or polybenzoxazole (PBO) is formed onto the surface on which re-wiring 52 of the sealed body 51 is formed. The formation of the insulating layer can be attained, for example, by laminating a film such as a dry film resist.

[0044]

Next, bumping is performed for forming bumps 53 onto the re-wiring 52. The bumping can be attained by solder balls, solder plating or any other known method. The material of the bumps 53 is not particularly limited, and examples thereof include tin-lead based metal materials, tin-silver based metal materials, tin-silver-copper based metal materials, tin-zinc based metal materials, tin-zinc-bismuth based metal materials, and other solders (alloys); gold based metal materials; and copper based metal materials.

[0045]

The laminate composed of the electronic devices 12, the

resin sheet 2-b, the re-wiring 52 and the other element may be diced (see Fig. 8). The above-mentioned process can give an electronic device package 61 in which the wiring is led outside from the chip region.

[0046]

(Embodiment 2)

Embodiment 2 is the same as Embodiment 1 except that the separator-attached resin sheets 1 to n each have a first separator having a color in accordance with the sort (specifically, for example, the usage or the composition) of the resin sheet.

[0047]

Example of the classification of the separator-attached resin sheets 1 to n using the colors thereof are described in Table 2 below as examples.

[0048]

[Table 2]

(Resin sheet group 101)

		Example 1	Example 2	Example 3	Example 4	Example 5
Separator-attached resin sheet 1	Sort of resin sheet 1-b	For sealing SAW filter	For sealing SAW filter	For sealing SAW filter	For sealing SAW filter	For sealing SAW filter
	Color of first separator 1-a	White	Transparent and colorless	White	White	White
	Color of second separator 1-c	Transparent and colorless	Transparent and colorless	White	Gray	Transparent and colorless
Separator-attached resin sheet 2	Sort of resin sheet 2-b	For sealing semiconductor or chip	For sealing semiconductor or chip	For sealing semiconductor or chip	For sealing semiconductor or chip	For sealing SAW filter
	Color of first separator 2-a	Yellow	Yellow	Yellow	Yellow	White
	Color of second separator 2-c	Transparent and	Transparent and	Yellow	Gray	Transparent and

		colorless	colorless			colorless
Separator- attached resin sheet 3	Sort of resin sheet 3-b	FOR SEALING MEMS	FOR SEALING MEMS	FOR SEALING MEMS	FOR SEALING MEMS	FOR SEALING MEMS
	Color of first separator 3-a	Red	Red	Red	Red	Red
	Color of second separator 3-c	Transparent and colorless	Transparent and colorless	Red	Gray	Transparent and colorless

[0049]

In Example 1 and Examples 3 to 5, the color corresponding to a resin sheet for sealing a SAW filter is white; the color corresponding to a resin sheet for sealing a semiconductor chip is yellow; and the color corresponding to a resin sheet for sealing MEMS is red.

[0050]

In Example 2, the color corresponding to a resin sheet for sealing a SAW filter is transparent and colorless; the color corresponding to a resin sheet for sealing a semiconductor chip is yellow; and the color corresponding to a resin sheet for sealing MEMS is red.

[0051]

[Second Aspect of the Invention]

(Embodiment 1)

Embodiment 1 of the second aspect of the invention is the same as Embodiment 1 of the first aspect of the invention except that separator-attached resin sheets 1 to n constituting a separator-attached resin sheet group 101 each have a first separator to which a mark in accordance with the thickness of

the resin sheet is attached.

[0052]

The mark is not particularly limited, and is, for example, a numeral, an alphabet, or a figure.

[0053]

The manner for proper use of the respective marks attached to the separator-attached resin sheets 1 to n are not particularly limited. For example, as shown in Table 3 described below, numerals in accordance with the respective sorts of the resin sheets can be attached to the first separators, respectively.

[0054]

[Table 3]

(Resin sheet group 101)

		Example 1
Separator-attached resin sheet 1	Thickness (μm) of resin sheet 1-b	200
	Mark attached to first separator 1-a	1
Separator-attached resin sheet 2	Thickness (μm) of resin sheet 2-b	150
	Mark attached to first separator 2-a	2
Separator-attached resin sheet 3	Thickness (μm) of resin sheet 3-b	100
	Mark attached to first separator 3-a	3

[0055]

In Example 1, the mark corresponding to a resin sheet thickness of 200 μm is the numeral "1"; the mark corresponding to a resin sheet thickness of 150 μm is the numeral "2"; and the mark corresponding to a resin sheet thickness of 100 μm is

the numeral "3".

[0056]

Marks may be attached, respectively, to the second separators of the separator-attached resin sheets 1 to n. It is however preferred to attach marks only to the first separators. By attaching the marks only to the first separators, a worker can easily distinguish the first separators from the second separators.

[0057]

(Embodiment 2)

Embodiment 2 of the second aspect of the invention is the same as Embodiment 2 of the first aspect of the invention except that separator-attached resin sheets 1 to n constituting a separator-attached resin sheet group 101 each have a first separator to which a mark in accordance with the sort of the resin sheet is attached.

[0058]

For example, as shown in Table 4 described below, respective numerals in accordance with the sorts of the resin sheets can be attached to the first separators, respectively.

[0059]

[Table 4]

(Resin sheet group 101)

		Example 1
Separator-attached resin sheet 1	Sort of resin sheet 1-b	High level of filler type

	Mark attached to first separator 1-a	1
Separator-attached resin sheet 2	Sort of resin sheet 2-b	Low level of filler type
	Mark attached to first separator 2-a	2
Separator-attached resin sheet 3	Sort of resin sheet 3-b	Thin-type
	Mark attached to first separator 3-a	3

[0060]

In Example 1, the mark corresponding to a resin sheet containing high level of filler is the numeral "1"; the mark corresponding to a resin sheet containing low level of filler is the numeral "2"; and the mark corresponding to a thin-type resin sheet is the numeral "3".

DESCRIPTION OF REFERENCE SIGNS

[0061]

1, 2 and 3: Separator-attached resin sheets

1-a, 2-a, and 3-a: First separators

1-b, 2-b, and 3-b: Resin sheets

1-c, 2-c, and 3-c: Second separators

11: Substrate

12: Electronic device

21: Electronic device Package

31: Chip-form electronic device package

41: Pressure-sensitive adhesive sheet

42: Support

43: Pressure-sensitive adhesive layer

51: Sealed body

52: Re-wiring

53: Bump

61: Chip-form electronic device package

101: Separator-attached resin sheet group

CLAIMS

1. A separator-attached resin sheet group for sealing electronic device, wherein separators are classified by using colors according to the thickness or sort of resin sheets for sealing electronic device.

2. A method for selecting a separator-attached resin sheet for sealing electronic device, the method comprising the steps of:

providing a separator-attached resin sheet group for sealing electronic device in which separators are classified by using colors according to the thickness or sort of resin sheets for sealing electronic device; and

selecting the separator-attached resin sheet for sealing electronic device from the separator-attached resin sheet group for sealing electronic device based on the respective colors of the separators.

3. A separator-attached resin sheet group for sealing electronic device, comprising a plurality of separator-attached resin sheets for sealing electronic device to which marks are attached, the marks being in accordance with the thickness or sort of the resin sheets for sealing electronic device.

4. A method for selecting a separator-attached resin sheet for sealing electronic device, the method comprising the steps of:

providing a separator-attached resin sheet group for sealing electronic device comprising a plurality of separator-attached resin sheets for sealing electronic device to which marks are attached, the marks being in accordance with the thickness or sort of the resin sheets for sealing electronic device; and

selecting the separator-attached resin sheet for sealing electronic device from the separator-attached resin sheet group for sealing electronic device based on the marks.