[DESCRIPTION]

[TITLE OF INVENTION]

ADHESIVE SHEET FOR WORKPIECE PROCESSING AND METHOD FOR MANUFACTURING SAME, AND METHOD FOR MANUFACTURING ELECTRONIC DEVICE

[Technical Field]

[0001]

The present invention relates to a pressure sensitive adhesive sheet for workpiece processing, a method for manufacturing the same, and a method for manufacturing an electronic device.

[Background Art]

[0002]

As information terminal devices are rapidly becoming thinner, smaller, and more multifunctional, electronic devices such as semiconductor devices mounted on these devices are also required to be thinner and denser.

As a method for thinning an electronic device, a method of grinding a back surface of a workpiece such as a semiconductor wafer used for the electronic device has been performed. The back surface grinding of the workpiece is performed in a state where a pressure sensitive adhesive sheet for workpiece processing for back surface grinding (hereinafter also referred to as "back grinding sheet") is attached to the front surface of the workpiece, and the front surface of the workpiece is protected by the sheet. The back grinding sheet is peeled off and removed from the front surface of the workpiece after the back grinding.

[0003]

In recent years, a pre-dicing method, a stealth pre-dicing method, and the like have been practically used as a grinding method and a singulation method for thinning a workpiece while suppressing damage to the workpiece. The pre-dicing method is a method in which a groove having a predetermined depth is formed on a surface of a workpiece with a dicing blade or the like, and then the workpiece is ground from the back surface side to the groove to be singulated into workpiece singulated products. The stealth pre-dicing method is a method in which a modified region is formed inside a workpiece through irradiation with a laser beam, the workpiece is ground from the back surface side, and the workpiece is singulated into workpiece singulated products by cleaving the modified region as a split starting point. In these methods as well, a back grinding sheet for protecting the front surface of the workpiece is used.

[0004]

The pressure sensitive adhesive sheet for workpiece processing is required to have good grinding properties for stably retaining a workpiece and suppressing generation of cracks and the like in the workpiece when the workpiece is processed.

As the pressure sensitive adhesive sheet for workpiece processing, for example, there has been proposed a pressure sensitive adhesive tape for semiconductor processing including a base material, a buffer layer provided on at least one surface side of the base material, and a pressure sensitive adhesive layer provided on the other surface side of the base material, wherein the buffer layer has a Young's modulus at 23°C of from 10 to 400 MPa and a breaking energy of from 1 to 9 MJ/m^3, and the base material has a Young's modulus at 23°C larger than the Young's modulus of the buffer layer (see Patent Document 1).

[Citation List]

[Patent Document]

[0005]

Patent Document 1: WO 2020/003920

[Summary of Invention]

[Technical Problem]

[0006]

In the pressure sensitive adhesive tape for semiconductor processing of Patent Document 1, the buffer layer is provided to absorb vibration generated at the time of grinding the workpiece, to alleviate unevenness due to foreign matters, and to stably retain the workpiece in a flat manner.

[0007]

In the pressure sensitive adhesive sheet for workpiece processing, odor due to the constituent components of the pressure sensitive adhesive sheet may be generated during manufacturing, storage, or use. In response to the recent increase in awareness of the working environment, low odor properties are required also for a pressure sensitive adhesive sheet for workpiece processing, but it has been difficult to obtain excellent low odor properties while maintaining good grinding properties of a workpiece.

[0008]

The present invention has been made in view of the above-described circumstances, and an object of the present invention is to provide a pressure sensitive adhesive sheet for workpiece processing having excellent low odor properties and grinding properties, a method for manufacturing the pressure sensitive adhesive sheet, and a method for manufacturing an electronic device using the pressure sensitive adhesive sheet for workpiece processing.

[Solution to Problem]

[0009]

As a result of intensive studies, the inventors of the present invention have found that the above-described problems can be solved by providing a buffer layer containing a cured product of a thermosetting resin composition in a pressure sensitive adhesive sheet for workpiece processing, and have completed the following present invention.

[0010]

That is, the present invention relates to the following [1] to [10].

[1] A pressure sensitive adhesive sheet for workpiece processing including a buffer layer, a base material, and a pressure sensitive adhesive layer,

wherein the buffer layer is a layer containing a cured product of a thermosetting resin composition.

[2] The pressure sensitive adhesive sheet for workpiece processing according to [1], wherein the thermosetting resin composition contains a polyester-based resin.

[3] The pressure sensitive adhesive sheet for workpiece processing according to [2], wherein the polyester-based resin is a polyester urethane resin.

[4] The pressure sensitive adhesive sheet for workpiece processing according to [2] or [3], wherein the polyester-based resin is a polyester-based resin having two or more hydroxy groups, and the thermosetting resin composition further contains a polyvalent isocyanate compound.

[5] The pressure sensitive adhesive sheet for workpiece processing according to any one of [1] to [4], wherein the buffer layer is provided on one surface side of the base material, and the pressure sensitive adhesive layer is provided on the other surface side of the base material.

[6] The pressure sensitive adhesive sheet for workpiece processing according to any one of [1] to [5], wherein the pressure sensitive adhesive sheet is used for grinding a workpiece.

[7] The pressure sensitive adhesive sheet for workpiece processing according to any one of [1] to [5], wherein the workpiece includes a groove in a front surface or has a modified region inside of the workpiece, and the pressure sensitive adhesive sheet for workpiece processing is used for singulating the workpiece into a plurality of workpiece singulated products starting from the groove or the modified region by grinding a back surface of the workpiece in a state where the pressure sensitive adhesive sheet for workpiece processing attached to the front surface of the workpiece is fixed.

[8] A method for manufacturing the pressure sensitive adhesive sheet for workpiece processing described in any one of [1] to [7],

the method including a step of curing the thermosetting resin composition by heating.

[9] A method for manufacturing an electronic device, the method including:

a step of attaching the pressure sensitive adhesive sheet for workpiece processing described in any one of [1] to [7] to a front surface of a workpiece with the pressure sensitive adhesive layer as an attachment surface; and

a step of grinding a back surface of the workpiece in a state where the pressure sensitive adhesive sheet for workpiece processing attached to the workpiece is fixed.

[10] A method for manufacturing an electronic device, the method including:

a split-planned line formation step as Step a of forming a groove on a front surface of a workpiece or Step b of forming a modified region inside the workpiece from the front surface or a back surface of the workpiece;

a sheet attachment step of attaching the pressure sensitive adhesive sheet for workpiece processing described in any one of [1] to [7] to the front surface of the workpiece with the pressure sensitive adhesive layer as an attachment surface after Step a or before or after Step b; and

a grinding and singulation step of grinding the back surface of the workpiece in a state where the pressure sensitive adhesive sheet for workpiece processing attached to the workpiece is fixed, and singulating the workpiece into a plurality of workpiece singulated products starting from the groove or the modified region.

[Advantageous Effects of Invention]

[0011]

The present invention can provide a pressure sensitive adhesive sheet for workpiece processing excellent in low odor properties and grinding properties, and a method for manufacturing an electronic device using the pressure sensitive adhesive sheet for workpiece processing.

[Description of Embodiments]

[0012]

In the present specification, the lower and upper limit values of a preferable numerical range described in stages can each be independently combined. For example, from the description "preferably from 10 to 90, more preferably from 30 to 60", the "preferred lower limit value (10)" and the "more preferred upper limit value (60)" can be combined as "from 10 to 60".

[0013]

In the present specification, an "active ingredient" refers to a component excluding a diluent solvent from components contained in a target composition.

[0014]

In the present specification, the number-average molecular weight (Mn) and the mass-average molecular weight (Mw) are values measured by gel permeation chromatography (GPC) method in terms of standard polystyrene, and specifically are values measured based on the method described in Examples.

[0015]

In the present specification, for example, "(meth)acrylic acid" refers to both "acrylic acid" and "methacrylic acid", and the same applies to other similar terms.

[0016]

In the present specification, the "energy ray" means an electromagnetic wave or a charged particle beam having an energy quantum, and examples include ultraviolet rays, radiation, and electron beams. The ultraviolet rays can be irradiated by using, for example, an electrodeless lamp, a high-pressure mercury lamp, a metal halide lamp, or a UV-LED as an ultraviolet ray source. The electron beam can be generated by an electron beam accelerator or the like and irradiated.

In the present specification, "energy ray-polymerizable" refers to a property of being polymerized through irradiation with energy rays. "Energy ray-curable" refers to a property of curing through irradiation with an energy ray, and "non-energy ray-curable" means a property of not curing with an energy ray.

[0017]

In the present specification, "workpiece" refers to a plate-like body to which the pressure sensitive adhesive sheet for workpiece processing of the present embodiment is attached and then processed.

Examples of the workpiece include a wafer, a panel level package, and a strip (strip-shaped substrate) sealed with a mold resin, and among these, a wafer is preferable from the viewpoint of easily obtaining the effect of the present invention.

The wafer may be, for example, a semiconductor wafer such as a silicon wafer, a gallium arsenide wafer, a silicon carbide wafer, a gallium nitride wafer, or an indium phosphide wafer, or may be an insulator wafer such as a glass wafer, a lithium tantalate wafer, or a lithium niobate wafer. The wafer may be a reconfigured wafer including a

resin and a semiconductor used for producing a fan-out package or the like. Among these, from the viewpoint of easily obtaining the effect of the present invention, the wafer is preferably a semiconductor wafer or an insulator wafer, more preferably a semiconductor wafer, still more preferably a silicon wafer.

Circuits such as wiring, capacitors, diodes, and transistors are usually formed on a surface of a semiconductor wafer. These circuits can be formed by a known method such as an etching method or a lift-off method.

The thickness of the workpiece before processing is not particularly limited, but is usually from 500 to 1000 μm.

[0018]

In the present specification, "workpiece singulated product" refers to a product obtained by splitting a workpiece. For example, when the workpiece is a semiconductor wafer, the workpiece singulated product is a semiconductor chip, and when the workpiece is a panel level package or a strip (strip-shaped substrate) subjected to mold resin sealing, the workpiece singulated product is a semiconductor package.

[0019]

In the present specification, examples of "electronic device" include a workpiece, a workpiece singulated product, an electronic component including the workpiece singulated product, and electronic equipment including the electronic component.

[0020]

In the present specification, “front surface” of the workpiece refers to a surface on which a circuit is formed, and “back surface” refers to a surface on which no circuit is formed.

[0021]

The mechanism of action described in the present specification is a presumption, and does not limit the mechanism of exerting the effect of the pressure sensitive adhesive sheet for workpiece processing of the present invention.

[0022]

[Pressure Sensitive Adhesive Sheet for Workpiece Processing]

A pressure sensitive adhesive sheet for workpiece processing (hereinafter, also referred to as "pressure sensitive adhesive sheet") of the present embodiment includes a buffer layer, a base material, and a pressure sensitive adhesive layer, in which the buffer layer is a layer containing a cured product of a thermosetting resin composition.

[0023]

The pressure sensitive adhesive sheet of the present embodiment is attached to a surface of a workpiece, and is used to perform predetermined processing on the workpiece while protecting the surface. After the predetermined processing is performed on the workpiece, the pressure sensitive adhesive sheet of the present embodiment is peeled and removed from the workpiece.

[0024]

A lamination configuration of the pressure sensitive adhesive sheet of the present embodiment is not particularly limited as long as the pressure sensitive adhesive layer can be attached to the workpiece. For example, the pressure sensitive adhesive sheet may have a buffer layer on one surface side of the base material and have a pressure sensitive adhesive layer on the other surface side of the base material, or may have the base material, the buffer layer, and the pressure sensitive adhesive layer in this order. Among these, from the viewpoint of easily obtaining better grinding properties, a pressure sensitive adhesive sheet having a buffer layer on one surface side of a base

material and having a pressure sensitive adhesive layer on the other surface side of the base material is preferable.

[0025]

The pressure sensitive adhesive sheet of the present embodiment may have a layer other than the buffer layer, the base material, or the pressure sensitive adhesive layer, but it does not have to have a layer other than the buffer layer, the base material, or the pressure sensitive adhesive layer.

Examples of the layer other than the buffer layer, the base material, or the pressure sensitive adhesive layer include an intermediate layer provided between the base material and the pressure sensitive adhesive layer, and a release sheet provided on a surface of the pressure sensitive adhesive sheet.

Hereinafter, each member constituting the pressure sensitive adhesive sheet of the present embodiment will be described in order.

[0026]

<Buffer Layer>

The pressure sensitive adhesive sheet of the present embodiment has a buffer layer, and thus can absorb vibration, impact, and the like generated when processing such as grinding is performed on the workpiece, and can prevent the occurrence of cracks in the workpiece. Further, by providing the buffer layer, unevenness of a foreign matter or the like present on the table of a support device can be absorbed, and the retention property of the support device retaining the pressure sensitive adhesive sheet can improve.

[0027]

The buffer layer included in the pressure sensitive adhesive sheet of the present embodiment is a layer containing a cured product of a thermosetting resin composition.

When the buffer layer is a layer containing a cured product of a thermosetting resin composition, the pressure sensitive adhesive sheet of the present embodiment is excellent in low odor properties and grinding properties. The reason for this is not clear, but is presumed as follows. It is considered that the raw material constituting the thermosetting resin composition forms a cross-linked structure through heating. When the cross-linked structure is formed, the raw material causing odor hardly remains, and thus, the odor of the buffer layer is suppressed, and excellent low odor properties are obtained. Further, it is considered that the workpiece can be favorably held at the time of grinding the workpiece due to favorable form retention property resulting from the cross-linked structure of the cured product of the thermosetting resin composition, and excellent grinding properties are obtained.

[0028]

The buffer layer included in the pressure sensitive adhesive sheet of the present embodiment is a layer containing a cured product of a thermosetting resin composition.

The content of the cured product of the thermosetting resin composition in the buffer layer included in the pressure sensitive adhesive sheet of the present embodiment is preferably from 90 to 100 mass%, more preferably from 95 to 100 mass%, still more preferably from 98 to 100 mass% from the viewpoint of low odor properties and grinding properties, and the buffer layer included in the pressure sensitive adhesive sheet of the present embodiment is preferably a cured product of a thermosetting resin composition formed into a layer (that is, the buffer layer included in the pressure sensitive adhesive sheet of the present embodiment is composed only of the cured product of the thermosetting resin composition).

Hereinafter, the thermosetting resin composition will be described in detail.

[0029]

(Thermosetting Resin Composition)

The thermosetting resin composition is not particularly limited as long as it is a resin composition having thermosetting properties.

The thermosetting resin contained in the thermosetting resin composition may be one that exhibits thermosetting properties alone, or one that exhibits thermosetting properties when used in combination with one or more selected from the group consisting of a cross-linking agent and a catalyst.

[0030]

[Thermosetting Resin]

Examples of the thermosetting resin include an epoxy resin, a phenol resin, a silicone resin, a melamine resin, an acrylic resin, and a polyester-based resin. Among these, a polyester-based resin is preferable from the viewpoint of low odor properties and grinding properties.

One thermosetting resin may be used alone, or two or more thermosetting resins may be used in combination.

[0031]

Examples of the polyester-based resin include polymers obtained through condensation polymerization of alcohol components such as ethylene oxide or propylene oxide adducts of ethylene glycol, propylene glycol, 1,3-butanediol, 1,4-butanediol, diethylene glycol, triethylene glycol, 1,5-pentanediol, 1,6-hexanediol, neopentyl glycol, cyclohexane-1,4-dimethanol, hydrogenated bisphenol A, and bisphenol A, and carboxylic acid components such as terephthalic acid, isophthalic acid, naphthalenedicarboxylic acid, cyclohexane-1,4-dicarboxylic acid, adipic acid, azelaic acid, maleic acid, fumaric acid, itaconic acid, and acid anhydrides thereof.

One of the alcohol components and one of the carboxylic acid components may each be used alone, or two or more thereof may be used in combination.

[0032]

The polyester-based resin may be a resin obtained by modifying polyester, and is preferably a polyester urethane resin obtained by urethane-modifying polyester from the viewpoint of low odor properties and grinding properties. In the present specification, the polyester urethane resin is included in the concept of a polyester-based resin, and a preferred embodiment of the polyester-based resin can be read as a preferred embodiment of the polyester urethane resin.

Examples of the polyester urethane resin include those obtained by reacting a polyvalent isocyanate compound with a polyester polyol having a hydroxy group at its terminal obtained through condensation polymerization of the alcohol component and the carboxylic acid component.

The polyvalent isocyanate compound as a raw material component of the polyester urethane resin may be any compound of an aromatic polyvalent isocyanate compound, an aliphatic polyvalent isocyanate compound, and an alicyclic polyvalent isocyanate compound. Specific examples of the polyvalent isocyanate compound include diisocyanate compounds such as diphenylmethane diisocyanate, tolylene diisocyanate, 1,3-xylylene diisocyanate, isophorone diisocyanate, and 1,6-hexane diisocyanate.

One of the polyester polyols and one of the polyvalent isocyanate compounds as raw material components of the polyester urethane resin may each be used alone, or two or more thereof may be used in combination.

[0033]

The polyester-based resin has a reactive functional group for thermal curing, and from the viewpoint of improving the thermal curability, a polyester-based resin having two or more hydroxy groups is preferable, and a polyester-based resin having two or more hydroxy groups at its molecular terminals is more preferable. The "molecular terminals" of the polyester-based resin are both terminals when the polyester-based resin is linear, and also include the terminal of the branched chain when the polyester-based resin has a branched chain. Among these, the polyester-based resin is linear, and preferably has hydroxy groups at its both terminals.

[0034]

The glass transition temperature (Tg) of the polyester-based resin is not particularly limited, but is preferably from 50 to 140°C, more preferably from 60 to 120°C, still more preferably from 70 to 110°C.

When the glass transition temperature (Tg) of the polyester-based resin is equal to or more than the lower limit value, excessive deformation of the buffer layer tends to be suppressed when the workpiece is processed. When the glass transition temperature (Tg) of the polyester-based resin is equal to or less than the upper limit value, the effect of absorbing vibration, impact, and the like generated during grinding of the workpiece and the retention property for the pressure sensitive adhesive sheet tend to improve.

The glass transition temperature (Tg) of the polyester-based resin can be measured in accordance with JIS K 7121:2012.

[0035]

The number-average molecular weight (Mn) of the polyester-based resin is not particularly limited, but is preferably from 5,000 to 100,000, more preferably from 10,000 to 70,000, still more preferably from 15,000 to 50,000.

When the number-average molecular weight (Mn) of the polyester-based resin is equal to or more than the lower limit value, excessive deformation of the buffer layer tends to be suppressed when the workpiece is processed. When the number-average molecular weight (Mn) of the polyester-based resin is equal to or less than the upper limit value, the effect of absorbing vibration, impact and the like generated at the time of grinding the workpiece and the retention property for the pressure sensitive adhesive sheet tend to improve.

[0036]

The hydroxyl value of the polyester-based resin is not particularly limited, but is preferably from 0.5 to 30 KOHmg/g, more preferably from 1 to 25 KOHmg/g, still more preferably from 2 to 20 KOHmg/g.

When the hydroxyl value of the polyester-based resin is equal to or more than the lower limit value, the thermosetting property improves, the low odor properties improve, and excessive deformation of the buffer layer tends to be suppressed when the workpiece is processed. When the hydroxyl value of the polyester-based resin is equal to or less than the upper limit value, there is a tendency that the effect of absorbing vibration, impact, and the like generated at the time of grinding the workpiece and the retention property for the pressure sensitive adhesive sheet improve.

The hydroxyl value of the polyester-based resin can be measured in accordance with JIS K 0070:1992.

[0037]

When the thermosetting resin composition contains a polyester-based resin, the content of the polyester-based resin in the thermosetting resin composition is not particularly limited, but is preferably from 30 to 98 mass%, more preferably from 50 to

98 mass%, still more preferably from 70 to 98 mass% with respect to the total solid content (100 mass%) of the thermosetting resin composition.

When the content of the polyester-based resin is within the above-described range, the low odor properties and the grinding properties tend to further improve.

In the present specification, the "total solid content of the thermosetting resin composition" means a component other than the solvent contained in the thermosetting resin composition, and the component other than the solvent is regarded as a solid content even when the component is liquid at room temperature (23°C).

[0038]

As a method for molding a polyester-based resin, processing through extrusion molding is generally performed, but because extrusion molding requires heating the polyester-based resin to a high temperature, facilities and energy load are large, and it is difficult to obtain good productivity. Further, it is also difficult to obtain excellent quality stability because problems specific to extrusion molding may occur, such as the generation of clumps called fish eyes. On the other hand, in the pressure sensitive adhesive sheet of the present embodiment, because a polyester-based resin is used as a raw material of the thermosetting resin composition, a buffer layer of uniform quality can be formed under relatively mild heating conditions. Thus, the pressure sensitive adhesive sheet of the present embodiment is excellent in productivity and also excellent in quality stability.

[0039]

The content of the thermosetting resin in the thermosetting resin composition is not particularly limited, but is preferably from 30 to 98 mass%, more preferably from 50 to 98 mass%, still more preferably from 70 to 98 mass% with respect to the total solid content (100 mass%) of the thermosetting resin composition.

When the content of the thermosetting resin is in the above-described range, the low odor properties and the grinding properties tend to further improve.

[0040]

[Cross-Linking Agent]

The thermosetting resin composition may contain a cross-linking agent for cross-linking the thermosetting resin as necessary. One cross-linking agent may be used alone, or two or more thereof may be used in combination.

As the cross-linking agent, a known compound can be applied depending on the type of the reactive group of the thermosetting resin to be cross-linked, and examples thereof include an isocyanate-based cross-linking agent, an epoxy-based cross-linking agent, an amine-based cross-linking agent, a melamine-based cross-linking agent, an aziridine-based cross-linking agent, a hydrazine-based cross-linking agent, an aldehyde-based cross-linking agent, an oxazoline-based cross-linking agent, a metal alkoxide-based cross-linking agent, a metal chelate-based cross-linking agent, a metal salt-based cross-linking agent, and an ammonium salt-based cross-linking agent.

Among the above-described cross-linking agents, when the thermosetting resin composition contains a polyester-based resin having two or more hydroxy groups, the cross-linking agent is preferably an isocyanate-based cross-linking agent from the viewpoint of improving the thermosetting property. The isocyanate-based cross-linking agent is preferably a polyvalent isocyanate compound. Since the polyvalent isocyanate compound has reactivity with a hydroxy group, a polyester-based resin having a hydroxy group can be bound to form a cross-linked structure.

The number of isocyanate groups contained in the polyvalent isocyanate compound may be, for example, two or three, or three or more, depending on the type of thermosetting resin to be cross-linked.

[0041]

Examples of the polyvalent isocyanate compound include aromatic isocyanates such as tolylene diisocyanate, diphenylmethane diisocyanate, xylylene diisocyanate, 1,3,5-triisocyanate benzene, 1,3,5-triisocyanate methylbenzene, 2,4,6-triisocyanate toluene, and triphenylmethane-4,4',4''-triisocyanate; alicyclic isocyanate compounds such as dicyclohexylmethane-4,4'-diisocyanate, bicycloheptane triisocyanate, cyclopentylene diisocyanate, cyclohexylene diisocyanate, methylcyclohexylene diisocyanate, and hydrogenated xylylene diisocyanate; and aliphatic isocyanate such as hexamethylene diisocyanate, trimethylhexamethylene diisocyanate, and lysine diisocyanate.

The polyvalent isocyanate compound may be a modified product such as: a biuret form or an isocyanurate form of the compounds exemplified above; and an adduct which is a reaction product of these compounds with a non-aromatic low molecular active hydrogen-containing compound such as ethylene glycol, trimethylolpropane, or castor oil.

Among these, an adduct of trimethylolpropane is preferable from the viewpoint that good reactivity is easily obtained.

[0042]

When the thermosetting resin composition contains the polyester-based resin having two or more hydroxy groups and the polyvalent isocyanate compound, the content of the polyvalent isocyanate compound in the thermosetting resin composition is not particularly limited, but is preferably from 1 to 15 parts by mass with respect to 100 parts by mass of the polyester-based resin having two or more hydroxy groups.

When the content of the polyvalent isocyanate compound is within the above-described range, the low odor properties and grinding properties of the pressure sensitive adhesive sheet tend to further improve.

[0043]

[Catalyst]

The thermosetting resin composition may contain a catalyst for promoting the thermosetting reaction of the thermosetting resin as necessary. One catalyst may be used alone, or two or more thereof may be used in combination.

Examples of the catalyst include an organometallic compound and a tertiary amine compound. Among these, an organometallic compound is preferable from the viewpoint of reactivity.

The organometallic compound is preferably a tin-based organometallic compound, and examples thereof include dibutyltin diacetate, dibutyltin dioctoate, dibutyltin dilaurate, dibutyltin bis(2-ethylhexanoate), dibutyltin dineodecanoate, dioctyltin diacetate, dioctyltin dioctoate, dioctyltin dilaurate, dioctyltin bis(2-ethylhexanoate), dioctyltin dineodecanoate, and the like. Among these, dioctyltin dilaurate is preferable from the viewpoint of reactivity. Examples of other organometallic compounds include metal acylates (for example, an octylic acid compound, a naphthenic acid compound, a stearic acid compound, and the like) such as bismuth, titanium, zirconium, zinc, and iron, metal chelates, metal alkoxides, and the like. One of these may be used alone, or two or more thereof may be used in combination.

[0044]

When the thermosetting resin composition contains a catalyst, the content of the catalyst in the thermosetting resin composition is not particularly limited, but is

preferably from 0.01 to 10 parts by mass, more preferably from 0.05 to 5 parts by mass, still more preferably from 0.1 to 1 part by mass, with respect to 100 parts by mass of the thermosetting resin.

When the content of the catalyst is within the above-described range, the thermosetting reaction can proceed uniformly and sufficiently.

[0045]

[Additional Component]

The thermosetting resin composition may contain an additional component as long as the effects of the present invention are not impaired. Examples of the additional component include resin components other than the above-described resins; and other additives such as an antistatic agent, an antioxidant, a softener, a filler, a rust inhibitor, a pigment, and a dye.

[0046]

(Young's Modulus of Buffer Layer)

The Young's modulus of the buffer layer at 23°C is not particularly limited, but is preferably from 200 to 4000 MPa, more preferably from 1000 to 3500 MPa, still more preferably from 1500 to 3200 MPa.

When the Young's modulus of the buffer layer at 23°C is equal to or more than the lower limit value, excessive deformation of the buffer layer tends to be suppressed when the workpiece is processed. When the Young's modulus of the buffer layer at 23°C is equal to or less than the upper limit value, the effect of absorbing vibration, impact, and the like generated at the time of grinding the workpiece and the retention property for the pressure sensitive adhesive sheet tend to improve.

The Young's modulus of the buffer layer at 23°C can be measured by the method described in Examples.

[0047]

(Thickness of Buffer Layer)

The thickness of the buffer layer is not particularly limited, but is preferably from 2 to 100 μm, more preferably from 3 to 60 μm, still more preferably from 4 to 40 μm, yet still more preferably from 5 to 30 μm.

When the thickness of the buffer layer is equal to or more than the lower limit value, the effect of absorbing vibration, impact, and the like generated at the time of grinding the workpiece and the retention property for the pressure sensitive adhesive sheet tends to increase. When the thickness of the buffer layer is equal to or less than the upper limit value, excessive deformation of the buffer layer tends to be suppressed when the workpiece is processed, and the buffer layer tends to be excellent in economic efficiency.

[0048]

<Pressure Sensitive Adhesive Layer>

The pressure sensitive adhesive layer is not particularly limited, but is preferably a layer formed of an energy ray-curable pressure sensitive adhesive. By forming the pressure sensitive adhesive layer from the energy ray-curable pressure sensitive adhesive, the surface of the workpiece can be satisfactorily protected by sufficient adhesiveness before the energy ray curing, and the peel strength is reduced after the energy ray curing, thus, the pressure sensitive adhesive layer can be easily peeled off from the workpiece.

[0049]

Examples of the energy ray-curable pressure sensitive adhesive include the following X-type pressure sensitive adhesive composition, Y-type pressure sensitive adhesive composition, and XY-type pressure sensitive adhesive composition.

X-type pressure sensitive adhesive composition: an energy ray-curable pressure sensitive adhesive composition containing a non-energy ray-curable pressure sensitive adhesive resin (hereinafter, also referred to as "pressure sensitive adhesive resin I") and an energy ray-curable compound other than the pressure sensitive adhesive resin.

Y-type pressure sensitive adhesive composition: an energy ray-curable pressure sensitive adhesive composition containing an energy ray-curable pressure sensitive adhesive resin (hereinafter, also referred to as "pressure sensitive adhesive resin II") in which an unsaturated group is introduced into a side chain of a non-energy ray-curable pressure sensitive adhesive resin, and containing no energy ray-curable compound other than the pressure sensitive adhesive resin.

XY-type pressure sensitive adhesive composition: an energy ray-curable pressure sensitive adhesive composition containing the energy ray-curable pressure sensitive adhesive resin II and an energy ray-curable compound other than the pressure sensitive adhesive resin.

Among these, the energy ray-curable pressure sensitive adhesive is preferably an XY-type pressure sensitive adhesive composition. By using the XY-type pressure sensitive adhesive composition, there is a tendency that the pressure sensitive adhesive composition has sufficient adhesiveness before curing, and the peel strength to the workpiece can be sufficiently reduced after curing.

[0050]

The pressure sensitive adhesive that forms the pressure sensitive adhesive layer may be a layer formed of a non-energy ray-curable pressure sensitive adhesive that does not cure even when irradiated with energy rays. Examples of the non-energy ray-curable pressure sensitive adhesive include those containing the pressure sensitive

adhesive resin I but not containing the pressure sensitive adhesive resin II or the energy ray-curable compound.

[0051]

Next, each component constituting the pressure sensitive adhesive layer will be described in more detail.

In the following description, "pressure sensitive adhesive resin" is used as a term indicating one or both of the pressure sensitive adhesive resin I and the pressure sensitive adhesive resin II. In the following description, "pressure sensitive adhesive composition" refers to a concept including an X-type pressure sensitive adhesive composition, a Y-type pressure sensitive adhesive composition, an XY-type pressure sensitive adhesive composition, and pressure sensitive adhesive compositions other than these.

[0052]

Examples of the pressure sensitive adhesive resin include an acrylic resin, a urethane-based resin, a rubber-based resin, and a silicone-based resin. Among these, an acrylic resin is preferred.

[0053]

(Acrylic Resin)

The acrylic resin preferably contains a constituent unit derived from an alkyl (meth)acrylate.

Examples of the alkyl (meth)acrylate include an alkyl (meth)acrylate having an alkyl group having from 1 to 20 carbon atoms.

The alkyl group of the alkyl (meth)acrylate may be linear or branched.

[0054]

From the viewpoint of further improving the adhesive strength of the pressure sensitive adhesive layer, the acrylic resin preferably contains a constituent unit derived from an alkyl (meth)acrylate in which the alkyl group has 4 or more carbon atoms.

The constituent unit derived from the alkyl (meth)acrylate in which the alkyl group contained in the acrylic resin has 4 or more carbon atoms may be one alone or two or more.

The number of carbon atoms of the alkyl group of the alkyl (meth)acrylate having an alkyl group having 4 or more carbon atoms is preferably from 4 to 12, more preferably from 4 to 8, still more preferably from 4 to 6.

Examples of the alkyl (meth)acrylate having an alkyl group having 4 or more carbon atoms include butyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, n-octyl (meth)acrylate, isooctyl (meth)acrylate, nonyl (meth)acrylate, decyl (meth)acrylate, undecyl (meth)acrylate, and dodecyl (meth)acrylate. Among these, butyl (meth)acrylate is preferable, and butyl acrylate is more preferable.

When the acrylic resin contains a constituent unit derived from an alkyl (meth)acrylate having an alkyl group having 4 or more carbon atoms, the content thereof is preferably from 30 to 90 mass%, more preferably from 40 to 80 mass%, still more preferably from 45 to 60 mass% in the acrylic resin from the viewpoint of further improving the adhesive strength of the pressure sensitive adhesive layer.

[0055]

The acrylic resin preferably contains a constituent unit derived from an alkyl (meth)acrylate having an alkyl group having 4 or more carbon atoms and a constituent unit derived from an alkyl (meth)acrylate having an alkyl group having from 1 to 3 carbon atoms, from the viewpoint of improving the storage elastic modulus G’ and the adhesive property of the pressure sensitive adhesive layer.

The constituent unit derived from the alkyl (meth)acrylate in which the alkyl group contained in the acrylic resin has from 1 to 3 carbon atoms may be one alone or two or more.

Examples of the alkyl (meth)acrylate having an alkyl group having from 1 to 3 carbon atoms include methyl (meth)acrylate, ethyl (meth)acrylate, isopropyl (meth)acrylate, and n-propyl (meth)acrylate. Among these, methyl (meth)acrylate and ethyl (meth)acrylate are preferable, methyl (meth)acrylate is more preferable, and methyl methacrylate is still more preferable.

When the acrylic resin contains a constituent unit derived from an alkyl (meth)acrylate having an alkyl group having from 1 to 3 carbon atoms, the content thereof is preferably from 1 to 35 mass%, more preferably from 5 to 30 mass%, still more preferably from 15 to 25 mass% in the acrylic resin.

[0056]

The acrylic resin preferably further contains a constituent unit derived from a functional group-containing monomer.

When the acrylic resin contains a constituent unit derived from a functional group-containing monomer, a functional group as a cross-linking starting point that reacts with a cross-linking agent or a functional group that reacts with an unsaturated group-containing compound to enable introduction of an unsaturated group into a side chain of the acrylic resin can be introduced.

The constituent unit derived from the functional group-containing monomer contained in the acrylic resin may be one alone or two or more.

[0057]

Examples of the functional group-containing monomer include a hydroxyl group-containing monomer, a carboxy group-containing monomer, an amino group-

containing monomer, and an epoxy group-containing monomer. Among these, a hydroxyl group-containing monomer and a carboxy group-containing monomer are preferable, and a hydroxyl group-containing monomer is more preferable.

Examples of the hydroxyl group-containing monomer include hydroxyalkyl (meth)acrylates such as 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 3-hydroxypropyl (meth)acrylate, 2-hydroxybutyl (meth)acrylate, 3-hydroxybutyl (meth)acrylate, and 4-hydroxybutyl (meth)acrylate; and unsaturated alcohols such as vinyl alcohol and allyl alcohol.

Examples of the carboxy group-containing monomer include ethylenically unsaturated monocarboxylic acids such as (meth)acrylic acid and crotonic acid; ethylenically unsaturated dicarboxylic acids such as fumaric acid, itaconic acid, maleic acid, and citraconic acid, and anhydrides thereof; and 2-carboxyethyl methacrylate.

[0058]

When the acrylic resin contains a constituent unit derived from a functional group-containing monomer, the content thereof is not particularly limited, but is preferably from 5 to 45 mass%, more preferably from 15 to 40 mass%, still more preferably from 25 to 35 mass% in the acrylic resin.

[0059]

The acrylic resin may contain a constituent unit derived from another monomer copolymerizable with the acrylic monomer in addition to the constituent unit described above.

The constituent units derived from other monomers contained in the acrylic resin may be one alone or two or more.

Examples of other monomers include styrene, α-methylstyrene, vinyltoluene, vinyl formate, vinyl acetate, acrylonitrile, and acrylamide.

[0060]

The acrylic resin may be further obtained by introducing an unsaturated group having energy ray polymerizability to impart energy ray curability.

The unsaturated group can be introduced, for example, by reacting a functional group of an acrylic resin containing a constituent unit derived from a functional group-containing monomer with a reactive substituent reactive with the functional group and a reactive substituent of a compound having an unsaturated group (hereinafter, also referred to as "unsaturated group-containing compound"). One unsaturated group-containing compound may be used alone, or two or more thereof may be used in combination.

Examples of the unsaturated group of the unsaturated group-containing compound include a (meth)acryloyl group, a vinyl group, and an allyl group. Among these, a (meth)acryloyl group is preferable.

Examples of the reactive substituent of the unsaturated group-containing compound include an isocyanate group and a glycidyl group.

Examples of the unsaturated group-containing compound include (meth)acryloyloxyethyl isocyanate, (meth)acryloyl isocyanate, and glycidyl (meth)acrylate.

[0061]

When the acrylic resin containing the constituent unit derived from the functional group-containing monomer is caused to react with the unsaturated group-containing compound, the proportion of the functional group that reacts with the unsaturated group-containing compound to the total number of functional groups in the acrylic resin is not particularly limited, but is preferably from 60 to 98 mol%, more preferably from 70 to 95 mol%, still more preferably from 80 to 93 mol%.

When the proportion of the functional group that reacts with the unsaturated group-containing compound is within the above-described range, sufficient energy ray curability can be imparted to the acrylic resin, and the functional group that has not reacted with the unsaturated group-containing compound can be caused to react with the cross-linking agent to cross-link the acrylic resin.

[0062]

The mass-average molecular weight (Mw) of the acrylic resin is not particularly limited, but is preferably from 300,000 to 1,500,000, more preferably from 350,000 to 1,000,000, still more preferably from 400,000 to 600,000. When the mass-average molecular weight (Mw) of the acrylic resin is in the above-described range, the adhesive strength and cohesive strength of the pressure sensitive adhesive layer tend to further improve.

[0063]

(Energy Ray-Curable Compound)

The energy ray-curable compound contained in the X-type or XY-type pressure sensitive adhesive composition is preferably a monomer or oligomer having an unsaturated group in the molecule and being curable through energy ray irradiation.

Examples of the energy ray-curable compound include polyvalent (meth)acrylate monomers such as trimethylolpropane tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, dipentaerythritol hexa(meth)acrylate, 1,4-butylene glycol di(meth)acrylate, and 1,6-hexanediol di(meth)acrylate; and oligomers such as urethane (meth)acrylate, polyester (meth)acrylate, polyether (meth)acrylate, and epoxy (meth)acrylate. Among these, a urethane (meth)acrylate oligomer is preferable from the viewpoint of having a relatively high molecular weight and hardly decreasing the elastic modulus of the pressure sensitive adhesive layer.

[0064]

The molecular weight of the energy ray-curable compound is not particularly limited, but is preferably from 100 to 12,000, more preferably from 200 to 10,000, still more preferably from 400 to 8,000, yet still more preferably from 600 to 6,000. When the energy ray-curable compound is an oligomer, the molecular weight means the mass-average molecular weight (Mw).

[0065]

The content of the energy ray-curable compound in the XY-type pressure sensitive adhesive composition is not particularly limited, but is preferably 1 to 30 parts by mass, more preferably 2 to 20 parts by mass, and still more preferably 3 to 15 parts by mass with respect to 100 parts by mass of the pressure sensitive adhesive resin.

When the content of the energy ray-curable compound in the XY-type pressure sensitive adhesive composition is in the above-described range, the balance between the pressure sensitive adhesive strength before energy ray irradiation and the peelability after energy ray irradiation tends to be good. In the XY-type pressure sensitive adhesive composition, the pressure sensitive adhesive resin is energy ray-curable, and thus, even when the content of the energy ray-curable compound is small, the peel strength tends to be sufficiently reduced after the energy ray irradiation.

[0066]

(Cross-Linking Agent)

The pressure sensitive adhesive composition preferably further contains a cross-linking agent.

The cross-linking agent, for example, reacts with a functional group derived from a functional group-containing monomer of the adhesive resin to cross-link the pressure sensitive adhesive resins.

One cross-linking agent may be used alone, or two or more thereof may be used in combination.

[0067]

Examples of the cross-linking agent include isocyanate-based cross-linking agents such as tolylene diisocyanate, hexamethylene diisocyanate, and adducts thereof; epoxy-based cross-linking agents such as ethylene glycol glycidyl ether; aziridine-based cross-linking agents such as hexa[1-(2-methyl)-aziridinyl]triphosphatriazine; and chelate-based cross-linking agent such as aluminum chelates. Among these, an isocyanate-based cross-linking agent is preferable from the viewpoint of increasing the cohesive strength to further improve the adhesive strength and the viewpoint of availability.

[0068]

When the pressure sensitive adhesive composition contains a cross-linking agent, the content thereof is not particularly limited, but is preferably from 0.01 to 10 parts by mass, more preferably from 0.03 to 7 parts by mass, still more preferably from 0.05 to 4 parts by mass with respect to 100 parts by mass of the pressure sensitive adhesive resin from the viewpoint of appropriately advancing the cross-linking reaction.

[0069]

(Photopolymerization Initiator)

When the pressure sensitive adhesive is an energy ray-curable pressure sensitive adhesive, the pressure sensitive adhesive composition preferably further contains a photopolymerization initiator. When the energy ray-curable pressure sensitive adhesive contains a photopolymerization initiator, the curing reaction of the energy ray-curable pressure sensitive adhesive tends to sufficiently proceed even with relatively low energy rays such as ultraviolet rays.

One photopolymerization initiator may be used alone, or two or more thereof may be used in combination.

[0070]

Examples of the photopolymerization initiator include a benzoin compound, an acetophenone compound, an acyl phosphinoxide compound, a titanocene compound, a thioxanthone compound, a peroxide compound, and further, a photosensitizer such as amine and quinone. More specific examples thereof include 1-hydroxycyclohexyl phenyl ketone, 2-hydroxy-2-methyl-1-phenyl-propan-1-one, benzoin, benzoin methyl ether, benzoin ethyl ether, benzoin isopropyl ether, benzyl phenyl sulfide, tetramethyl thiuram monosulfide, azobisobutyronitrile, dibenzyl, diacetyl, 8-chloroanthraquinone, and bis(2,4,6-trimethylbenzoyl)phenyl phosphine oxide.

[0071]

When the pressure sensitive adhesive composition contains a photopolymerization initiator, the content of the photopolymerization initiator is not particularly limited, but is preferably from 0.01 to 10 parts by mass, more preferably from 0.03 to 7 parts by mass, still more preferably from 0.05 to 5 parts by mass with respect to 100 parts by mass of the pressure sensitive adhesive resin from the viewpoint of homogeneously and sufficiently progressing the energy ray curing reaction.

[0072]

(Other Additives)

The pressure sensitive adhesive composition may contain other additives as long as the effects of the present invention are not impaired. Examples of other additives include antistatic agents, antioxidants, softeners, fillers, rust inhibitors, pigments, and dyes.

[0073]

(Organic Solvent)

The pressure sensitive adhesive composition may be diluted with an organic solvent to form a solution from the viewpoint of further improving the coating properties to a base material, a release sheet or the like. Examples of the organic solvent include the same organic solvents as those that can be contained in the thermosetting resin composition described later. As the organic solvent, the organic solvent used at the time of synthesis of the pressure sensitive adhesive resin may be used as it is, or one or more organic solvents other than the organic solvent used at the time of synthesis may be added.

[0074]

The thickness of the pressure sensitive adhesive layer is not particularly limited, but is preferably from 5 to 100 μm, more preferably from 10 to 80 μm, still more preferably from 15 to 60 μm.

When the thickness of the pressure sensitive adhesive layer is equal to or more than the lower limit value, excellent adhesiveness is obtained, and the surface of the workpiece tends to be better protected during processing. When the thickness of the pressure sensitive adhesive layer is equal to or less than the upper limit value, generation of tape scraps at the time of cutting the pressure sensitive adhesive sheet is suppressed, and breakage of the workpiece tends to be more favorably prevented.

[0075]

<Base Material>

Examples of the base material include various resin films. Examples of the resin constituting the resin film include polyethylene such as low density polyethylene (LDPE), linear low density polyethylene (LLDPE), and high density polyethylene (HDPE); polyolefin such as polypropylene, polybutene, polybutadiene,

polymethylpentene, ethylene-norbornene copolymer, and norbornene resin; ethylene-based copolymers such as an ethylene-vinyl acetate copolymer, an ethylene-(meth)acrylic acid copolymer, and an ethylene-(meth)acrylic acid ester copolymer; polyvinyl chloride such as polyvinyl chloride and vinyl chloride copolymer; polyesters such as polyethylene terephthalate, polyethylene naphthalate, polybutylene terephthalate, and wholly aromatic polyester; polyurethane, polyimide, polyamide, polycarbonate, fluororesin, polyacetal, modified polyphenylene oxide, polyphenylene sulfide, polysulfone, polyether ketone, and acrylic polymers.

The base material may be a single-layer film of a resin film composed of one or two or more resins selected from these resins, or may be a laminated film obtained by laminating two or more of these resin films. The film may be a modified film such as a cross-linked film or an ionomer film of the above-described resins.

Among these resin films, the base material is preferably one or more selected from a polyester film, a polyamide film, a polyimide film, and a biaxially stretched polypropylene film, more preferably a polyester film, still more preferably a polyethylene terephthalate film.

[0076]

The Young's modulus of the base material is not particularly limited, but is preferably 1000 MPa or more, more preferably from 1800 to 30,000 MPa, still more preferably from 2500 to 6000 MPa.

The Young's modulus of the base material can be measured at a test speed of 200 mm/min in accordance with JIS K 7127:1999.

[0077]

The thickness of the base material is not particularly limited, but is preferably from 10 to 200 μm, more preferably from 25 to 100 μm, still more preferably from 30 to 70 μm.

When the thickness of the base material is equal to or more than the lower limit value, sufficient strength for functioning as a support of the pressure sensitive adhesive sheet tends to be obtained. When the thickness of the base material is equal to or less than the upper limit value, moderate flexibility is obtained, and handleability tends to improve.

"Thickness of the base material" means the thickness of the entire base material, and when the base material is a base material including a plurality of layers, it means the total thickness of all the layers constituting the base material.

[0078]

The base material may contain a plasticizer, a lubricant, an infrared absorber, an ultraviolet absorber, a filler, a colorant, an antistatic agent, an antioxidant, a catalyst, and the like as long as the effect of the present invention is not impaired.

The base material may be transparent or opaque, and it may be colored or deposited as desired.

From the viewpoint of improving adhesion to other layers, the base material may be obtained by subjecting at least one surface to a surface treatment such as a corona treatment, or may be provided with a coating layer for improving adhesiveness.

[0079]

<Release Sheet>

The release sheet is peelably attached to the surface of the pressure sensitive adhesive sheet before use to protect the surface, and is peeled off and removed when the pressure sensitive adhesive sheet is used.

The release sheet may be a release sheet subjected to a single-side release treatment or a release sheet subjected to a double-side release treatment.

Preferable examples of the release sheet include a release sheet obtained by applying a release agent such as a silicone-based resin to a base material for a release sheet. Examples of the base material for a release sheet include those exemplified as the base material of the pressure sensitive adhesive sheet of the present embodiment.

[0080]

<Total Thickness of Pressure Sensitive Adhesive Sheet>

The total thickness of the pressure sensitive adhesive sheet of the present embodiment is not particularly limited, but is preferably from 30 to 300 μm, more preferably from 40 to 220 μm, still more preferably from 45 to 160 μm.

When the total thickness of the pressure sensitive adhesive sheet is equal to or more than the lower limit value, the pressure sensitive adhesive performance of the pressure sensitive adhesive layer, the impact absorption performance of the buffer layer, and the like are appropriately maintained, and the function as the pressure sensitive adhesive sheet for workpiece processing tends to be sufficiently exhibited. When the total thickness of the pressure sensitive adhesive sheet is equal to or less than the upper limit value, the peel strength when the workpiece is peeled off from the pressure sensitive adhesive sheet tends to decrease.

When the pressure sensitive adhesive sheet of the present embodiment is provided with a release sheet, the "total thickness of the pressure sensitive adhesive sheet" does not include the thickness of the release sheet.

[0081]

<Young's Modulus of Pressure Sensitive Adhesive Sheet>

The Young's modulus of the pressure sensitive adhesive sheet of the present embodiment at 23°C is not particularly limited, but is preferably from 1200 to 4200 MPa, more preferably from 1700 to 3700 MPa, still more preferably from 2200 to 3200 MPa.

When the Young's modulus of the pressure sensitive adhesive sheet at 23°C is equal to or less than the upper limit value, the effect of absorbing vibration, impact, and the like generated at the time of grinding the workpiece and the retention property for the pressure sensitive adhesive sheet tend to improve. When the Young's modulus of the pressure sensitive adhesive sheet at 23°C is equal to or more than the lower limit value, excessive deformation of the pressure sensitive adhesive sheet tends to be suppressed when the workpiece is processed.

The Young's modulus of the pressure sensitive adhesive sheet at 23°C can be measured by the method described in Examples. When the pressure sensitive adhesive sheet of the present embodiment is provided with a release sheet, the "Young's modulus of the pressure sensitive adhesive sheet" is measured in a state where the release sheet is peeled.

[0082]

[Method for Manufacturing Pressure Sensitive Adhesive Sheet]

The method for manufacturing a pressure sensitive adhesive sheet of the present embodiment is a method including a step of curing a thermosetting resin composition by heating (hereinafter, also referred to as "thermal curing step"). The buffer layer included in the pressure sensitive adhesive sheet of the present embodiment can be formed through the thermal curing step.

[0083]

The thermal curing step is preferably a step of heating and curing a coating film formed by applying the thermosetting resin composition.

When the thermosetting resin composition is applied, the thermosetting resin composition is preferably in the form of a solution diluted with an organic solvent. By diluting with the organic solvent, the coating operation becomes easy, the thickness of the buffer layer becomes easy to adjust, and a buffer layer having a small thickness can be formed with excellent thickness accuracy.

Examples of the organic solvent include methyl ethyl ketone, acetone, ethyl acetate, tetrahydrofuran, dioxane, cyclohexane, n-hexane, toluene, xylene, n-propanol, and isopropanol. One organic solvent may be used alone, or two or more thereof may be used in combination.

The content of the organic solvent in the thermosetting resin composition diluted with the organic solvent is not particularly limited, but is preferably from 40 to 90 mass%, more preferably from 50 to 85 mass%, still more preferably from 60 to 80 mass%.

[0084]

The thermosetting resin composition may be applied onto a release sheet, or may be applied directly to the surface of the base material or the pressure sensitive adhesive layer.

Examples of the method for applying the thermosetting resin composition include a spin coating method, a spray coating method, a bar coating method, a knife coating method, a roll coating method, a blade coating method, a die coating method, and a gravure coating method.

[0085]

The heating temperature of the thermosetting resin composition is preferably from 80 to 150°C, more preferably from 90 to 140°C, still more preferably from 100 to

130°C from the viewpoint of productivity of the pressure sensitive adhesive sheet and sufficient curing of the thermosetting resin composition.

The heating time of the thermosetting resin composition is preferably from 0.1 to 60 minutes, more preferably from 0.3 to 30 minutes, still more preferably from 0.5 to 5 minutes from the viewpoint of productivity of the pressure sensitive adhesive sheet and sufficient curing of the thermosetting resin composition.

When the thermosetting resin composition is applied onto the release sheet to obtain a release sheet with a buffer layer, the buffer layer of the release sheet with a buffer layer may then be attached to a surface of the base material or the pressure sensitive adhesive layer.

[0086]

In the method for manufacturing a pressure sensitive adhesive sheet of the present embodiment, the method for forming the pressure sensitive adhesive layer is not particularly limited, and examples thereof include a method in which the pressure sensitive adhesive composition is applied and then dried.

The pressure sensitive adhesive composition may be applied onto the release sheet or directly applied to a surface of the base material or the buffer layer. When the pressure sensitive adhesive composition is applied onto the release sheet to obtain a release sheet with a pressure sensitive adhesive layer, the pressure sensitive adhesive layer of the release sheet with a pressure sensitive adhesive layer may then be applied to a surface of the base material or the buffer layer. The method for applying the pressure sensitive adhesive composition is described in the same manner as the method for applying the thermosetting resin composition described above.

[0087]

<Application of Pressure Sensitive Adhesive Sheet>

Examples of the processing of the workpiece performed in a state where the pressure sensitive adhesive sheet of the present embodiment is attached include back grinding processing in which the other surface of the workpiece is ground in a state where the pressure sensitive adhesive sheet is attached to one surface of the workpiece, dicing processing in which the workpiece is singulated in a state where the pressure sensitive adhesive sheet is attached to one surface of the workpiece, conveyance of the workpiece, pickup of workpiece singulated products, and the like.

Among these, the pressure sensitive adhesive sheet of the present embodiment is suitable for grinding a workpiece, more suitable for back grinding processing of a workpiece, and further suitable for back grinding processing of grinding a back surface of a workpiece in a state where the pressure sensitive adhesive sheet of the present embodiment is attached to a circuit formation surface of the workpiece.

In particular, the pressure sensitive adhesive sheet of the present embodiment has an effect of suppressing the occurrence of cracks when the workpiece is thinned, and thus is suitable for processes such as a pre-dicing method and a stealth pre-dicing method. Specifically, the workpiece has a groove on a front surface or has a modified region therein, and the pressure sensitive adhesive sheet for workpiece processing attached to the front surface of the workpiece is suitably used for singulating the workpiece into a plurality of workpiece singulated products starting from the groove or the modified region by grinding the back surface of the workpiece in a state where the pressure sensitive adhesive sheet for workpiece processing is fixed.

[0088]

[Method for Manufacturing Electronic Device]

A method for manufacturing an electronic device of the present embodiment includes:

a step of attaching the pressure sensitive adhesive sheet for workpiece processing of the present embodiment to a front surface of a workpiece with the pressure sensitive adhesive layer as an attachment surface; and

a step of grinding a back surface of the workpiece in a state where the pressure sensitive adhesive sheet for workpiece processing attached to the workpiece is fixed.

[0089]

A method for manufacturing an electronic device of the present embodiment is preferably a method for manufacturing an electronic device including:

a split-planned line formation step as Step a of forming a groove on a front surface of a workpiece or Step b of forming a modified region inside the workpiece from the front surface or a back surface of the workpiece;

a sheet attachment step of attaching the pressure sensitive adhesive sheet for workpiece processing of the present embodiment to the front surface of the workpiece with the pressure sensitive adhesive layer as an attachment surface after Step a or before or after Step b; and

a grinding and singulation step of grinding the back surface of the workpiece in a state where the pressure sensitive adhesive sheet for workpiece processing attached to the workpiece is fixed, and singulating the workpiece into a plurality of workpiece singulated products starting from the groove or the modified region.

A method for manufacturing an electronic device of the present embodiment may include a peeling step of peeling the pressure sensitive adhesive sheet for workpiece processing of the present embodiment from a plurality of workpieces after the grinding and singulation step.

The method for manufacturing an electronic device including Step a is a process corresponding to a pre-dicing method, and the method for manufacturing an electronic device including Step b is a process corresponding to a stealth pre-dicing method.

Hereinafter, each step of the method for manufacturing an electronic device according to the present embodiment will be described in detail.

[0090]

<Split-Planned Line Formation Step>

The split-planned line formation step is Step a of forming a groove on the front surface of the workpiece or Step b of forming a modified region inside the workpiece from the front surface or the back surface of the workpiece.

[0091]

Step a is a step of forming a groove on the front surface of the workpiece, and is performed before the pressure sensitive adhesive sheet is attached to the front surface of the workpiece.

The groove formed on the front surface of the workpiece in Step a is a groove having a depth shallower than the thickness of the workpiece. After Step a, the workpiece is subjected to back surface grinding up to the groove formed in Step a, and is split into a plurality of workpiece singulated products. Thus, in Step a, the groove is formed along the split line when the workpiece is split and singulated.

The groove can be formed by dicing using a known wafer dicing device or the like.

[0092]

Step b is a step of forming a modified region inside the workpiece from the front surface or the back surface of the workpiece, and may be performed before or after attaching the pressure sensitive adhesive sheet to the front surface of the workpiece.

In Step b, the modified region is formed inside the workpiece through irradiation with a laser focusing inside the workpiece. The modified region is an embrittled portion of the workpiece, and is a region serving as a starting point where the workpiece is thinned by back surface grinding or broken by application of a force by grinding to singulate the workpiece. Thus, the modified region is formed along the split line when the workpiece is split and singulated.

The laser irradiation may be performed from the front surface side or the back surface side of the workpiece. When Step b is performed after the sheet attachment step, the workpiece may be irradiated with a laser beam through the pressure sensitive adhesive sheet.

[0093]

<Sheet Attachment Step>

The sheet attachment step is a step of attaching the pressure sensitive adhesive sheet to the front surface of the workpiece with the pressure sensitive adhesive layer as the attachment surface after Step a or before or after Step b.

The method for attaching the pressure sensitive adhesive sheet is not particularly limited, and for example, a known method using a laminator or the like can be applied.

[0094]

<Grinding and Singulation Step>

The grinding and singulation step is a step of, in a state where the pressure sensitive adhesive sheet for workpiece processing attached to the workpiece is fixed by a support device, grinding the back surface of the workpiece and singulating the workpiece into a plurality of workpiece singulated products starting from the groove or the modified region.

The pressure sensitive adhesive sheet side of the workpiece to which the pressure sensitive adhesive sheet is attached and in which the groove or the modified region is formed is fixed by a support device. The support device is not particularly limited, but is a device that sucks and retains an object to be fixed such as a chuck table is preferable.

[0095]

Next, the back surface of the fixed workpiece is ground to singulate the workpiece into a plurality of workpiece singulated products.

In the back surface grinding, when the groove is formed in the workpiece through Step a, the workpiece is ground at least to a position where the grinding surface reaches the bottom of the groove. Through this back surface grinding, the groove becomes a cut penetrating the workpiece, and the workpiece is split by the cut and singulated into individual workpiece singulated products.

On the other hand, when the modified region is formed in the workpiece through Step b, the grinding surface may reach the modified region, but it does not have to strictly reach the modified region. That is, grinding may be performed up to a position close to the modified region so that the workpiece is broken and singulated starting from the modified region. For example, after the workpiece is ground to a position close to the modified region without being singulated, a pickup tape may be attached to the workpiece, and the workpiece may be singulated by stretching the pickup tape.

[0096]

The shape of the singulated workpiece singulated products may be a square or an elongated shape such as a rectangle.

The thickness of the workpiece singulated product is not particularly limited, but is preferably from 5 to 100 μm, more preferably from 7 to 70 μm, still more preferably from 10 to 45 μm.

The size of the workpiece singulated product is not particularly limited, but is preferably less than 50 mm^2, more preferably less than 30 mm^2, still more preferably less than 10 mm^2.

[0097]

<Peeling Step>

The peeling step is a step of peeling the pressure sensitive adhesive sheet from the plurality of workpiece singulated products after the grinding and singulation step.

When the pressure sensitive adhesive layer of the pressure sensitive adhesive sheet is formed of an energy ray-curable pressure sensitive adhesive, the pressure sensitive adhesive is cured through irradiation with an energy ray to reduce the peel strength of the pressure sensitive adhesive layer, and then the pressure sensitive adhesive sheet is peeled off.

When the pressure sensitive adhesive sheet is peeled off, a pickup tape may be used. The pickup tape is formed of, for example, a pressure sensitive adhesive sheet including a base material and a pressure sensitive adhesive layer provided on one surface of the base material.

In the case of using the pickup tape, first, the pickup tape is attached to the back surface side of the workpiece singulated products, and position and direction alignment is performed so that pickup can be performed. In this case, it is preferable that the ring frame disposed on the outer peripheral side of the workpiece singulated products is also attached to the pickup tape to fix the outer peripheral edge portion of the pickup tape to

the ring frame. Next, the pressure sensitive adhesive sheet is peeled from the plurality of workpiece singulated products fixed on the pickup tape.

Thereafter, the plurality of workpiece singulated products on the pickup tape may be picked up and then fixed on a substrate or the like to manufacture an electronic device.

[Examples]

[0098]

Hereinafter, the present invention will be described in more detail based on examples, but the present invention is not limited by these examples.

In the following description, the blending amount of each component and the like all mean the blending amount of the active ingredients.

Measurement methods and evaluation methods of various physical properties are as follows.

[0099]

[Mass-Average Molecular Weight (Mw) and Number-Average Molecular Weight (Mn)]

The mass-average molecular weight (Mw) and the number-average molecular weight (Mn) were measured under the following conditions using a gel permeation chromatograph (available from Tosoh Corporation, product name "HLC-8220"), and determined in terms of standard polystyrene.

(Measurement Conditions)

• Column: "TSK guard column HXL-H", "TSK gel GMHXL (× 2)", and "TSK gel G2000 HXL" (all available from Tosoh Corporation)

• Column temperature: 40°C

• Developing solvent: tetrahydrofuran

• Flow rate: 1.0 mL/min

[0100]

[Measurement of Thickness of Pressure Sensitive Adhesive Sheet or the like]

The total thickness of the pressure sensitive adhesive sheet, the thickness of each layer, and the thickness of a test piece produced therefrom were measured with a constant pressure thickness measuring device (available from TECLOCK Corporation, product name "PG-02"). At this time, any 10 points were measured, and an average value was calculated.

The total thickness of the pressure sensitive adhesive sheet is a value obtained by measuring the thickness of the pressure sensitive adhesive sheet with a release sheet and subtracting the thickness of the release sheet from the thickness.

The thickness of the buffer layer is a value obtained by subtracting the thickness of the base material from the thickness of the base material with a buffer layer.

The thickness of the pressure sensitive adhesive layer is a value obtained by subtracting the thicknesses of the buffer layer and the base material from the total thickness of the pressure sensitive adhesive sheet.

[0101]

[Method for Measuring Young's Modulus of Buffer Layer]

A single film of only a buffer layer produced by the same method as in Examples and Comparative Examples was cut into a width of 15 mm and a length of 150 mm, and laminated so as to have a thickness of 0.1 mm to obtain a test piece. This test piece was attached to a precision universal tester (available from Shimadzu Corporation, product name "Autograph AG-IS") at a distance between chucks of 100 mm, and the Young's modulus of the buffer layer was measured at a test speed of 200 mm/min in accordance with JIS K 7127:1999. The measurement was performed under an environment of 23°C and 50%RH.

[0102]

[Method for Measuring Young's Modulus of Pressure Sensitive Adhesive Sheet]

The pressure sensitive adhesive sheet for workpiece processing produced in each of Examples and Comparative Examples was cut to a width of 15 mm and a length of 150 mm, and the release sheet was peeled off to obtain a test piece. The test piece was attached to a precision universal tester (available from Shimadzu Corporation, product name "Autograph AG-IS") at a distance between chucks of 100 mm, and the Young's modulus of the pressure sensitive adhesive sheet was measured at a test speed of 200 mm/min in accordance with JIS K 7127:1999. The measurement was performed under an environment of 23°C and 50%RH.

[0103]

[Evaluation of Low Odor Property]

The release sheet was peeled from the pressure sensitive adhesive sheet for workpiece processing produced in each of Examples and Comparative Examples, and the sensory evaluation of odor was performed at room temperature (23°C) to evaluate the low odor properties of the pressure sensitive adhesive sheet based on the following criteria.

A: No odor

C: Odor is present

[0104]

[Evaluation of Grinding Property: Back Grinding Processing]

The pressure sensitive adhesive sheet for workpiece processing produced in each of Examples and Comparative Examples was attached to a silicon wafer having a size of 12 inches and a thickness of 775 μm using a tape laminator for back grinding (available from Lintec Corporation, product name "RAD3510F/12”) so that the pressure sensitive

adhesive layer came to the attachment surface. Next, the silicon wafer was ground (including dry polish) until the thickness reached 30 μm with the pressure sensitive adhesive sheet for workpiece processing fixed using a backside grinding device (available from DISCO Corporation, product name "DGP 8761"). The appearance of the silicon wafer after grinding was visually observed, and the grinding properties in the back grinding processing were evaluated based on the following criteria.

A: No damage was confirmed in the silicon wafer.

C: Damage was confirmed in the silicon wafer.

[0105]

[Evaluation of Grinding Property: Stealth Pre-Dicing Processing]

The pressure sensitive adhesive sheet for workpiece processing produced in each of Examples and Comparative Examples was attached to a silicon wafer having a size of 12 inches and a thickness of 775 μm using a tape laminator for back grinding (available from Lintec Corporation, product name "RAD3510F/12") so that the pressure sensitive adhesive layer came to the attachment surface. Subsequently, a lattice-shaped modified region was formed inside the silicon wafer using a laser saw (available from DISCO Corporation, product name "DFL 7361"). The lattice size was 10 mm × 10 mm.

Next, the silicon wafer was ground (including dry polish) using a backside grinding device (available from DISCO Corporation, product name "DGP 8761") until the thickness reached 30 μm, and the silicon wafer was singulated into a plurality of chips starting from the modified region. Thereafter, the pressure sensitive adhesive sheet for workpiece processing was irradiated with energy rays (ultraviolet rays). Subsequently, a dicing tape (available from Lintec Corporation, product name "Adwill D-175D") was attached to the surfaces of the plurality of chips on the side opposite to the attachment surface of the pressure sensitive adhesive sheet for workpiece processing, and

the pressure sensitive adhesive sheet for workpiece processing was peeled off from the plurality of chips.

The plurality of chips after peeling the pressure sensitive adhesive sheet for workpiece processing were observed with a digital microscope, classified according to the following criteria for each size of cracks, the number of chips in which cracks were confirmed was counted, and grinding properties in stealth pre-dicing processing were evaluated based on the following criteria. The size (μm) of the crack was determined by comparing the length (μm) of the crack along the longitudinal direction of the chip with the length (μm) of the crack along the lateral direction of the chip, and using the larger value.

(Classification of Cracks by Crack Size)

Large crack: The size of the crack is more than 20 μm.

Middle crack: The size of the crack is 10 μm or more and 20 μm or less.

Small crack: The size of the crack is less than 10 μm.

(Evaluation Criteria)

A: 0 large cracks, 7 or less middle cracks, and 15 or less small cracks

B: 0 large cracks, 8 or more and 10 or less middle cracks, and 15 or less small cracks, or 0 large cracks, 7 or less middle cracks, and 16 or more and 20 or less small cracks

C: 1 or more large cracks, 11 or more middle cracks, or 21 or more small cracks

[0106]

[Production of Pressure Sensitive Adhesive Composition]

Manufacturing Example 1

To an acrylic polymer obtained by copolymerizing 65 parts by mass of n-butyl acrylate (BA), 20 parts by mass of methyl methacrylate (MMA), and 15 parts by mass of

2-hydroxyethyl acrylate (2HEA), 2-methacryloyloxyethyl isocyanate (MOI) was caused to react so as to add to 80 equivalent of the total hydroxyl groups (100 equivalents) of the acrylic polymer, whereby an energy ray-curable acrylic copolymer (Mw: 500,000) was obtained.

To 100 parts by mass of the energy ray-curable acrylic copolymer, 6 parts by mass of a polyfunctional urethane acrylate-based ultraviolet curable compound (available from Mitsubishi Chemical Corporation, product name "UT-4332"), 0.375 parts by mass of an isocyanate-based cross-linking agent (available from Mitsui Chemicals, Inc., product name "TAKENATE D-101E"), and 1 part by mass of bis(2,4,6-trimethylbenzoyl) phenylphosphine oxide as a photopolymerization initiator were blended, and the mixture was diluted with methyl ethyl ketone to prepare a pressure sensitive adhesive composition having a solid content concentration of 34 mass%.

The pressure sensitive adhesive composition obtained as above was applied to a peeling-treated surface of a release sheet (available from Lintec Corporation, product name "SP-PET 381031") so that the thickness after drying was 20 μm, and then dried by heating, whereby a release sheet with a pressure sensitive adhesive layer was produced.

[0107]

[Manufacturing of Pressure Sensitive Adhesive Sheet for Workpiece Processing]

Examples 1 to 7

(1) Preparation of buffer layer forming composition

As a thermosetting resin, 100 parts by mass of a polyester-based resin shown in Table 1, 7.5 parts by mass of an isocyanate-based cross-linking agent (available from Tosoh Corporation, product name "CORONATE HL", ethyl acetate diluted product, solid content concentration: from 74 to 76 mass%), and 0.5 parts by mass of dibutyl tin dilaurate (available from Toyochem Co., Ltd., product name "BXX 3778G") as a curing

catalyst were blended to prepare a thermosetting resin composition as a buffer layer forming composition.

Details of the polyester-based resin shown in Table 1 are as follows.

• UR-1400: Polyester urethane resin having 2 or more hydroxy groups, available from Toyobo Co., Ltd., product name, glass transition temperature 83°C, number-average molecular weight (Mn) 40,000, hydroxyl value from 2 to 3 KOHmg/g, solvent (in the solvent, the content of methyl ethyl ketone was 50 mass%, and the content of toluene was 50 mass%) diluted product, solid content concentration 30 mass%

• UR-1700: Polyester urethane resin having 2 or more hydroxy groups, available from Toyobo Co., Ltd., product name, glass transition temperature 92°C, number-average molecular weight (Mn) 16,000, hydroxyl value 19 KOHmg/g, solvent (the content of methyl ethyl ketone in the solvent was 100 mass%) diluted product, solid content concentration 30 mass%

• UR-4800: Polyester urethane resin having 2 or more hydroxy groups, available from Toyobo Co., Ltd., product name, glass transition temperature 106°C, number-average molecular weight (Mn) 25,000, hydroxyl value from 4 to 6 KOHmg/g, solvent (in the solvent, the content of methyl ethyl ketone was 50 mass%, and the content of toluene was 50 mass%) diluted product, solid content concentration 32 mass%

(2) Production of Pressure Sensitive Adhesive Sheet for Workpiece Processing

A polyethylene terephthalate film (thickness: 50 μm) was prepared as a base material, and the thermosetting resin composition obtained as above was applied onto one surface of the base material to form a coating film. The amount of coating of the thermosetting resin composition was adjusted so that the thickness of the buffer layer to be formed was the thickness shown in Table 1. Subsequently, the coating film was heated at 110°C for 2 minutes to allow the thermosetting reaction of the thermosetting

resin composition to proceed while the organic solvent was dried, whereby a base material with a buffer layer was obtained in which a buffer layer having a thickness as described in Table 1 was formed on one surface of the base material.

Subsequently, the pressure sensitive adhesive layer of the release sheet with the pressure sensitive adhesive layer obtained in Manufacturing Example 1 was attached to the surface of the base material of the base material with a buffer layer on the side opposite to the buffer layer, to obtain a pressure sensitive adhesive sheet for workpiece processing having a buffer layer, a base material, and a pressure sensitive adhesive layer in this order.

[0108]

Example 8

A pressure sensitive adhesive sheet for workpiece processing was obtained in the same manner as that in Example 1 except that the pressure sensitive adhesive layer of the release sheet with a pressure sensitive adhesive layer was attached to a surface of the buffer layer of the base material with a buffer layer, not the base material of the base material with a buffer layer, in "(2) Production of Pressure Sensitive Adhesive Sheet for Workpiece Processing" in Example 1. That is, the pressure sensitive adhesive sheet for workpiece processing obtained in Example 8 is a pressure sensitive adhesive sheet for workpiece processing having a base material, a buffer layer, and a pressure sensitive adhesive layer in this order.

[0109]

Comparative Example 1

(1) Preparation of buffer layer forming composition

An energy ray-curable resin composition as a buffer layer forming composition was prepared by blending 50 parts by mass of a urethane acrylate-based oligomer

(available from Sartomer, product name "CN 8881") and 50 parts by mass of polyethylene glycol (400) diacrylate as energy ray-curable compounds, and 2.0 parts by mass of 2-hydroxy-2-methyl-1-phenyl-propan-1-one (available from IGM Resins, product name "Omnirad 1173") as a photopolymerization initiator.

(2) Production of Pressure Sensitive Adhesive Sheet

The energy ray-curable resin composition obtained as above was applied to a peeling-treated surface of a release sheet (available from Lintec Corporation, product name "SP-PET 381031") to form a coating film. Then, the coating film was irradiated with ultraviolet rays to semi-cure the energy ray-curable resin composition, whereby a layer obtained by semi-curing the energy ray-curable resin composition having a thickness of 28 μm on the release sheet was obtained.

The ultraviolet irradiation was performed using a belt conveyor type ultraviolet irradiation device (available from Eye Graphics Co., Ltd., product name "ECS-401GX") and a high-pressure mercury lamp (available from Eye Graphics Co., Ltd., product name "H04-L41") under irradiation conditions of a lamp height of 260 mm, an output of 80 W/cm, an illuminance of 70 mW/cm^2, and an irradiation amount of 30 mW/cm2.

Next, the surface of the layer obtained by semi-curing the energy ray-curable resin composition formed on the release sheet was attached to one surface of a PET film (available from Mitsubishi Plastics, Inc., product name "PET 50 T910 WM19", thickness 50 μm) as a base material. Subsequently, the energy ray-curable resin composition was completely cured through irradiation with ultraviolet rays from the release sheet side to obtain a base material with a buffer layer in which a buffer layer having a thickness of 28 μm was formed on one surface of the base material.

The ultraviolet irradiation was performed using the ultraviolet irradiation device and the high-pressure mercury lamp under irradiation conditions of a lamp height of 210

mm, a lamp output, an output of 120 W/cm, an illuminance of 155 mW/cm^2, and an irradiation amount of 600 mW/cm^2.

Subsequently, the pressure sensitive adhesive layer of the release sheet with the pressure sensitive adhesive layer obtained in Manufacturing Example 1 was attached to the surface of the base material of the base material with a buffer layer on the side opposite to the buffer layer, to obtain a pressure sensitive adhesive sheet for workpiece processing having a buffer layer, a base material, and a pressure sensitive adhesive layer in this order.

[0110]

Comparative Example 2

(1) Preparation of buffer layer forming composition

A thermosetting resin composition as a buffer layer forming composition was prepared in the same manner as in Example 1.

(2) Production of Pressure Sensitive Adhesive Sheet for Workpiece Processing

The thermosetting resin composition obtained as above was applied onto a peeling-treated surface of a release sheet (available from Lintec Corporation, product name "SP-PET 381031") to form a coating film. The amount of coating of the thermosetting resin composition was adjusted so that the thickness of the buffer layer to be formed was the thickness shown in Table 1. Subsequently, the coating film was heated at 110°C for 2 minutes to allow the thermosetting reaction of the thermosetting resin composition to proceed while the organic solvent was dried, whereby a release sheet with a buffer layer was obtained in which a buffer layer having a thickness as described in Table 1 was formed on the release sheet.

Then, the buffer layer of the release sheet with a buffer layer and the pressure sensitive adhesive layer of the release sheet with a pressure sensitive adhesive layer

obtained in Manufacturing Example 1 were attached to each other to obtain a pressure sensitive adhesive sheet for workpiece processing having the buffer layer and the pressure sensitive adhesive layer in this order.

[0111]

The evaluation results of the pressure sensitive adhesive sheets obtained in Examples and Comparative Examples are shown in Table 1.

[0112]

[Table 1]

Table 1

	Configuration of pressure sensitive adhesive sheet for workpiece processing				Evaluation results				
								Grinding properties	
	Layer configuration	Curing mechanism of buffer layer forming composition	Type of polyester-based resin	Thickness of buffer layer (μm)	Young's modulus of buffer layer (MPa)	Young's modulus of pressure sensitive adhesive sheet (MPa)	Low odor property	Back grinding processing	Stealth pre-dicing processing
Example 1	Buffer layer/base material/pressure sensitive adhesive layer	Thermosetting property	UR-1400	50	2400	2667	A	A	A
Example 2	Buffer layer/base material/pressure sensitive adhesive layer	Thermosetting property	UR-1400	30	2400	2720	A	A	A
Example 3	Buffer layer/base material/pressure sensitive adhesive layer	Thermosetting property	UR-1400	10	2400	2800	A	A	A
Example 4	Buffer layer/base material/pressure sensitive adhesive layer	Thermosetting property	UR-1700	10	2100	2763	A	A	A
Example 5	Buffer layer/base material/pressure sensitive adhesive layer	Thermosetting property	UR-1700	30	2100	2630	A	A	A
Example 6	Buffer layer/base material/pressure sensitive adhesive layer	Thermosetting property	UR-4800	10	2450	2806	A	A	A
Example 7	Buffer layer/base material/pressure sensitive adhesive layer	Thermosetting property	UR-4800	30	2450	2735	A	A	A
Example 8	Base material/buffer layer/pressure sensitive adhesive layer	Thermosetting property	UR-1400	50	2400	2667	A	A	B
Comparative Example 1	Buffer layer/base material/pressure sensitive adhesive layer	Energy ray curability	-	28	600	2168	C	A	A
Comparative Example 2	Buffer layer/pressure sensitive adhesive layer	Thermosetting property	UR-1400	30	2400	2720	A	C	C

[0113]

Table 1 shows that the pressure sensitive adhesive sheets for workpiece processing of Examples 1 to 8 of the present embodiment are excellent in low odor properties and grinding properties. On the other hand, the pressure sensitive adhesive sheet for workpiece processing of Comparative Example 1 in which the buffer layer was formed using the energy ray-curable resin composition was poor in low odor properties. The pressure sensitive adhesive sheet for workpiece processing of Comparative Example 2 containing no base material was inferior in grinding properties.

[CLAIMS]

[Claim 1]

A pressure sensitive adhesive sheet for workpiece processing, comprising a buffer layer, a base material, and a pressure sensitive adhesive layer,

wherein the buffer layer is a layer containing a cured product of a thermosetting resin composition.

[Claim 2]

The pressure sensitive adhesive sheet for workpiece processing according to claim 1, wherein the thermosetting resin composition contains a polyester-based resin.

[Claim 3]

The pressure sensitive adhesive sheet for workpiece processing according to claim 2, wherein the polyester-based resin is a polyester urethane resin.

[Claim 4]

The pressure sensitive adhesive sheet for workpiece processing according to claim 2 or 3, wherein

the polyester-based resin is a polyester-based resin having two or more hydroxy groups, and

the thermosetting resin composition further contains a polyvalent isocyanate compound.

[Claim 5]

The pressure sensitive adhesive sheet for workpiece processing according to any one of claims 1 to 3, wherein

the buffer layer is provided on one surface side of the base material, and

the pressure sensitive adhesive layer is provided on the other surface side of the base material.

[Claim 6]

The pressure sensitive adhesive sheet for workpiece processing according to any one of claims 1 to 3, wherein the pressure sensitive adhesive sheet is used for grinding a workpiece.

[Claim 7]

The pressure sensitive adhesive sheet for workpiece processing according to any one of claims 1 to 3, wherein

the workpiece includes a groove in a front surface or includes a modified region inside of the workpiece, and

the pressure sensitive adhesive sheet for workpiece processing is used for singulating the workpiece into a plurality of workpiece singulated products starting from the groove or the modified region by grinding a back surface of the workpiece in a state where the pressure sensitive adhesive sheet for workpiece processing attached to the front surface of the workpiece is fixed.

[Claim 8]

A method for manufacturing the pressure sensitive adhesive sheet for workpiece processing described in any one of claims 1 to 3,

the method comprising a step of curing the thermosetting resin composition by heating.

[Claim 9]

A method for manufacturing an electronic device, the method comprising:

a step of attaching the pressure sensitive adhesive sheet for workpiece processing described in any one of claims 1 to 3 to a front surface of a workpiece with the pressure sensitive adhesive layer as an attachment surface; and

a step of grinding a back surface of the workpiece in a state where the pressure sensitive adhesive sheet for workpiece processing attached to the workpiece is fixed.

[Claim 10]

A method for manufacturing an electronic device, the method comprising:

a split-planned line formation step as Step a of forming a groove on a front surface of a workpiece or Step b of forming a modified region inside the workpiece from the front surface or a back surface of the workpiece;

a sheet attachment step of attaching the pressure sensitive adhesive sheet for workpiece processing described in any one of claims 1 to 3 to the front surface of the workpiece with the pressure sensitive adhesive layer as an attachment surface after Step a or before or after Step b; and

a grinding and singulation step of grinding the back surface of the workpiece in a state where the pressure sensitive adhesive sheet for workpiece processing attached to the workpiece is fixed, and singulating the workpiece into a plurality of workpiece singulated products starting from the groove or the modified region.