

SPECIFICATION

TITLE OF INVENTION: ADHESIVE FILM AND METHOD FOR PRODUCING
ELECTRONIC DEVICE

5

TECHNICAL FIELD

[0001]

The present invention relates to an adhesive film and a
method for producing an electronic device.

10

BACKGROUND ART

[0002]

As a technology capable of reducing the size and weight of
an electronic device (for example, a semiconductor device), a
fan-out type wafer level package (WLP) has been developed.

In embedded wafer level ball grid array (eWLB), which is
one of manufacturing methods of the fan-out type WLP, a
plurality of electronic components such as a semiconductor chip
are temporarily fixed on the adhesive film attached to the
support substrate in a spaced state, and the plurality of
electronic components are collectively sealed with a sealing
material. Here, the adhesive film needs to be fixed to the
electronic component and the support substrate in the sealing
process or the like and needs to be removed from the sealed
electronic component and the support substrate after the
sealing.

25

[0003]

Examples of a technique related to such a fan-out type WLP manufacturing method include the technique described in Patent Document 1.

[0004]

5 Patent Document 1 describes a heat-resistant adhesive sheet for use in manufacturing a semiconductor device, which is attached and used when a substrateless semiconductor chip is resin-sealed in a manufacturing method of a substrateless semiconductor package in which an adhesive sheet is used as a
10 temporary fixing support, with a problem of occurrence of a shift of a chip position and breakage of a package, wherein the heat-resistant adhesive sheet has a base material layer and an adhesive layer, and the adhesive layer is a layer that is cured by being subjected to a stimulus until a completion point of a
15 resin sealing step and has an adhesive force to SUS304 after bonding of 0.5 N/20 mm or more and a peel force with respect to a package of 2.0 N/20 mm or less.

RELATED DOCUMENT

20 PATENT DOCUMENT

[0005]

Patent Document 1: Japanese Unexamined Patent Publication No. 2011-134811

25 SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0006]

The present invention provides an adhesive film having improved heat peelability.

SOLUTION TO PROBLEM

[0007]

5 The present inventors conducted a thorough investigation in order to achieve the above-described object. As a result, the present inventors have found that the heat peelability of the adhesive film can be improved by setting the arithmetic average height Sa of the adhesive resin layer after the heating
10 treatment with a specific numerical range, and have completed the present invention.

[0008]

According to the present invention, there is provided an adhesive film and a method for producing an electronic device as
15 shown below.

[0009]

[1]

An adhesive film including
a base material layer (A),
20 an adhesive resin layer (B) for temporarily fixing an electronic component on a first surface side of the base material layer (A), and
an adhesive resin layer (C) on a second surface side of the base material layer (A),
25 in which an arithmetic average height Sa of a surface of the adhesive resin layer (C) opposite to the base material layer (A) is 5.5 μm or more, in a case where a test piece having a

size of 5 cm x 5 cm is produced from the adhesive film, and the test piece is subjected to a pressurization and heating treatment for 1 minute under conditions of a temperature of 190°C, a load of 100 kN, and a humidity of 65% Rh in a state of being interposed between two SUS plates having a size of 15 cm x 15 cm.

[2]

The adhesive film according to [1],
which can be used for temporarily fixing the electronic component in a case of sealing the electronic component with a sealing material.

[3]

The adhesive film according to [1] or [2],
in which a maximum height S_z of a surface of the adhesive resin layer (C) opposite to the base material layer (A) is 50 μm or more, in a case where a test piece having a size of 5 cm x 5 cm is produced from the adhesive film, and the test piece is subjected to a pressurization and heating treatment for 1 minute under conditions of a temperature of 190°C, a load of 100 kN, and a humidity of 65% Rh in a state of being interposed between two SUS plates having a size of 15 cm x 15 cm.

[4]

The adhesive film according to any one of [1] to [3],
in which the adhesive resin layer (B) includes one or two or more selected from the group consisting of a (meth)acrylic adhesive resin, a silicone adhesive resin, a urethane adhesive resin, an olefin adhesive resin, and a styrene adhesive resin.

[5]

The adhesive film according to any one of [1] to [4],
in which a total content of a gas generating component and
thermally expandable microspheres in the adhesive resin layer
5 (B) is 0.1% by mass or less, in a case where the entire adhesive
resin layer (B) is set to 100% by mass.

[6]

The adhesive film according to any one of [1] to [5],
in which a thickness of the adhesive resin layer (B) is 1
10 μm or more and 40 μm or less.

[7]

The adhesive film according to any one of [1] to [6],
in which the adhesive resin layer (C) is a layer in which
an adhesive force is reduced by a heating treatment.

15 [8]

The adhesive film according to [7],
in which the adhesive resin layer (C) contains one or two
or more selected from the group consisting of a gas generating
component and thermally expandable microspheres.

20 [9]

The adhesive film according to [8],
in which the adhesive resin layer (C) contains thermally
expandable microspheres, and
in a cumulative frequency distribution curve based on a
25 volume of the thermally expandable microspheres, which is
measured by a laser diffraction and scattering type particle
size distribution measuring device, a maximum particle diameter

D₁₀₀ at a cumulative frequency of 100% is 10 µm or more and 100 µm or less.

[10]

The adhesive film according to any one of [7] to [9],
5 in which the adhesive resin layer (C) is a layer in which
an adhesive force is reduced by heating at a temperature
exceeding 180°C.

[11]

The adhesive film according to any one of [1] to [10],
10 in which the adhesive resin layer (C) includes one or two
or more selected from the group consisting of a (meth)acrylic
adhesive resin, a silicone adhesive resin, a urethane adhesive
resin, an olefin adhesive resin, and a styrene adhesive resin.

[12]

15 The adhesive film according to any one of [1] to [11],
in which a thickness of the adhesive resin layer (C) is 10
µm or more and 100 µm or less.

[13]

The adhesive film according to any one of [1] to [12],
20 in which the base material layer (A) includes one or two or
more selected from the group consisting of polypropylene,
polyethylene terephthalate, polyethylene naphthalate, polyamide,
and polyimide.

[14]

25 The adhesive film according to any one of [1] to [13],
further including:

an intermediate layer (D) in at least one of between the

base material layer (A) and the adhesive resin layer (B) or between the base material layer (A) and the adhesive resin layer (C).

[15]

5 The adhesive film according to [14],
in which a thickness of the intermediate layer (D) is 5 μm or more and 100 μm or less.

[16]

A method for producing an electronic device, the method
10 including:
a step of preparing a structure including the adhesive film according to any one of [1] to [15], an electronic component attached to the adhesive resin layer (B) of the adhesive film, and a support substrate attached to the adhesive resin layer (C)
15 of the adhesive film, and
a step of sealing the electronic component with a sealing material.

[17]

The method for producing an electronic device according to
20 [16], further including:

a step of peeling the support substrate from the structure by reducing an adhesive force of the adhesive resin layer (C) by a heating treatment.

[18]

25 The method for producing an electronic device according to [16] or [17], further including:

a step of peeling the adhesive film from the electronic

component.

[19]

The method for producing an electronic device according to any one of [16] to [18],

5 in which the sealing material includes an epoxy resin-based sealing material.

[20]

The method for producing an electronic device according to any one of [16] to [19],

10 in which the electronic device includes a fan-out type package.

ADVANTAGEOUS EFFECTS OF INVENTION

[0010]

15 According to the present invention, it is possible to provide an adhesive film having improved heat peelability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

20 [FIG. 1] A cross-sectional view schematically showing an example of a structure of an adhesive film of the present embodiment.

[FIG. 2] A cross-sectional view schematically showing an example of a structure of an adhesive film of the present
25 embodiment.

[FIG. 3] A cross-sectional view schematically showing an example of a method for producing an electronic device of the

present embodiment.

DESCRIPTION OF EMBODIMENTS

[0012]

5 Hereinafter, an embodiment of the present invention will be described with reference to the drawings.

In all drawings, the same constituents are marked with the same reference signs and may not be repeatedly described as appropriate. In addition, the drawings are schematic and do not
10 necessarily correspond to actual dimensional ratios.

In the present specification, unless otherwise specified, an upper limit value and a lower limit value related to a numerical range can be optionally combined with each other.

In the specification, “(meth)acrylic” means acrylic,
15 methacrylic, or both acrylic and methacrylic.

[0013]

<Adhesive Film>

The adhesive film 100 according to the present embodiment will be described.

20 FIG. 1 is a cross-sectional view schematically showing an example of a structure of an adhesive film 100 according to the present embodiment.

[0014]

The adhesive film 100 according to the present embodiment
25 includes a base material layer (A), an adhesive resin layer (B) for temporarily fixing an electronic component on a first surface A1 side of the base material layer (A), and an adhesive

resin layer (C) on a second surface A2 side of the base material layer (A), in which an arithmetic average height Sa of a surface of the adhesive resin layer (C) opposite to the base material layer (A) is 5.5 μm or more, in a case where a test piece having
5 a size of 5 cm x 5 cm is produced from the adhesive film 100, and the test piece is subjected to a pressurization and heating treatment for 1 minute under conditions of a temperature of 190°C, a load of 100 kN, and a humidity of 65% Rh in a state of being interposed between two SUS plates having a size of 15 cm x
10 15 cm.
[0015]

In the method for producing the electronic device, the electronic component is disposed on the adhesive film attached to the support substrate in a spaced state, and is collectively
15 sealed with a sealing material. Thereafter, the electronic component is peeled from the support substrate, and then the adhesive film is peeled from the electronic component.

According to the studies of the present inventors, it has been clarified that the heat peelability between the support
20 substrate and the adhesive resin layer of the adhesive film may be reduced due to an increase in the adhesive force between the support substrate and the adhesive film or a decrease in the foaming force of the foaming component in the adhesive resin layer on the support substrate side by the heating treatment
25 performed before peeling the electronic component from the support substrate.

As a result of intensive studies, the present inventors

have found that the heat peelability of the adhesive film 100 can be improved by setting the arithmetic average height S_a of the adhesive resin layer (C) after the heating treatment under specific conditions to be equal to or higher than the lower
5 limit value, and have completed the present invention.

The reason why the heat peelability of the adhesive film 100 can be improved by setting the arithmetic average height S_a of the adhesive resin layer (C) after the heating treatment under specific conditions to be equal to or higher than the
10 lower limit value is not clear, but it is considered that, in a case where the arithmetic average height S_a is equal to or higher than the lower limit value, for example, in a step of peeling the support substrate from the adhesive film 100 by reducing the adhesive force of the adhesive resin layer (C) by
15 the heating treatment, the contact area between the support substrate and the adhesive film 100 can be effectively reduced, and as a result, the heat peelability of the adhesive film 100 from the support substrate can be improved.

[0016]

20 From the viewpoint of further improving the heat peelability, the arithmetic average height S_a of the surface of the adhesive resin layer (C) of the adhesive film 100 according to the present embodiment on a side opposite to the base material layer (A) is preferably 6.0 μm or more, more preferably
25 6.5 μm or more, still more preferably 7.0 μm or more, even more preferably 7.5 μm or more, and even still more preferably 8.0 μm or more. From the viewpoint of suppressing the displacement of

the electronic component, the arithmetic average height S_a is preferably less than 50.0 μm , more preferably less than 40.0 μm , still more preferably less than 30.0 μm , even more preferably less than 20.0 μm , even still more preferably less than 15.0 μm ,
5 and even further preferably less than 10.0 μm .

That is, from the viewpoint of further improving the heat peelability, the arithmetic average height S_a of the surface of the adhesive resin layer (C) of the adhesive film 100 according to the present embodiment on a side opposite to the base
10 material layer (A) is preferably 5.5 μm or more and 50 μm or less, more preferably 6.0 μm or more and 40 μm or less, still more preferably 6.5 μm or more and 30 μm or less, even more preferably 7.0 μm or more and 20 μm or less, even still more preferably 7.5 μm or more and 20 μm or less, and even further
15 preferably 8.0 μm or more and 10 μm or less.

[0017]

In the adhesive film 100 according to the present embodiment, from the viewpoint of further improving the heat peelability, a maximum height S_z of the surface of the adhesive
20 resin layer (C) on a side opposite to the base material layer (A) is preferably 50 μm or more, more preferably 60 μm or more, still more preferably 70 μm or more, even more preferably 80 μm or more, even still more preferably 90 μm or more, even further preferably 100 μm or more, even further preferably 110 μm or
25 more, even further preferably 120 μm or more, even further preferably 130 μm or more, and even further preferably 140 μm or more, in a case where a test piece having a size of 5 cm x 5 cm

is produced from the adhesive film 100, and the test piece is subjected to a pressurization and heating treatment for 1 minute under conditions of a temperature of 190°C, a load of 100 kN, and a humidity of 65% Rh in a state of being interposed between
5 two SUS plates having a size of 15 cm x 15 cm. From the viewpoint of suppressing the displacement of the electronic component, the maximum height Sz is preferably less than 500 μm, more preferably less than 450 μm, still more preferably less than 400 μm, even more preferably less than 350 μm, even still
10 more preferably less than 300 μm, and even further preferably less than 250 μm.

That is, from the viewpoint of further improving the heat peelability and the viewpoint of suppressing the displacement of the electronic component, the maximum height Sz of the surface
15 of the adhesive resin layer (C) of the adhesive film 100 according to the present embodiment on a side opposite to the base material layer (A) is preferably 50 μm or more and 500 μm or less, more preferably 70 μm or more and 450 μm or less, still more preferably 80 μm or more and 400 μm or less, even more
20 preferably 90 μm or more and 350 μm or less, even still more preferably 100 μm or more and 300 μm or less, even further preferably 110 μm or more and 250 μm or less, even further preferably 120 μm or more and 250 μm or less, even further preferably 130 μm or more and 250 μm or less, and even further
25 preferably 140 μm or more and 250 μm or less.

[0018]

The adhesive film 100 in which the arithmetic average

height S_a and the maximum height S_z are within the above-described ranges can be obtained, for example, by adjusting drying conditions or heat treatment conditions in a case of forming the adhesive resin layer (C), a content of the gas generating component and the thermally expandable microspheres in the adhesive resin layer (C), a maximum particle diameter D_{100} of the gas generating component and the thermally expandable microspheres, and the like. Examples of a method of adjusting the maximum particle diameter D_{100} of the gas generating component and the thermally expandable microspheres include classification.

[0019]

The arithmetic average height S_a and the maximum height S_z of the adhesive film 100 according to the present embodiment can be measured, for example, in accordance with ISO25178 using a surface roughness measuring device (for example, trade name "P-11", manufactured by Tencor).

[0020]

Since the adhesive film 100 according to the present embodiment can further improve the heat peelability, it can be suitably used for temporarily fixing the electronic component in a case of sealing the electronic component with the sealing material.

[0021]

From the viewpoint of further improving the performance balance between the mechanical characteristics and the handleability, a thickness of the entire adhesive film 100

according to the present embodiment is preferably 25 μm or more, more preferably 30 μm or more, and still more preferably 50 μm or more, and is preferably 800 μm or less, more preferably 500 μm or less, still more preferably 300 μm or less, even more
5 preferably 200 μm or less, and even still more preferably 150 μm or less.

In addition, from the viewpoint of further improving the performance balance between the mechanical characteristics and the handleability, a thickness of the entire adhesive film 100
10 according to the present embodiment is preferably 25 μm or more and 800 μm or less, more preferably 25 μm or more and 500 μm or less, still more preferably 25 μm or more and 300 μm or less, even more preferably 30 μm or more and 200 μm or less, and even still more preferably 50 μm or more and 150 μm or less.

15 [0022]

Hereinafter, each layer of the adhesive film 100 will be described.

[0023]

[Base Material Layer (A)]

20 The base material layer (A) is a layer provided for the purpose of further improving characteristics such as handleability, mechanical characteristics, and heat resistance of the adhesive film 100.

The base material layer (A) is not particularly limited,
25 but examples thereof include a resin film.

Examples of the resin constituting the resin film include thermoplastic resins, and examples thereof include one or two or

more selected from polyolefin such as polyethylene, polypropylene, poly(4-methyl-1-pentene), and poly(1-butene); polyester such as polyethylene terephthalate, polybutylene terephthalate, and polyethylene naphthalate; polyamide such as
5 nylon-6, nylon-66, and poly-metaxylene adipamide; polyacrylate; polymethacrylate; polyvinyl chloride; polyvinylidene chloride; polyimide; polyetherimide; ethylene-vinyl acetate copolymer; polyacrylonitrile; polycarbonate; polystyrene; ionomer; polysulfone; polyethersulfone; and polyphenylene ether.

10 Among these, from the viewpoint of excellent balance of transparency, mechanical strength, price, and the like, the resin constituting the resin film preferably includes one or two or more selected from the group consisting of polypropylene, polyethylene terephthalate, polyethylene naphthalate, polyamide,
15 and polyimide, more preferably includes one or two or more selected from the group consisting of polyethylene terephthalate and polyethylene naphthalate, and still more preferably includes polyethylene terephthalate.

[0024]

20 The base material layer (A) may be a single layer or two or more layers.

 In addition, the resin film for forming the base material layer (A) may be a stretched film or a film stretched in the uniaxial or biaxial direction; however, from the viewpoint of
25 improving the mechanical strength of the base material layer (A), a film stretched in the uniaxial or biaxial direction is preferable.

[0025]

From the viewpoint of obtaining more favorable film characteristics, a thickness of the base material layer (A) is preferably 1 μm or more, more preferably 5 μm or more, still
 5 more preferably 10 μm or more, and even more preferably 20 μm or more, and is preferably 500 μm or less, more preferably 300 μm or less, still more preferably 250 μm or less, even more preferably 150 μm or less, and even still more preferably 100 μm or less.

10 In addition, from the viewpoint of obtaining more favorable film characteristics, a thickness of the base material layer (A) is preferably 1 μm or more and 500 μm or less, more preferably 1 μm or more and 300 μm or less, still more preferably 5 μm or more and 250 μm or less, even more preferably 10 μm or more and
 15 150 μm or less, and even still more preferably 20 μm or more and 100 μm or less.

The base material layer (A) may be subjected to a surface treatment in order to further improve the adhesive force to other layers. Specifically, the base material layer (A) may be
 20 subjected to a corona treatment, a plasma treatment, an undercoat treatment, a primer coating treatment, or the like, but from the viewpoint of further improving the adhesive force to other layers, a corona treatment is preferable.

[0026]

25 [Adhesive Resin Layer (B)]

The adhesive resin layer (B) is a layer on the first surface A1 side of the base material layer (A). The adhesive

resin layer (B) is a layer for contacting the surface of the electronic component to temporarily fix the electronic component when the electronic component is sealed with a sealing material in the electronic device manufacturing process.

5 [0027]

From the viewpoint of further improving the performance balance between the adhesive force and the heat resistance, the adhesive resin constituting the adhesive resin layer (B) preferably includes one or two or more selected from the group
10 consisting of a (meth)acrylic adhesive resin, a silicone adhesive resin, a urethane adhesive resin, an olefin adhesive resin, and a styrene adhesive resin, and from the viewpoint of easily adjusting the adhesive force and the like, it more preferably includes a (meth)acrylic adhesive resin.

15 [0028]

As the adhesive resin layer (B), a radiation crosslinking type adhesive resin layer that can reduce the adhesive force by radiation can be used. Since the radiation crosslinking type adhesive resin layer (B) is crosslinked by irradiation with
20 radiation and the adhesive force is significantly reduced, the electronic component is easily picked up from the adhesive resin layer (B) in a pickup step of the electronic component. Examples of the radiation include ultraviolet rays, electron beams, infrared rays, and the like.

25 As the radiation crosslinking type adhesive resin layer, an ultraviolet crosslinking type adhesive resin layer is preferable.

[0029]

Examples of the (meth)acrylic adhesive resin include a copolymer including a (meth)acrylic acid alkyl ester monomer unit (b1) and a monomer unit (b2) having a functional group that
5 can react with a crosslinking agent.

In the present embodiment, the (meth)acrylic acid alkyl ester means an acrylic acid alkyl ester, a methacrylic acid alkyl ester, or a mixture thereof.

[0030]

10 The (meth)acrylic adhesive resin according to the present embodiment can be obtained, for example, by copolymerizing a monomer mixture including a monomer forming a (meth)acrylic acid alkyl ester monomer unit (b1) and a monomer forming a monomer unit (b2) having a functional group that can react with a
15 crosslinking agent.

[0031]

The monomer forming the (meth)acrylic acid alkyl ester monomer unit (b1) is preferably a (meth)acrylic acid alkyl ester having an alkyl group having 1 to 12 carbon atoms, and more
20 preferably a (meth)acrylic acid alkyl ester having an alkyl group having 1 to 8 carbon atoms. Specific examples of the monomer forming the (meth)acrylic acid alkyl ester monomer unit (b1) include methyl acrylate, methyl methacrylate, ethyl acrylate, ethyl methacrylate, butyl acrylate, butyl
25 methacrylate, 2-ethylhexyl acrylate, and 2-ethylhexyl methacrylate. These may be used alone or in a combination of two or more types.

In the (meth)acrylic adhesive resin according to the present embodiment, a content of the monomer unit (b1) is preferably 10% by mass or more and 98.9% by mass or less, more preferably 50% by mass or more and 98% by mass or less, and
5 still more preferably 85% by mass or more and 97% by mass or less, in a case where the total of all the monomer units in the (meth)acrylic adhesive resin is set to 100% by mass.

[0032]

Examples of the monomer forming the monomer unit (b2)
10 having a functional group capable of reacting with the crosslinking agent include acrylic acid, methacrylic acid, itaconic acid, mesaconic acid, citraconic acid, fumaric acid, maleic acid, itaconic acid monoalkyl ester, mesaconic acid monoalkyl ester, citraconic acid monoalkyl ester, fumaric acid
15 monoalkyl ester, maleic acid monoalkyl ester, glycidyl acrylate, glycidyl methacrylate, 2-hydroxyethyl acrylate, 2-hydroxyethyl methacrylate, acrylamide, methacrylamide, tert-butylaminoethyl acrylate, tert-butylaminoethyl methacrylate, and the like. Preferable are acrylic acid, methacrylic acid, 2-hydroxyethyl
20 acrylate, 2-hydroxyethyl methacrylate, acrylamide, methacrylamide, and the like. These may be used alone or in a combination of two or more types.

In the (meth)acrylic adhesive resin according to the present embodiment, a content of the monomer unit (b2) is
25 preferably 1% by mass or more and 40% by mass or less, more preferably 1% by mass or more and 20% by mass or less, and still more preferably 1% by mass or more and 10% by mass or less in a

case where the total of all monomer units in the (meth)acrylic adhesive resin is set to 100% by mass.

[0033]

The (meth)acrylic adhesive resin according to the present
5 embodiment may further include a bifunctional monomer unit (b3) or a specific comonomer unit having a property as a surfactant (hereinafter, referred to as a polymerizable surfactant) in addition to the monomer unit (b1) and the monomer unit (b2).

The polymerizable surfactant has a property of
10 copolymerizing with the monomer unit (b1), the monomer unit (b2), and the bifunctional monomer unit (b3), and has an action as an emulsifier in a case of emulsion polymerization.

[0034]

Examples of the monomer forming the bifunctional monomer
15 unit (b3) include allyl methacrylate, allyl acrylate, divinylbenzene, vinyl methacrylate, vinyl acrylate, trimethylolpropane tri(meth)acrylate, pentaerythritol tri(meth)acrylate, dipentaerythritol hexa(meth)acrylate, tetraethylene glycol di(meth)acrylate, or, for example, monomers
20 in which a main chain structure is a propylene glycol type with diacrylate or dimethacrylate at both ends (for example, manufactured by NOF Corp., trade name: PDP-200, PDP-400, ADP-200, and ADP-400), tetramethylene glycol type monomers (for example, manufactured by NOF Corp., trade name: ADT-250, ADT-
25 850), mixtures thereof (for example, manufactured by NOF Corp., trade name: ADET-1800 and ADPT-4000), and the like.

[0035]

In the (meth)acrylic adhesive resin according to the present embodiment, a content of the bifunctional monomer unit (b3) is preferably 0.1% by mass or more and 30% by mass or less, more preferably 0.1% by mass or more and 15% by mass or less, still more preferably 0.1% by mass or more and 20% by mass or less, and even more preferably 0.1% by mass or more and 5% by mass or less, in a case where the total of all the monomer units in the (meth)acrylic adhesive resin is set to 100% by mass.

[0036]

Examples of the polymerizable surfactant include a surfactant in which a polymerizable 1-propenyl group is introduced into a benzene ring of polyoxyethylene nonylphenyl ether (manufactured by Daiichi Kogyo Seiyaku Co., Ltd.; trade name: Aqualon RN-10, RN-20, RN-30, RN-50, and the like), a surfactant in which a polymerizable 1-propenyl group is introduced into a benzene ring of ammonium salt of sulfuric acid ester of polyoxyethylene nonylphenyl ether (manufactured by Daiichi Kogyo Seiyaku Co., Ltd.; trade name: Aqualon HS-10, HS-20, HS-1025, and the like), and a sulfosuccinate diester-based surfactant having a polymerizable double bond in the molecule (manufactured by Kao Corp.; trade name: Latemul S-120A, S-180A, and the like), or the like.

In the (meth)acrylic adhesive resin according to the present embodiment, a content of the polymerizable surfactant is preferably 0.1% by mass or more and 30% by mass or less, more preferably 0.1% by mass or more and 15% by mass or less, still more preferably 0.1% by mass or more and 20% by mass or less,

and even more preferably 0.1% by mass or more and 5% by mass or less, in a case where the total of all the monomer units in the (meth)acrylic adhesive resin is set to 100% by mass.

[0037]

5 The (meth)acrylic adhesive resin according to the present embodiment may further include a monomer unit formed of a monomer having a polymerizable double bond such as vinyl acetate, acrylonitrile, styrene, or the like, as necessary.

[0038]

10 Examples of the polymerization reaction mechanism of the (meth)acrylic adhesive resin according to the present embodiment include radical polymerization, anionic polymerization, cationic polymerization, and the like.

When the (meth)acrylic adhesive resin according to the
15 present embodiment is polymerized by a radical polymerization reaction, specific examples of radical polymerization initiators include organic peroxides such as benzoyl peroxide, di-*t*-butyl peroxide, dicumyl peroxide, 3,3,5-trimethylhexanoyl peroxide, di-2-ethylhexylperoxy dicarbonate, methyl ethyl ketone peroxide,
20 *t*-butylperoxyphthalate, *t*-butylperoxybenzoate, di-*t*-butylperoxyacetate, *t*-butylperoxyisobutyrate, *t*-butylperoxy-2-hexanoate, *t*-butylperoxy-2-ethylhexanoate, *t*-butylperoxy-3,5,5-trimethylhexanoate, acetyl peroxide, isobutyryl peroxide, octanoyl peroxide, *t*-butyl peroxide, and di-*t*-amyl peroxide;
25 inorganic peroxides such as ammonium persulfate, potassium persulfate, and sodium persulfate; azo compounds such as 2,2'-azobisisobutyronitrile, 2,2'-azobis-2-methylbutyronitrile, and

4,4'-azobis-4-cyanovaleric acid.

[0039]

From the viewpoint of improving the performance balance between the adhesive force and the heat resistance of the adhesive resin layer (B), the radical polymerization initiator in the (meth)acrylic adhesive resin according to the present embodiment is preferably an inorganic peroxide such as water-soluble ammonium persulfate, potassium persulfate, or sodium persulfate, or a water-soluble azo compound having a carboxyl group in the molecule such as 4,4'-azobis-4-cyanovaleric acid, and from the viewpoint of the influence of ions on the surface of the electronic component, more preferably ammonium persulfate, or an azo compound having a carboxyl group in the molecule such as 4,4'-azobis-4-cyanovaleric acid, and still more preferably an azo compound having a carboxyl group in the molecule such as 4,4'-azobis-4-cyanovaleric acid.

[0040]

It is preferable that the adhesive resin layer (B) according to the present embodiment further includes a crosslinking agent having two or more crosslinkable functional groups in one molecule, in addition to the adhesive resin.

Examples of such a crosslinking agent include epoxy-based compounds such as sorbitol polyglycidyl ether, polyglycerol polyglycidyl ether, pentaerythritol polyglycidyl ether, diglycerol polyglycidyl ether, glycerol polyglycidyl ether, neopentyl glycol diglycidyl ether, and resorcin diglycidyl ether; isocyanate-based compounds such as tetramethylene

diisocyanate, hexamethylene diisocyanate, toluene diisocyanate 3
 adducts of trimethylolpropane, polyisocyanate, diphenylmethane
 diisocyanate, and tolylene diisocyanate; aziridine-based
 compounds such as trimethylolpropane-tri- β -aziridinypropionate,
 5 tetramethylolmethane-tri- β -aziridinypropionate, N,N'-
 diphenylmethane-4,4'-bis(1-aziridinecarboxamide), N,N'-
 hexamethylene-1,6-bis(1-aziridinecarboxamide), N,N'-toluene-2,4-
 bis(1-aziridinecarboxamide), and trimethylolpropane-tri- β -(2-
 methylaziridine) propionate; tetrafunctional epoxy-based
 10 compounds such as N,N,N',N'-tetraglycidyl-m-xylenediamine and
 1,3-bis(N,N'-diglycidylaminomethyl) cyclohexane; and melamine-
 based compounds such as hexamethoxymethylolmelamine.

Among these, it is preferable to contain one or two or more
 selected from the group consisting of an epoxy-based compound,
 15 an isocyanate-based compound, and an aziridine-based compound.
 [0041]

From the viewpoint of improving the performance balance
 between the adhesive force and the heat resistance of the
 adhesive resin layer (B), a content of the crosslinking agent in
 20 the adhesive resin layer (B) is preferably 0.1 parts by mass or
 more, more preferably 1 part by mass or more, still more
 preferably 3 parts by mass or more, and even more preferably 5
 parts by mass or more, and is preferably 15 parts by mass or
 less, more preferably 10 parts by mass or less, and still more
 25 preferably 8 parts by mass or less, with respect to 100 parts by
 mass of the adhesive resin.

In addition, from the viewpoint of improving the

performance balance between the adhesive force and the heat resistance of the adhesive resin layer (B), a content of the crosslinking agent in the adhesive resin layer (B) is preferably 0.1 parts by mass or more and 15 parts by mass or less, more preferably 1 part by mass or more and 15 parts by mass or less, still more preferably 3 parts by mass or more and 10 parts by mass or less, and even more preferably 5 parts by mass or more and 8 parts by mass or less, with respect to 100 parts by mass of the adhesive resin.

10 [0042]

The adhesive resin layer (B) may include additives such as plasticizers and adhesion-imparting resins as other components. In a case where the adhesive resin layer (B) is a radiation crosslinking type adhesive resin layer, various additives for radiation crosslinking may be contained. From the viewpoint of improving the performance balance between the adhesive force and the heat resistance, a total content of the adhesive resin and the crosslinking agent in the adhesive resin layer (B) is preferably 50% by mass or more, more preferably 70% by mass or more, still more preferably 90% by mass or more, and even more preferably 95% by mass or more, in a case where the entire adhesive resin layer (B) is set to 100% by mass. Due to this, it is possible to further suppress the residue of the adhesive on the electronic component side when the adhesive film is peeled from the electronic component.

[0043]

In addition, in the adhesive film 100 according to the

present embodiment, from the viewpoint of stably holding the electronic component 70 on the adhesive resin layer (B) in a case of reducing the adhesive force of the adhesive resin layer (C) by the heating treatment to peel the support substrate from the adhesive resin layer (C), a total content of the gas generating component and the thermally expandable microspheres in the adhesive resin layer (B) is preferably 0.1% by mass or less, more preferably 0.05% by mass or less, and still more preferably 0.01% by mass or less, and it is even more preferable that the adhesive resin layer (B) does not contain the gas generating component and the thermally expandable microspheres, in a case where the entire adhesive resin layer (B) is set to 100% by mass.

[0044]

From the viewpoint of further improving the performance balance between the adhesive force and the heat resistance, a thickness of the adhesive resin layer (B) is preferably 1 μm or more, more preferably 3 μm or more, and still more preferably 5 μm or more, and is preferably 40 μm or less, more preferably 35 μm or less, still more preferably 30 μm or less, even more preferably 25 μm or less, and even still more preferably 20 μm or less.

In addition, from the viewpoint of further improving the performance balance between the adhesive force and the heat resistance, the thickness of the adhesive resin layer (B) is preferably 1 μm or more and 40 μm or less, more preferably 1 μm or more and 35 μm or less, still more preferably 1 μm or more

and 30 μm or less, even more preferably 3 μm or more and 25 μm or less, and even still more preferably 5 μm or more and 20 μm or less.

[0045]

5 [Adhesive Resin Layer (C)]

The adhesive resin layer (C) is a layer on the second surface A2 side of the base material layer (A).

The adhesive resin layer (C) is preferably a layer in which the adhesive force is reduced by a heating treatment. As a
10 result, the adhesive film 100 can be peeled from the support substrate by the heating treatment.

[0046]

From the viewpoint of further improving the heat peelability, the adhesive resin layer (C) according to the
15 present embodiment preferably contains one or two or more selected from the group consisting of a gas generating component and thermally expandable microspheres, and more preferably contains thermally expandable microspheres.

[0047]

20 In the adhesive resin layer (C) according to the present embodiment, the adhesive force is reduced or lost by heating at a temperature of preferably higher than 180°C, more preferably a temperature of 185°C or higher, still more preferably a temperature of 190°C or higher, even more preferably a
25 temperature of 195°C or higher, even still more preferably a temperature of 200°C or higher, even further preferably a temperature of 210°C or higher, and even further preferably a

temperature of 230°C or higher.

Such an adhesive resin layer (C) can be obtained by selecting the type of the gas generating component or the thermally expandable microspheres in the adhesive resin layer
5 (C).

Here, it is possible to evaluate the reduction or loss of the adhesive force by heating at a temperature over 180°C, for example, by the peeling strength from a stainless steel plate, measured after attaching the adhesive resin layer (C) side to
10 the stainless steel plate, performing a heating treatment at 140°C for one hour, and then heating at a temperature exceeding 180°C for two minutes. The specific heating temperature when heating at a temperature exceeding 180°C is set to a temperature exceeding the temperature at which gas is generated or the
15 temperature at which thermally expandable microspheres undergo heat expansion and is set as appropriate depending on the type of gas to be generated or the thermally expandable microspheres. In the present embodiment, loss of adhesive force means, for example, a case where the 180° peeling strength measured under
20 conditions of 23°C and a tensile speed of 300 mm/min is less than 0.5 N/25 mm.

[0048]

As the gas generating component, for example, it is possible to use an azo compound, an azide compound, a Meldrum's
25 acid derivative, or the like. In addition, as the gas generating component, for example, it is also possible to use inorganic foaming agents such as ammonium carbonate, ammonium

hydrogen carbonate, sodium hydrogen carbonate, ammonium nitrite, sodium borohydride, and various azides, and water; chlorofluoroalkane-based compounds such as trichloromonofluoromethane and dichloromonofluoromethane; azo-
5 based compounds such as azobisisobutyronitrile, azodicarbonamide, and barium azodicarboxylate; hydrazine-based compounds such as paratoluenesulfonyl hydrazide, diphenylsulfone-3,3'-disulfonylhydrazide, 4,4'-oxybis(benzenesulfonyl hydrazide) and
10 allylbis(sulfonylhydrazide); semicarbazide-based compounds such as p-toluylenesulfonyl semicarbazide, and 4,4'-oxybis(benzenesulfonyl semicarbazide); triazole-based compounds such as 5-morpholyl-1,2,3,4-thiatriazole; organic foaming agents such as N-nitroso compounds such as N,N'-
15 dinitrosopentamethylenetetramine, and N,N'-dimethyl-N,N'-dinitrosoterephthalamide, and the like. The gas generating component may be mixed with the adhesive resin (C1) or may be directly bonded to the adhesive resin (C1).

[0049]

20 As the thermally expandable microspheres, for example, a foaming agent that is microencapsulated can be used. Examples of such thermally expandable microspheres include microspheres in which a substance that is easily gasified and expanded by heating such as isobutane, propane, and pentane is sealed in a
25 shell having elasticity, or the like. Examples of the material forming the shell include vinylidene chloride-acrylonitrile copolymer, polyvinyl alcohol, polyvinyl butyral, polymethyl

methacrylate, polyacrylonitrile, polyvinylidene chloride, polysulfone, and the like. It is possible to manufacture thermally expandable microspheres by, for example, a coacervation method, an interfacial polymerization method, or
5 the like.

[0050]

In a case where the adhesive resin layer (C) according to the present embodiment contains thermally expandable microspheres, in a volume-based cumulative frequency
10 distribution curve measured for the thermally expandable microspheres in the adhesive resin layer (C) by a laser diffraction and scattering type particle size distribution measuring device, a maximum particle diameter D_{100} at a cumulative frequency of 100% is preferably 10 μm or more, more
15 preferably 15 μm or more, still more preferably 20 μm or more, even more preferably 25 μm or more, even still more preferably 30 μm or more, and even further preferably 35 μm or more, and is preferably 100 μm or less, more preferably 90 μm or less, still more preferably 80 μm or less, even more preferably 70 μm or
20 less, even still more preferably 60 μm or less, even further preferably 50 μm or less, and even further preferably 40 μm or less, from the viewpoint of further improving the heat peelability.

That is, in the volume-based cumulative frequency
25 distribution curve measured for the thermally expandable microspheres in the adhesive resin layer (C) according to the present embodiment by a laser diffraction and scattering type

particle size distribution measuring device, the maximum particle diameter D_{100} at a cumulative frequency of 100% is preferably 10 μm or more and 100 μm or less, more preferably 15 μm or more and 90 μm or less, still more preferably 20 μm or more and 80 μm or less, even more preferably 25 μm or more and 70 μm or less, even still more preferably 30 μm or more and 60 μm or less, even further preferably 35 μm or more and 50 μm or less, and even further preferably 35 μm or more and 40 μm or less, from the viewpoint of further improving the heat peelability.

[0051]

The thermally expandable microspheres having the maximum particle diameter D_{100} within the above-described range can be obtained by classifying the thermally expandable microspheres using a sieve. More specifically, the thermally expandable microspheres having the maximum particle diameter D_{100} within the above-described range can be obtained by classifying the thermally expandable microspheres using a sieve having an opening of preferably 100 μm or less, more preferably 90 μm or less, still more preferably 80 μm or less, even more preferably 70 μm or less, even still more preferably 60 μm or less, even further preferably 50 μm or less, and even further preferably 40 μm or less.

[0052]

From the viewpoint of further improving the heat peelability, a total content of the gas generating component and the thermally expandable microspheres in the adhesive resin

layer (C) is preferably 1 part by mass or more, more preferably 3 parts by mass or more, still more preferably 5 parts by mass or more, even more preferably 7 parts by mass or more, even still more preferably 11 parts by mass or more, even further 5 preferably 12 parts by mass or more, and even further preferably 14 parts by mass or more, and is preferably 150 parts by mass or less, more preferably 100 parts by mass or less, still more preferably 50 parts by mass or less, even more preferably 25 parts by mass or less, even still more preferably 20 parts by 10 mass or less, and even further preferably 18 parts by mass or less, with respect to 100 parts by mass of the adhesive resin (C1) in the adhesive resin layer (C).

In addition, from the viewpoint of further improving the heat peelability, a total content of the gas generating 15 component and the thermally expandable microspheres in the adhesive resin layer (C) is preferably 1 part by mass or more and 150 parts by mass or less, more preferably 3 parts by mass or more and 150 parts by mass or less, still more preferably 5 parts by mass or more and 100 parts by mass or less, even more 20 preferably 7 parts by mass or more and 50 parts by mass or less, even still more preferably 11 parts by mass or more and 25 parts by mass or less, even further preferably 12 parts by mass or more and 20 parts by mass or less, and even further preferably 14 parts by mass or more and 18 parts by mass or less, with 25 respect to 100 parts by mass of the adhesive resin (C1) in the adhesive resin layer (C).

It is preferable that the temperature at which the gas is

generated or the temperature at which the thermally expandable microspheres are thermally expanded is a temperature higher than 180°C.

[0053]

5 As the adhesive resin (C1) constituting the adhesive resin layer (C), it is preferably an adhesive resin (C1) including one or two or more selected from the group consisting of a (meth)acrylic adhesive resin, a silicone adhesive resin, a urethane adhesive resin, an olefin adhesive resin, a polyester
10 adhesive resin, a polyamide adhesive resin, a fluorine adhesive resin, and a styrene adhesive resin, and from the viewpoint of further improving the heat peelability, it is more preferably an adhesive resin (C1) including one or two or more selected from the group consisting of a (meth)acrylic adhesive resin, a
15 silicone adhesive resin, a urethane adhesive resin, an olefin adhesive resin, and a styrene adhesive resin, and from the viewpoint of easily adjusting the adhesive force and the like, it is still more preferably an adhesive resin (C1) including a (meth)acrylic adhesive resin.

20 [0054]

 The adhesive resin layer (C) according to the present embodiment preferably further includes a crosslinking agent (C2) having two or more crosslinkable functional groups in one molecule, in addition to the adhesive resin (C1).

25 The crosslinking agent (C2) having two or more crosslinkable functional groups in one molecule is used to react with the functional group of the adhesive resin (C1) and adjust

the adhesive force and cohesive force.

Examples of such a crosslinking agent (C2) include epoxy-based crosslinking agents such as sorbitol polyglycidyl ether, polyglycerol polyglycidyl ether, pentaerythritol polyglycidyl ether, diglycerol polyglycidyl ether, glycerol polyglycidyl ether, neopentyl glycol diglycidyl ether, and resorcin diglycidyl ether; isocyanate-based crosslinking agents such as tetramethylene diisocyanate, hexamethylene diisocyanate, toluene diisocyanate 3 adducts of trimethylolpropane, polyisocyanate, diphenylmethane diisocyanate, and tolylene diisocyanate; aziridine-based crosslinking agents such as trimethylolpropane-tri- β -aziridinypropionate, tetramethylolmethane-tri- β -aziridinypropionate, N,N'-diphenylmethane-4,4'-bis(1-aziridinecarboxamide), N,N'-hexamethylene-1,6-bis(1-aziridinecarboxamide), N,N'-toluene-2,4-bis(1-aziridinecarboxamide), and trimethylolpropane-tri- β -(2-methylaziridine) propionate; tetrafunctional epoxy-based crosslinking agents such as N,N,N',N'-tetraglycidyl-m-xylenediamine and 1,3-bis(N,N'-diglycidylaminomethyl)cyclohexane; and melamine-based crosslinking agents such as hexamethoxymethylolmelamine. These may be used alone or in a combination of two or more types.

From the viewpoint of further improving the performance balance between the adhesive force and the heat peelability, the adhesive resin layer (C) according to the present embodiment preferably contains one or two or more selected from the group consisting of an epoxy-based crosslinking agent, an isocyanate-

based crosslinking agent, and an aziridine-based crosslinking agent.

[0055]

A content of the crosslinking agent (C2) in the adhesive resin layer (C) is preferably in a range in which the number of functional groups in the crosslinking agent (C2) does not substantially exceed the number of functional groups in the adhesive resin (C1). However, in a case where a functional group is newly generated in the cross-linking reaction, a case where the cross-linking reaction is slow, or the like, the amount thereof may be greater as necessary.

From the viewpoint of further improving the performance balance between the adhesive force and the heat peelability, a lower limit value of the content of the crosslinking agent (C2) in the adhesive resin layer (C) is preferably 0.1 parts by mass or more, more preferably 0.5 parts by mass or more, still more preferably 1.0 part by mass or more, and even more preferably 2.0 parts by mass or more, with respect to 100 parts by mass of the adhesive resin (C1).

In addition, from the viewpoint of storage stability, an upper limit value of the content of the crosslinking agent (C2) in the adhesive resin layer (C) is preferably 10.0 parts by mass or less, more preferably 5.0 parts by mass or less, and still more preferably 3.0 parts by mass or less, with respect to 100 parts by mass of the adhesive resin (C1).

In addition, from the viewpoint of further improving the performance balance between the adhesive force, the heat

peelability, and the storage stability, a content of the crosslinking agent (C2) in the adhesive resin layer (C) is preferably 0.1 parts by mass or more and 10.0 parts by mass or less, more preferably 0.5 parts by mass or more and 10.0 parts by mass or less, still more preferably 1.0 part by mass or more and 5.0 parts by mass or less, and even more preferably 2.0 parts by mass or more and 3.0 parts by mass or less, with respect to 100 parts by mass of the adhesive resin (C1).

[0056]

10 From the viewpoint of further improving the adhesive force, the adhesive resin layer (C) according to the present embodiment preferably contains an adhesion-imparting resin in addition to the adhesive resin (C1). Containing an adhesion-imparting resin in the adhesive resin layer (C) is preferable for facilitating
15 adjustment of the adhesion to the support substrate near room temperature. The adhesion-imparting resin in which the softening point is 100°C or higher is preferable. Specific examples of adhesion-imparting resins include rosin-based resins such as rosin-based derivatives subjected to a treatment such as
20 esterification; terpene-based resins such as α -pinene-based, β -pinene-based, dipentene-based, and terpene phenol-based resins; natural rosin such as gum-based, wood-based, and tall oil-based rosin; petroleum resins obtained by hydrogenating, disproportionating, polymerizing, or maleating the natural
25 rosin; and coumarone-indene resins.

 Among these adhesion-imparting resins, the adhesive resin layer (C) according to the present embodiment preferably

contains an adhesion-imparting resin having a softening point in a range of 100°C or higher and 160°C or lower, and more preferably contains an adhesion-imparting resin having a softening point in a range of 120°C or higher and 150°C or lower.

[0057]

From the viewpoint of further improving the adhesive force to the support substrate during the operation, a content of the adhesion-imparting resin in the adhesive resin layer (C) is preferably 1 part by mass or more, and more preferably 2 parts by mass or more, and from the viewpoint of further improving the performance balance between the adhesive force to the support substrate and the attachability at room temperature, it is preferably 100 parts by mass or less and more preferably 50 parts by mass or less, with respect to 100 parts by mass of the adhesive resin (C1).

In addition, from the viewpoint of further improving the adhesive force to the support substrate during the operation and the attachability at room temperature, a content of the adhesion-imparting resin in the adhesive resin layer (C) is preferably 1 part by mass or more and 100 parts by mass or less, and more preferably 2 parts by mass or more and 50 parts by mass or less, with respect to 100 parts by mass of the adhesive resin (C1).

[0058]

The adhesive resin layer (C) may include additives such as plasticizers as other components. In a case where the entire

adhesive resin layer (C) is set to 100% by mass, the lower limit value of the total content of the adhesive resin (C1), the crosslinking agent (C2), and the adhesion-imparting resin in the adhesive resin layer (C) is preferably 50% by mass or more, more preferably 70% by mass or more, still more preferably 90% by mass or more, and even more preferably 95% by mass or more. Further, in a case where the adhesive resin layer (C) is a heat expansion type adhesive resin layer, in a case where the entire adhesive resin layer (C) is set to 100% by mass, a lower limit value of the total content of the adhesive resin (C1), the crosslinking agent (C2), the adhesion-imparting resin, the gas generating component, and the thermally expandable microspheres in the adhesive resin layer (C) is preferably 50% by mass or more, more preferably 70% by mass or more, still more preferably 90% by mass or more, and even more preferably 95% by mass or more.

The upper limit value thereof is not particularly limited, but is, for example, 100% by mass or less.

[0059]

The adhesive resin layer (C) may be a single layer or a multilayer.

From the viewpoint of further improving the performance balance between the adhesive force and the heat peelability, a thickness of the adhesive resin layer (C) is preferably 10 μm or more, more preferably 15 μm or more, still more preferably 20 μm or more, and even more preferably 25 μm or more, and from the viewpoint of improving the handleability of the adhesive film

100, it is preferably 100 μm or less, more preferably 80 μm or less, and still more preferably 50 μm or less.

In addition, from the viewpoint of further improving the performance balance between the adhesive force, the heat

5 peelability, and the handleability of the adhesive film 100, a thickness of the adhesive resin layer (C) is preferably 10 μm or more and 100 μm or less, more preferably 15 μm or more and 100 μm or less, still more preferably 20 μm or more and 80 μm or less, and even more preferably 25 μm or more and 50 μm or less.

10 [0060]

[Intermediate Layer (D)]

The adhesive film 100 according to the present embodiment may further include the intermediate layer (D).

The adhesive film 100 according to the present embodiment
15 preferably further contains an intermediate layer (D) in at least one of between the base material layer (A) and the adhesive resin layer (B) or between the base material layer (A) and the adhesive resin layer (C), and more preferably further contains an intermediate layer (D) between the base material
20 layer (A) and the adhesive resin layer (C). FIG. 2 is a cross-sectional view schematically showing a structure of the adhesive film 100 in a case where the intermediate layer (D) is located between the base material layer (A) and the adhesive resin layer (C).

25 The intermediate layer (D) can be provided for a purpose such as an unevenness absorbing resin layer and an impact absorbing layer.

[0061]

The intermediate layer (D) preferably contains a thermoplastic resin, more preferably contains one or two or more resins selected from the group consisting of a polyolefin-based resin, a polystyrene-based resin, a (meth)acrylic-based resin, a urethane-based resin, a silicone-based resin, a polyester-based resin, a polyamide-based resin, and a fluorine-based resin, and still more preferably contains one or two or more resins selected from the group consisting of a polyolefin-based resin, a polystyrene-based resin, and a (meth)acrylic-based resin.

[0062]

From the viewpoint of improving the unevenness absorbing property of the adhesive film 100, a thickness of the intermediate layer (D) is preferably 5 μm or more, more preferably 10 μm or more, still more preferably 15 μm or more, and even more preferably 20 μm or more, and is preferably 100 μm or less, more preferably 80 μm or less, still more preferably 60 μm or less, and even more preferably 50 μm or less.

In addition, from the viewpoint of improving the unevenness absorbing property of the adhesive film 100, a thickness of the intermediate layer (D) is preferably 5 μm or more and 100 μm or less, more preferably 10 μm or more and 80 μm or less, still more preferably 15 μm or more and 60 μm or less, and even more preferably 20 μm or more and 50 μm or less.

[0063]

From the viewpoint of further improving the performance balance between the adhesive force and the heat peelability, in

the adhesive film 100 according to the present embodiment, in a case where a thickness of the adhesive resin layer (C) is P [μm] and a maximum particle diameter D_{100} of the thermally expandable microspheres is R [μm], the following expression (1) is

5 preferably satisfied.

$$0.8R < P \leq 1.5R \quad (1)$$

[0064]

[Method for Producing Adhesive Film]

Next, an example of a method for producing the adhesive
10 film 100 according to the present embodiment will be described.

The adhesive film 100 according to the present embodiment can be formed by, for example, a method of applying the adhesive resin layer (B) and the adhesive resin layer (C) to the base material layer (A), a method of transferring the adhesive resin
15 layer (B) and the adhesive resin layer (C) formed on a separator to the base material layer (A), or the like.

In addition, the adhesive film 100 according to the present embodiment may be formed by laminating (stacking) the adhesive resin layer (B), the base material layer (A), and the adhesive
20 resin layer (C) in this order. In addition, the adhesive resin layer (B), the base material layer (A), and the adhesive resin layer (C) may be formed in this order by co-extrusion molding.

In a case where the adhesive film 100 according to the present embodiment contains the intermediate layer (D), for
25 example, the adhesive film 100 can be formed by a method of co-extruding the adhesive resin layer (B), the base material layer (A), the intermediate layer (D), and the adhesive resin layer

(C) in this order, a method of laminating (stacking) the base material layer (A) and the intermediate layer (D) and then applying the adhesive resin layer (B) and the adhesive resin layer (C), a method of laminating (stacking) the base material layer (A) and the intermediate layer (D) and then transferring the adhesive resin layer (B) and the adhesive resin layer (C) formed on a separator to the base material layer (A) and the intermediate layer (D), or the like.

[0065]

10 Examples of the method of applying the adhesive resin layer (B) and the adhesive resin layer (C) to the base material layer (A) include a method of applying an adhesive coating solution capable of forming the adhesive resin layer (B) and the adhesive resin layer (C). As a method for coating the adhesive coating solution, it is possible to adopt a coating method known in the related art, for example, a roll coater method, a reverse roll coater method, a gravure roll method, a bar coating method, a comma coater method, a die coater method, or the like. The drying conditions of the adhesive coating solution are not particularly limited, but are generally preferably drying for 10 seconds to 10 minutes in a temperature range of 80°C to 200°C. More preferably, the drying is performed at 80°C to 170°C for 15 seconds to 5 minutes.

25 In the adhesive coating solution, in order to sufficiently promote the crosslinking reaction between the crosslinking agent and the adhesive resin, the adhesive coating solution may be heated at 40°C to 80°C for about 5 to 300 hours after the drying

of the adhesive coating solution is completed.

[0066]

[Method for Producing Electronic Device]

The method for producing the electronic device according to
5 the present embodiment will be described with reference to the
drawings. FIG. 3 is a cross-sectional view schematically
showing a method for producing an electronic device of the
embodiment according to the present invention.

The method for producing the electronic device according to
10 the present embodiment includes a step of preparing a structure
200 including the adhesive film 100, the electronic component 70
attached to the adhesive resin layer (B) of the adhesive film
100, and the support substrate 80 attached to the adhesive resin
layer (C) of the adhesive film 100, and a step of sealing the
15 electronic component 70 with a sealing material 90.

[0067]

From the viewpoint of further suppressing the displacement
of the electronic component 70, the support substrate 80
preferably includes at least one selected from the group
20 consisting of a stainless steel substrate and a glass substrate.

[0068]

Examples of the electronic component 70 include a
semiconductor chip such as an IC, LSI, discrete component, light
emitting diode, or light receiving element, a semiconductor
25 panel, a semiconductor package, and the like.

The surface of the electronic component 70 has an uneven
structure, for example, by having electrodes.

In addition, the electrodes are, for example, bonded with respect to the electrodes formed on the mounting surface when the electronic device is mounted on the mounting surface, so as to form an electrical connection between the electronic device
5 and the mounting surface (mounting surface of a printed substrate or the like).

Examples of electrodes include bump electrodes such as ball bumps, printing bumps, stud bumps, plating bumps, pillar bumps, and the like. That is, the electrode is, for example, a
10 protruding electrode. These bump electrodes may be used alone or in combination of two or more kinds thereof.

In addition, the type of the metal forming the bump electrode is not particularly limited and examples thereof include silver, gold, copper, tin, lead, bismuth, alloys
15 thereof, and the like. These types of metal may be used alone or in combination of two or more kinds thereof.

[0069]

In the step of sealing the electronic component 70 with the sealing material 90, a plurality of the electronic components 70
20 may be collectively sealed with the sealing material 90, or may be individually sealed.

As a method of individually coating each of the plurality of electronic components 70 with the sealing material 90, it is preferable to use one or two or more methods selected from the
25 group consisting of a 3D printer method, a spray method, a screen printing method, and an ink jet method, and it is more preferable to use the 3D printer method.

[0070]

As the sealing material 90, a known sealing material can be used as long as the sealing material has high insulating properties, but from the viewpoint of further improving the affinity of the sealing material 90 to the adhesive film 100 and further sealing the electronic component 70 more uniformly, the sealing material 90 preferably includes an epoxy resin-based sealing material.

As such an epoxy resin-based sealing material, for example, it is possible to use the T693/R4000 series, the T693/R1000 series, the T693/R5000 series, and the like, manufactured by Nagase Chemtex Corporation.

The sealing material 90 may be in a solid state or a liquid state, but from the viewpoint of being able to perform the sealing step at a low temperature and low pressure and further suppress the displacement of the electronic component 70 in the sealing step, the sealing material is preferably in a liquid state.

[0071]

From the viewpoint of further suppressing the displacement of the electronic component 70, a thickness of the sealing material 90 after coating the electronic component 70 is preferably 1.0 μm or more, more preferably 1.5 μm or more, still more preferably 5.0 μm or more, even more preferably 10.0 μm or more, even still more preferably 30.0 μm or more, even still more preferably 50.0 μm or more, even still more preferably 100.0 μm or more, even still more preferably 200.0 μm or more,

and even still more preferably 300.0 μm or more, and is preferably 2000.0 μm or less, more preferably 1500.0 μm or less, still more preferably 1000.0 μm or less, and even more preferably 500.0 μm or less.

5 In addition, from the viewpoint of further suppressing the displacement of the electronic component 70, a thickness of the sealing material 90 after the coating of the electronic component 70 is preferably 1.0 μm or more and 2000.0 μm or less, more preferably 1.5 μm or more and 2000.0 μm or less, still more
10 preferably 5.0 μm or more and 2000.0 μm or less, even more preferably 10.0 μm or more and 2000.0 μm or less, even still more preferably 30.0 μm or more and 2000.0 μm or less, even further preferably 50.0 μm or more and 2000.0 μm or less, even further preferably 100.0 μm or more and 1500.0 μm or less, even
15 further preferably 200.0 μm or more and 1000.0 μm or less, and even further preferably 300.0 μm or more and 500.0 μm or less.

[0072]

From the viewpoint of further improving the work efficiency of the step of sealing the electronic component 70 with the
20 sealing material 90, a sealing temperature in the step of sealing the electronic component 70 with the sealing material 90 is preferably 10°C or higher, more preferably 15°C or higher, and still more preferably 20°C or higher, and from the viewpoint of further suppressing the displacement of the electronic
25 component 70, it is preferably 45°C or lower, more preferably 40°C or lower, still more preferably 35°C or lower, and even more preferably 30°C or lower.

In addition, from the viewpoint of further improving the work efficiency of the step of sealing the electronic component 70 with the sealing material 90 and further suppressing the displacement of the electronic component 70, a sealing

5 temperature in the step of sealing the electronic component 70 with the sealing material 90 is preferably 10°C or higher and 45°C or lower, more preferably 10°C or higher and 40°C or lower, still more preferably 15°C or higher and 35°C or lower, and even more preferably 20°C or higher and 30°C or lower.

10 The sealing temperature in the present embodiment refers to a set temperature in a device used for sealing the electronic component 70.

[0073]

From the viewpoint of improving the reliability of the
15 electronic device, a sealing pressure in the step of sealing the electronic component 70 with the sealing material 90 is preferably 30 kPa or more, more preferably 50 kPa or more, still more preferably 70 kPa or more, and even more preferably 90 kPa or more, and from the viewpoint of further suppressing the
20 displacement of the electronic component 70, the sealing pressure is preferably 150 kPa or less, more preferably 130 kPa or less, and still more preferably 110 kPa or less.

In addition, from the viewpoint of improving the reliability of the electronic device and further suppressing the
25 displacement of the electronic component 70, a sealing pressure in the step of sealing the electronic component 70 with the sealing material 90 is preferably 30 kPa or higher and 150 kPa

or lower, more preferably 50 kPa or higher and 150 kPa or lower, still more preferably 70 kPa or higher and 130 kPa or lower, and even more preferably 90 kPa or higher and 110 kPa or lower. In addition, the sealing pressure in the step of sealing the
5 electronic component 70 with the sealing material 90 is still more preferably normal pressure.

The sealing pressure in the present embodiment refers to a set pressure in a device used for sealing the electronic component 70.

10 [0074]

The method for producing the electronic device according to the present embodiment preferably further includes a step of curing the sealing material 90. As a result, the electronic component 70 can be fixed, and the displacement of the
15 electronic component 70 can be further suppressed.

Examples of a method of curing the sealing material 90 include a method of treating the sealing material 90 with one or two methods selected from the group consisting of light irradiation and a heating treatment, and from the viewpoint of
20 further suppressing the displacement of the electronic component 70, it is preferable to cure the sealing material 90 by light irradiation.

[0075]

The method of curing the sealing material 90 by light
25 irradiation is preferably a method of curing the sealing material 90 by crosslinking the sealing material 90 by irradiating the sealing material 90 with light such as

ultraviolet rays. As the light source used in this case, it is preferable to use a light source capable of emitting ultraviolet rays including a wavelength component capable of exciting a photoinitiator, and it is more preferable to use a light source
5 capable of emitting ultraviolet rays including a component having a wavelength of less than 300 nm.

The method of curing the sealing material 90 by the heating treatment is preferably a method of curing the sealing material 90 by thermal crosslinking with an oven, thermal crosslinking
10 with a hot plate, thermal crosslinking with infrared irradiation, or the like. In a case of thermal crosslinking, the heating temperature is, for example, 100°C to 180°C, and the heating treatment time is, for example, 10 to 180 minutes. The heating temperature is preferably a temperature not exceeding a
15 temperature at which the gas is generated in the adhesive film 100 or a temperature at which the thermally expandable microspheres are thermally expanded.

[0076]

In the method for producing the electronic device according
20 to the present embodiment, it is preferable to further include a step of peeling the support substrate 80 from the structure 200 by reducing the adhesive force of the adhesive resin layer (C) by the heating treatment.

After sealing the electronic component 70, for example, it
25 is possible to easily remove the support substrate 80 from the adhesive film 100 by heating to a temperature exceeding 180°C to reduce the adhesive force of the adhesive resin layer (C).

It is preferable that the step of peeling the support substrate 80 from the structure 200 by reducing the adhesive force of the adhesive resin layer (C) by the heating treatment is performed after the step of sealing the electronic component 5 70 with the sealing material 90, and it is more preferable that the step is performed after the step of curing the sealing material 90.

[0077]

In the method for producing the electronic device according 10 to the present embodiment, it is preferable to further include a step of peeling the adhesive film 100 from the plurality of electronic components 70. As a result of this step, the electronic device is obtained.

Examples of the method for peeling the adhesive film 100 15 from the electronic component 70 include a mechanical peeling method, a method of peeling after reducing the adhesive force on the surface of the adhesive film 100, or the like.

It is preferable that the step of peeling the adhesive film 100 from the plurality of electronic components 70 is performed 20 after the step of sealing the electronic component 70 with the sealing material 90, it is more preferable that the step is performed after the step of curing the sealing material 90, and it is still more preferable that the step is performed after the step of peeling the support substrate 80 from the structure 200 25 by reducing the adhesive force of the adhesive resin layer (C) by the heating treatment.

[0078]

The adhesive film 100 according to the present embodiment can be preferably used for manufacturing an electronic device including a fan-out type package. That is, the electronic device obtained by the method for producing the electronic
5 device according to the present embodiment includes a fan-out type package. In the fan-out type package, since the terminals can be spread to the outside of the chip (fan out), the fan-out type package can be adopted even in an application in which the number of terminals is larger than the chip area. In addition,
10 since the package substrate is not required, thinning is also possible.

[0079]

The embodiments according to the present invention have been described above. However, these are examples of the
15 present invention, and various configurations other than the above can be adopted.

[0080]

In addition, the present invention is not limited to the above-described embodiments, and modifications, improvements,
20 and the like within a range where the object of the present invention can be achieved are included in the present invention.

Examples

[0081]

Hereinafter, the present invention will be specifically
25 described using Examples, but the present invention is not limited to thereto.

[0082]

Details of the materials used to manufacture the adhesive film are as follows.

[0083]

<Adhesive Resin Solution SB1>

5 0.5 parts by mass of 4,4'-azobis-4-cyanobutyric acid
(manufactured by Otsuka Chemical Co., Ltd., trade name: ACVA) as
a polymerization initiator, 74.3 parts by mass of n-butyl
acrylate, 13.7 parts by mass of methyl methacrylate, 9 parts by
mass of 2-hydroxyethyl methacrylate, and 3 parts by mass of a
10 compound obtained by introducing a polymerizable 1-propenyl
group into a benzene ring of an ammonium salt of a sulfuric acid
ester of polyoxyethylene nonylphenyl ether (manufactured by DKS
Co., Ltd., trade name: AQUARON HS-1025) were charged into
deionized pure water, and emulsion polymerization was carried
15 out at 70°C to 72°C for 8 hours with stirring to obtain an
acrylic resin emulsion. The result was neutralized with aqueous
ammonia (pH = 7.0) to obtain an adhesive resin solution SB1
having a solid content concentration of 42.5%.

[0084]

20 <Adhesive Resin Solution SB2>

0.5 parts by mass of ammonium persulfate as a
polymerization initiator, 63 parts by mass of 2-ethylhexyl
acrylate, 22 parts by mass of n-butyl acrylate, 9 parts by mass
of methyl methacrylate, 3 parts by mass of 2-hydroxyethyl
25 methacrylate, 1 part by mass of polytetramethylene glycol
diacrylate (manufactured by NOF Corporation, trade name: ADT-
250), and 2 parts by mass of a compound obtained by introducing

a polymerizable 1-propenyl group into a benzene ring of an ammonium salt of a sulfuric acid ester of polyoxyethylene nonylphenyl ether (manufactured by DKS Co., Ltd., trade name: Aqualon HS-1025) were charged into deionized pure water, and
5 emulsion polymerization was carried out at 70°C to 72°C for 8 hours with stirring to obtain an acrylic resin emulsion. The result was neutralized (pH=7.0) with ammonia water to obtain an adhesive resin solution SB2 having a solid content concentration of 56.5%.

10 [0085]

<Adhesive Coating Solution B>

57.4 parts by mass of the adhesive resin solution SB1, 42.6 parts by mass of the adhesive resin solution SB2, 0.4 parts by mass of dimethyl ethanolamine, and 3.4 parts by mass of epoxy-
15 based compound (manufactured by Nagase Chemtex Corporation, trade name: Ex-1610), as a crosslinking agent, were each mixed to obtain an adhesive coating solution B.

[0086]

<Adhesive Resin Solution SC1>

20 0.536 parts by mass of t-butyl peroxy-2-ethylhexanoate (manufactured by NOF Corporation, trade name: PERBUTYL (registered trademark)), 34.9 parts by mass of 2-ethylhexyl acrylate, 41 parts by mass of n-butyl acrylate, 14.7 parts by mass of ethyl acrylate, and 9.4 parts by mass of 2-hydroxyethyl
25 methacrylate were charged into a mixed solvent containing ethyl acetate and toluene, and solution polymerization was carried out at 83°C to 87°C for 11 hours with stirring to obtain an acrylic

adhesive resin solution having a concentration of solid contents of 45% by mass. The above was used as an adhesive resin solution SC1.

[0087]

5 <Adhesive Coating Solution C1>

100 parts by mass of the adhesive resin solution SC1, 2.25 parts by mass of a rosin-based resin (manufactured by Arakawa Chemical Industries, Ltd., trade name: Pencel D-125) (5 parts by mass with respect to 100 parts by mass of the adhesive resin),
10 1.2 parts by mass of an isocyanate-based crosslinking agent (manufactured by Mitsui Chemicals, Inc., trade name: OLESTER P49-75S) (2.7 parts by mass with respect to 100 parts by mass of the adhesive resin), and 6.75 parts by mass of thermally expandable microspheres (manufactured by Sekisui Chemical Co.,
15 Ltd., trade name: ADVANCEL EM-503, maximum particle diameter D_{100} : 38 μm , a sieve passing fraction in a case of classification using a metal mesh having an opening of 38 μm was used) (15 parts by mass with respect to 100 parts by mass of the adhesive resin) were mixed, and the concentration of solid contents was
20 adjusted to 30% with ethyl acetate to prepare an adhesive coating solution C1.

[0088]

 <Adhesive Coating Solution C2>

100 parts by mass of the adhesive resin solution SC1, 2.25
25 parts by mass of a rosin-based resin (manufactured by Arakawa Chemical Industries, Ltd., trade name: Pencel D-125) (5 parts by mass with respect to 100 parts by mass of the adhesive resin),

1.2 parts by mass of an isocyanate-based crosslinking agent (manufactured by Mitsui Chemicals, Inc., trade name: OLESTER P49-75S) (2.7 parts by mass with respect to 100 parts by mass of the adhesive resin), and 4.5 parts by mass of thermally expandable microspheres (manufactured by Sekisui Chemical Co., Ltd., trade name: ADVANCEL EM-503, maximum particle diameter D_{100} : 38 μm , a sieve passing fraction in a case of classification using a metal mesh having an opening of 38 μm was used) (10 parts by mass with respect to 100 parts by mass of the adhesive resin) were mixed, and the concentration of solid contents was adjusted to 30% with ethyl acetate to prepare an adhesive coating solution C2.

[0089]

<Adhesive Coating Solution C3>

100 parts by mass of the adhesive resin solution SC1, 2.25 parts by mass of a rosin-based resin (manufactured by Arakawa Chemical Industries, Ltd., trade name: Pencil D-125) (5 parts by mass with respect to 100 parts by mass of the adhesive resin), 1.2 parts by mass of an isocyanate-based crosslinking agent (manufactured by Mitsui Chemicals, Inc., trade name: OLESTER P49-75S) (2.7 parts by mass with respect to 100 parts by mass of the adhesive resin), and 6.75 parts by mass of thermally expandable microspheres (manufactured by Sekisui Chemical Co., Ltd., trade name: ADVANCEL EM-503, maximum particle diameter D_{100} : 42 μm , a sieve passing fraction in a case of classification using a metal mesh having an opening of 42 μm was used) (15 parts by mass with respect to 100 parts by mass of the adhesive

resin) were mixed, and the concentration of solid contents was adjusted to 30% with ethyl acetate to prepare an adhesive coating solution C3.

[0090]

5 <Adhesive Coating Solution C4>

100 parts by mass of the adhesive resin solution SC1, 2.25 parts by mass of a rosin-based resin (manufactured by Arakawa Chemical Industries, Ltd., trade name: Pencel D-125) (5 parts by mass with respect to 100 parts by mass of the adhesive resin),
10 1.2 parts by mass of an isocyanate-based crosslinking agent (manufactured by Mitsui Chemicals, Inc., trade name: OLESTER P49-75S) (2.7 parts by mass with respect to 100 parts by mass of the adhesive resin), and 6.75 parts by mass of thermally expandable microspheres (manufactured by Kureha Corporation,
15 trade name: H1100-S, maximum particle diameter D_{100} : 60 μm , not classified) (15 parts by mass with respect to 100 parts by mass of the adhesive resin) were mixed, and the concentration of solid contents was adjusted to 30% with ethyl acetate to prepare an adhesive coating solution C4.

20 [0091]

[Example 1]

The adhesive coating solution B was applied onto a polyethylene terephthalate (PET) film (thickness: 38 μm) as the base material layer (A), and dried to form an adhesive resin
25 layer (B) having a thickness of 10 μm . Next, the adhesive coating solution C1 was applied onto a surface of the PET film opposite to the adhesive resin layer (B), and heated by raising

the temperature from 75°C to 120°C at a constant rate over 80 seconds to form an adhesive resin layer (C) having a thickness of 47 μm , thereby obtaining an adhesive film 1.

[0092]

5 [Example 2]

An adhesive film 2 was obtained by the same method as in Example 1, except that the heating treatment conditions of the adhesive coating solution C1 in Example 1 were changed to heating at 120°C for 3 minutes.

10 [0093]

[Comparative Examples 1 and 2]

An adhesive film 2 and an adhesive film 3 were obtained by the same method as in Example 1, except that the adhesive coating solution C1 used for forming the adhesive resin layer (C) in Example 1 was changed to the adhesive coating solution C2 and the adhesive coating solution C3, respectively, and the heating treatment conditions of the adhesive coating solutions C2 and C3 were changed to heating at 120°C for 5 minutes.

[0094]

20 [Example 3]

An adhesive film 4 was obtained by the same method as in Example 1, except that the adhesive coating solution C1 used for forming the adhesive resin layer (C) in Example 1 was changed to the adhesive coating solution C4.

25 [0095]

<Evaluation>

[Adhesive Force]

The adhesive films obtained in each of Examples and Comparative Examples were cut into 500 mm x 25 mm, and the adhesive resin layer (C) side of the adhesive film was bonded to a stainless steel plate (ϕ 320 mm, thickness: 2.0 mm) for compression molding. Thereafter, the 180° peeling strength was measured by peeling the adhesive film from the stainless steel plate under conditions of 23°C, a peeling angle of 180°, and a tensile speed of 300 mm/min, and the measured 180° peeling strength was defined as the adhesive force before heating.

10 The adhesive film was attached to the stainless steel plate using a 2 kgf rubber roller at an attachment speed of 300 mm/min for one round trip.

In addition, the adhesive film attached to the stainless steel plate was heated at 140°C for 1 hour and then heated at 15 190°C for 2 minutes. After natural cooling, the 180° peeling strength was measured by peeling the adhesive film from the stainless steel plate under conditions of 23°C, a peeling angle of 180°, and a tensile speed of 300 mm/min, and the measured 180° peeling strength was defined as the adhesive force after 20 heating. The adhesive force before and after the heating is shown in Table 1.

[0096]

[Arithmetic Average Height Sa, Maximum Height Sz]

The adhesive films obtained in each of Examples and Comparative Examples were cut into 5 cm x 5 cm and interposed 25 between two SUS plates having a size of 15 cm x 15 cm. Next, the adhesive film was subjected to a pressurization and heating

treatment for 1 minute under conditions of a temperature of 190°C, a load of 100 kN, and a humidity of 65% Rh. In this case, the load is a load applied to the entire SUS plate.

Thereafter, the surface height (arithmetic average height S_a and
5 maximum height S_z) of the surface of the adhesive resin layer (C) in contact with the SUS plate was measured in accordance with ISO25178 using a surface roughness measuring device (trade name "P-11", manufactured by Tencor). The results are shown in Table 1.

10 [0097]

[Heat Peelability]

The adhesive resin layer (C) side of the adhesive film obtained in each of Examples and Comparative Examples was bonded to a stainless steel plate ($\phi 320$ mm, thickness: 2.0 mm) for
15 compression molding.

Next, as the electronic component, 500 silicon chips having a pattern of 1.5 mm x 1.5 mm were placed on the adhesive resin layer (B) of the adhesive film to obtain a structure. Thereafter, the structure was heated at 150°C for 1 hour.

20 Next, using a compression molding machine, the silicon chip on the adhesive resin layer (B) was sealed by compression molding (125°C, 500 seconds) with a liquid epoxy resin-based sealing material (manufactured by Nagase Chemtex Corporation, trade name: R4212-2C). As a result, a structure in which a
25 sealing resin wafer ($\phi 300$ mm, thickness: 550 μ m) was formed on the stainless steel plate was obtained.

The obtained structure was post-mold cured under conditions

of 150°C and 1 hour.

Thereafter, the adhesive film was peeled from the stainless steel plate by heating at 190°C for 60 seconds.

This test was performed 10 times for each of the adhesive films obtained in each of Examples and Comparative Examples, and the peeling success rate was calculated from the following expression (peeling success rate (%) = [(number of times the adhesive film was peeled from the stainless steel plate)/10] x 100). The results are shown in Table 1.

10 [0098]

[Displacement of Silicon Chip]

For the structure obtained in the evaluation of the [heat peelability], the displacement of the silicon chip was visually observed and evaluated according to the following standard.

15 No: No displacement of the silicon chip was observed

Yes: Displacement was observed in at least a part of the silicon chip

[0099]

[Table 1]

		Example 1	Example 2	Comparative Example 1	Comparative Example 2	Example 3
Type of adhesive coating solution for forming adhesive resin layer (C)		C1	C1	C2	C3	C4
Maximum particle diameter D ₁₀₀ of thermally expandable microspheres [μm]		38	38	38	42	60
Adhesive force [N/25 mm]	Before heating	5.5	5.5	5.5	5.5	5.5
	After heating	0.00	0.00	0.02	0.02	0.00
Arithmetic average height [μm]		9.1	8.2	4.2	5.0	50.0
Maximum height [μm]		214.7	144.7	22.1	31.4	500.0
Heat peelability [%]		100	100	90	90	100
Displacement of silicon chip		No	No	No	No	Yes

[0100]

It was confirmed that the heat peelability of the adhesive film 100 according to the present embodiment could be improved by setting the arithmetic average height Sa of the adhesive resin layer (C) after the pressurization and heating treatment for 1 minute under conditions of a temperature of 190°C, a load of 100 kN, and a humidity of 65% Rh to a specific numerical range.

[0101]

10 This application claims priority based on Japanese Patent Application No. 2023-201053 filed on November 28, 2023, the entirety of the disclosure of which is incorporated herein.

REFERENCE SIGNS LIST

15 [0102]

A base material layer (A)
 B adhesive resin layer (B)
 C adhesive resin layer (C)
 D intermediate layer (D)
 20 A1 first surface of base material layer (A)
 A2 second surface of base material layer (A)
 70 electronic component
 80 support substrate
 90 sealing material
 25 100 adhesive film
 200 structure

CLAIMS

[Claim 1]

An adhesive film comprising:

5 a base material layer (A);

an adhesive resin layer (B) for temporarily fixing an electronic component on a first surface side of the base material layer (A); and

10 an adhesive resin layer (C) on a second surface side of the base material layer (A),

wherein an arithmetic average height S_a of a surface of the adhesive resin layer (C) opposite to the base material layer (A) is 5.5 μm or more, in a case where a test piece having a size of 5 cm x 5 cm is produced from the adhesive film, and the test
15 piece is subjected to a pressurization and heating treatment for 1 minute under conditions of a temperature of 190°C, a load of 100 kN, and a humidity of 65% Rh in a state of being interposed between two SUS plates having a size of 15 cm x 15 cm.

20 [Claim 2]

The adhesive film according to Claim 1,

which can be used for temporarily fixing the electronic component in a case of sealing the electronic component with a sealing material.

25

[Claim 3]

The adhesive film according to Claim 1 or 2,

wherein a maximum height Sz of a surface of the adhesive resin layer (C) opposite to the base material layer (A) is 50 μm or more, in a case where a test piece having a size of 5 cm x 5 cm is produced from the adhesive film, and the test piece is
5 subjected to a pressurization and heating treatment for 1 minute under conditions of a temperature of 190°C, a load of 100 kN, and a humidity of 65% Rh in a state of being interposed between two SUS plates having a size of 15 cm x 15 cm.

10 [Claim 4]

The adhesive film according to any one of Claims 1 to 3,
wherein the adhesive resin layer (B) includes one or two or more selected from the group consisting of a (meth)acrylic adhesive resin, a silicone adhesive resin, a urethane adhesive
15 resin, an olefin adhesive resin, and a styrene adhesive resin.

[Claim 5]

The adhesive film according to any one of Claims 1 to 4,
wherein a total content of a gas generating component and
20 thermally expandable microspheres in the adhesive resin layer (B) is 0.1% by mass or less, in a case where the entire adhesive resin layer (B) is set to 100% by mass.

[Claim 6]

25 The adhesive film according to any one of Claims 1 to 5,
wherein a thickness of the adhesive resin layer (B) is 1 μm or more and 40 μm or less.

[Claim 7]

The adhesive film according to any one of Claims 1 to 6,
wherein the adhesive resin layer (C) is a layer in which an
5 adhesive force is reduced by a heating treatment.

[Claim 8]

The adhesive film according to Claim 7,
wherein the adhesive resin layer (C) contains one or two or
10 more selected from the group consisting of a gas generating
component and thermally expandable microspheres.

[Claim 9]

The adhesive film according to Claim 8,
15 wherein the adhesive resin layer (C) contains thermally
expandable microspheres, and
in a cumulative frequency distribution curve based on a
volume of the thermally expandable microspheres, which is
measured by a laser diffraction and scattering type particle
20 size distribution measuring device, a maximum particle diameter
 D_{100} at a cumulative frequency of 100% is 10 μm or more and 100
 μm or less.

[Claim 10]

25 The adhesive film according to any one of Claims 7 to 9,
wherein the adhesive resin layer (C) is a layer in which an
adhesive force is reduced by heating at a temperature exceeding

180°C.

[Claim 11]

The adhesive film according to any one of Claims 1 to 10,
5 wherein the adhesive resin layer (C) includes one or two or
more selected from the group consisting of a (meth)acrylic
adhesive resin, a silicone adhesive resin, a urethane adhesive
resin, an olefin adhesive resin, and a styrene adhesive resin.

10 [Claim 12]

The adhesive film according to any one of Claims 1 to 11,
wherein a thickness of the adhesive resin layer (C) is 10
μm or more and 100 μm or less.

15 [Claim 13]

The adhesive film according to any one of Claims 1 to 12,
wherein the base material layer (A) includes one or two or
more selected from the group consisting of polypropylene,
polyethylene terephthalate, polyethylene naphthalate, polyamide,
20 and polyimide.

[Claim 14]

The adhesive film according to any one of Claims 1 to 13,
further comprising:

25 an intermediate layer (D) in at least one of between the
base material layer (A) and the adhesive resin layer (B) or
between the base material layer (A) and the adhesive resin layer

(C).

[Claim 15]

The adhesive film according to Claim 14,
5 wherein a thickness of the intermediate layer (D) is 5 μm
or more and 100 μm or less.

[Claim 16]

A method for producing an electronic device, the method
10 comprising:

 a step of preparing a structure including the adhesive film
according to any one of Claims 1 to 15, an electronic component
attached to the adhesive resin layer (B) of the adhesive film,
and a support substrate attached to the adhesive resin layer (C)
15 of the adhesive film; and

 a step of sealing the electronic component with a sealing
material.

[Claim 17]

20 The method for producing an electronic device according to
Claim 16, further comprising:

 a step of peeling the support substrate from the structure
by reducing an adhesive force of the adhesive resin layer (C) by
a heating treatment.

25

[Claim 18]

The method for producing an electronic device according to

Claim 16 or 17, further comprising:

a step of peeling the adhesive film from the electronic component.

5 [Claim 19]

The method for producing an electronic device according to any one of Claims 16 to 18,

wherein the sealing material includes an epoxy resin-based sealing material.

10

[Claim 20]

The method for producing an electronic device according to any one of Claims 16 to 19,

15 wherein the electronic device includes a fan-out type package.