

[Name of Document] Description

[Title of Invention] PRESSURE SENSITIVE ADHESIVE SHEET AND
METHOD OF MANUFACTURING PROCESSED ARTICLES

[Technical Field]

5 [0001]

 The present invention relates to a pressure sensitive
adhesive sheet used when irradiating a plate-like member with
laser light to form modified parts and dividing the plate-like
member into individual pieces to obtain chip-like processed
10 articles. The present invention relates also to a method of
manufacturing processed articles, such as chips, using the
above pressure sensitive adhesive sheet.

[Background Art]

 [0002]
15 Semiconductor wafers are formed with circuits on their
surfaces and thereafter a backside grinding step and a dicing
step may be performed for each wafer. In the former step, a
grinding process is performed for the backside of a wafer to
adjust the thickness of the wafer. In the latter step, the wafer
20 is divided into individual pieces having a predetermined chip
size.

 [0003]
 In recent years, in accordance with the downsizing of
electronic equipment housings and the growth in demand for
25 semiconductor devices using multiple stacked chips,
semiconductor chips as the constitutional members are also
being thinned. It is therefore desired to reduce the thickness
of wafers, which has conventionally been about 350 μm , to 50
to 100 μm or less.

30 [0004]

 As the thickness of wafers, which are brittle members,
is reduced, the risk of breakage increases when they are
processed and transported. If such a very thin wafer is cut

by a dicing blade rotating at a high speed, chipping and the like occur particularly at the backside of the semiconductor wafer to significantly deteriorate the flexural strength of chips.

5 [0005]

To overcome such issues, a so-called stealth dicing method is proposed in which a semiconductor wafer is formed with dicing lines while being radiated with laser light to selectively form modified parts inside the wafer and the semiconductor wafer is cut at the modified parts as origins of fracture (Patent Literature 1). According to the stealth dicing method, semiconductor chips can be manufactured at a good yield through irradiating a very thin semiconductor wafer with laser light to form modified parts inside the wafer, then
10 attaching the semiconductor wafer to a pressure sensitive adhesive sheet (dicing sheet) comprising a base film and a pressure sensitive adhesive layer, and expanding the dicing sheet to divide (dice) the semiconductor wafer along the dicing lines. Another process is also proposed in which a semiconductor wafer is attached to a dicing sheet and thereafter modified parts are formed by irradiation with laser light. Employing such a process can eliminate the step of attaching a dicing tape to the wafer weakened due to formation of the modified parts, and the risk of breakage of the weakened wafer
15 can be reduced. In this case, however, irradiation with laser may have to be performed via the dicing sheet because the wafer is ordinarily irradiated with laser from the surface on which no circuits are formed.

[0006]

30 In addition to the above cases of using laser as a processing means in the dicing step, there may be a case in which laser is used as a tool for accurately aligning a plate-like member, such as a semiconductor wafer, during the dicing step.

Pressure sensitive adhesive sheets used in cases of employing laser light during the dicing step as in the above cases (such pressure sensitive adhesive sheets are referred also to as "laser dicing sheets" in the present description) have to have
5 excellent transmittance to laser light when laser transmits through the laser dicing sheet in use.

[0007]

To respond to such a demand, Patent Literature 2, for example, discloses a laser dicing sheet comprising a base film
10 and a pressure sensitive adhesive layer formed on one surface of the base film, wherein the total luminous transmittance within a wavelength region of 300 to 400 nm is 60% or more, the haze is 20% or less, and the transmission clarity at a width of an optical comb of 0.25 mm is 30 or more.

15 [Prior Art Literature]

[Patent Literature]

[0008]

[Patent Literature 1] JP2005-229040A

[Patent Literature 2] JP5124778B

20 [Summary of the Invention]

[Problems to be solved by the Invention]

[0009]

Patent Literature 2 also discloses laser dicing sheets having the above structure in which, provided that the center
25 line average roughness Ra of one surface of the base film is larger than that of the other surface and the pressure sensitive adhesive layer is formed on the surface having the larger center line average roughness Ra, a surface having a center line average roughness Ra of 0.3 to 0.7 μm is the surface to be formed
30 with the pressure sensitive adhesive layer and the center line average roughness Ra of the opposite surface of the base film is 0.14 μm (Examples of Patent Literature 2).

[0010]

Such a laser dicing sheet has a smooth surface as the surface to which laser is incident, that is, the surface of the base film opposite to the surface formed with the pressure sensitive adhesive layer. Scattering of laser light at the base
5 film surface can therefore be prevented and the laser light can be effectively utilized.

[0011]

Processed articles such as semiconductor chips manufactured from a plate-like member such as a semiconductor
10 wafer using a laser dicing sheet tend to have a further reduced thickness. In addition, as the high-density mounting technique progresses, a silicon wafer may be used as substitute for a board and one or more chips may be stacked on the silicon wafer using through-silicon vias (TSV). When, as the above,
15 the processed articles are thin and/or the processed articles have a structure based on TSV, it may be preferred to allow the pressure sensitive adhesive layer of a laser dicing sheet to be easily removed from the processed articles which are attached to the pressure sensitive adhesive layer (i.e., the pressure
20 sensitive adhesive sheet may preferably be excellent in the picking-up property).

[0012]

In the laser dicing sheets as described in Patent Literature 2, unfortunately, portions may be caused in which
25 the pressure sensitive adhesive layer is not appropriately formed on the base film. Such portions will be observed as defects in the plan view of the laser dicing sheet and may possibly cause the laser, which is incident to process a plate-like member, to unevenly reach the plate-like member.

30 [0013]

An object of the present invention is to provide a pressure sensitive adhesive sheet that is less likely to cause defects and has an excellent picking-up property when used in a dicing

step with laser light. Another object of the present invention is to provide a method of manufacturing processed articles from a plate-like member using such a pressure sensitive adhesive sheet.

5 [Means for solving the Problems]

[0014]

The present inventors conducted studies to achieve the above objects and have acquired a novel knowledge that a pressure sensitive adhesive sheet can be obtained which has an excellent picking-up property while stably reducing the possibility of the occurrence of defects when the thickness of a pressure sensitive adhesive layer is 2 μm or more and 12 μm or less and the arithmetic average roughness Ra of both surfaces of a base film is 0.2 μm or less.

15 The present invention accomplished on the basis of the above knowledge is as follows.

[0015]

(1) A pressure sensitive adhesive sheet used when irradiating a plate-like member with laser light to form a modified part and dividing the plate-like member into chips, the pressure sensitive adhesive sheet comprising a base film and a pressure sensitive adhesive layer provided on one surface of the base film, wherein each of the one surface and a surface opposite to the one surface of the base film has an arithmetic average roughness Ra as defined in JIS B0601: 2013 (ISO 4287: 1997) of 0.01 μm or more and 0.2 μm or less, and the pressure sensitive adhesive layer has a thickness of 2 μm or more and 12 μm or less.

[0016]

30 (2) The pressure sensitive adhesive sheet as described in the above (1), wherein the pressure sensitive adhesive sheet has a haze as defined in JIS K7136: 2000 (ISO 14782: 1999) of 0.01% or more and 10% or less when the base film side is an

incident side.

[0017]

(3) The pressure sensitive adhesive sheet as described in the above (1) or (2), wherein the pressure sensitive adhesive
5 layer contains an acrylic-based polymer and the acrylic-based polymer has a glass-transition temperature T_g of -40°C or higher and -10°C or lower.

[0018]

(4) The pressure sensitive adhesive sheet as described
10 in the above (3), wherein the acrylic-based polymer includes a constitutional unit originated from methyl methacrylate and a mass ratio of the methyl methacrylate to total monomers for providing the acrylic-based polymer is 5 mass% or more and 20 mass% or less.

15 [0019]

(5) The pressure sensitive adhesive sheet as described in the above (3) or (4), wherein the acrylic-based polymer has an energy ray polymerizable group.

[0020]

20 (6) The pressure sensitive adhesive sheet as described in any one of the above (1) to (5), wherein the base film contains a polyolefin-based material.

[0021]

(7) The pressure sensitive adhesive sheet as described
25 in any one of the above (1) to (6), wherein the arithmetic average roughness R_a of the base film is set through a procedure including roll pressurization for the base film.

[0022]

(8) The pressure sensitive adhesive sheet as described
30 in the above (7), wherein rolls used for the roll pressurization are rolls each having a surface formed of a metal material.

[0023]

(9) A method of manufacturing processed articles, the

method comprising: an attaching step of attaching a surface of the pressure sensitive adhesive sheet as described in any one of the above (1) to (8) to one surface of an adherend including the plate-like member to obtain a first laminate comprising the pressure sensitive adhesive sheet and the plate-like member, the surface of the pressure sensitive adhesive sheet being located more proximally to the pressure sensitive adhesive layer than to the base film; a dividing step of expanding the base film of the first laminate thereby to divide the plate-like member on the pressure sensitive adhesive sheet to obtain a second laminate in which a plurality of chips is arranged on the pressure sensitive adhesive sheet, the plurality of chips comprising divided bodies of the plate-like member; and a picking-up step of separating each of the plurality of chips of the second laminate from the pressure sensitive adhesive sheet to obtain the chips as the processed articles, wherein a modified part forming step is performed before the dividing step is started, wherein the modified part forming step is a step in which the plate-like member is irradiated with laser light so that the laser light is focused on a focal spot set inside the plate-like member, to form a modified part in the plate-like member.

[0024]

(10) The method of manufacturing processed articles as described in the above (9), wherein the first laminate supplied to the dividing step comprises an additional layer between the pressure sensitive adhesive layer and the plate-like member, the additional layer is also divided through the dividing step, and the chips to be separated from the pressure sensitive adhesive sheet through the picking-up step comprise the divided bodies of the plate-like member and divided bodies of the additional layer, wherein the divided bodies of the additional layer are formed on surfaces of the divided bodies of the

plate-like member, wherein the surfaces of the divided bodies of the plate-like member are located proximally to the pressure sensitive adhesive sheet.

[0025]

5 (11) The method of manufacturing processed articles as described in the above (10), wherein the additional layer comprises a protection layer.

[0026]

10 (12) The method of manufacturing processed articles as described in the above (11), further comprising a protection film forming step of, before the dividing step is started, forming the protection layer of the first laminate from a film for protection film formation.

[0027]

15 (13) The method of manufacturing processed articles as described in the above (10), wherein the additional layer comprises a die bonding layer.

[Advantageous Effect of the Invention]

[0028]

20 According to the present invention, there is provided a pressure sensitive adhesive sheet that is less likely to cause defects and has an excellent picking-up property. Moreover, such a pressure sensitive adhesive sheet can be used thereby to stably manufacture processed articles from the plate-like
25 member.

[Embodiments for Carrying out the Invention]

[0029]

Hereinafter, embodiments of the present invention will be described.

30 [0030]

1. Pressure Sensitive Adhesive Sheet

The pressure sensitive adhesive sheet according to an embodiment of the present invention comprises a base film and

a pressure sensitive adhesive layer.

[0031]

(1) Base Film

The base film of the pressure sensitive adhesive sheet
5 according to the present embodiment has a surface facing the
pressure sensitive adhesive layer (this surface will also be
referred to as a "pressure sensitive adhesive processing
surface" in the present description) and a surface opposite to
the pressure sensitive adhesive processing surface (this
10 opposite surface will also be referred to as a "laser incident
surface" in the present description). Each of the pressure
sensitive adhesive processing surface and the laser incident
surface has an arithmetic average roughness Ra as defined in
JIS B0601: 2013 (ISO 4287: 1997) of 0.2 μm or less (unless
15 otherwise stated, the "arithmetic average roughness Ra" is used
in this sense, hereinafter). When the arithmetic average
roughness Ra of these surfaces is 0.2 μm or less, defects are
less likely to be observed in the plan view of the pressure
sensitive adhesive sheet. In other words, laser light incident
20 from the base film side of the pressure sensitive adhesive sheet
may readily and evenly reach a plate-like member to which the
pressure sensitive adhesive sheet is attached. If such laser
light unevenly reaches the plate-like member, portions may
remain in the plate-like member in which modified parts are not
25 appropriately formed, for example, and troubles may possibly
occur, such as that the plate-like member cannot be
appropriately divided into individual pieces at those portions.
In view of enhancing the above evenness of the incident laser
light, the arithmetic average roughness Ra of each of the
30 pressure sensitive adhesive processing surface and the laser
incident surface may preferably be 0.18 μm or less, more
preferably 0.16 μm or less, further preferably 0.14 μm or less,
and particularly preferably 0.12 μm or less. As for the

pressure sensitive adhesive processing surface, the lower limit of the arithmetic average roughness Ra is not limited from the viewpoint of obtaining a pressure sensitive adhesive sheet in which defects are less likely to occur in the plan view. In
5 view of maintaining the production stability and the like, the arithmetic average roughness Ra of each of the pressure sensitive adhesive processing surface and the laser incident surface may preferably be 0.01 μm or more.

[0032]

10 Constitutional materials of the base film according to an embodiment of the present invention are not particularly limited, provided that the base film satisfies the above condition as for the arithmetic average roughness Ra and can be used as that of a laser dicing sheet, that is, requirements
15 are satisfied that the base film can transmit laser light of a desired wavelength at a transmittance within a practical range and is less likely to fracture even when the base film is expanded in the in-plane direction and/or locally projected in the thickness direction. The base film according to an embodiment
20 of the present invention may ordinarily be composed of a film of which the primary material is a resin-based material. This film may be a single layer or may also be a laminate.

[0033]

Specific examples of the resin-based material contained
25 in such a film include: polyolefin-based materials, such as random copolymer polypropylene, block copolymer polypropylene and other polypropylenes, low-density polyethylene (LDPE), linear low-density polyethylene (LLDPE), high-density polyethylene (HDPE) and other polyethylenes, ethylene-vinyl
30 acetate copolymer, ethylene-(meth)acrylic acid copolymer, ethylene-(meth)acrylic ester copolymer, ethylene-norbornene copolymer and other ethylene-based copolymers, norbornene resin and other cycloolefin polymers (COP), polybutene,

polybutadiene, and polymethylpentene; polyvinyl chloride-based materials, such as polyvinyl chloride and vinyl chloride copolymer; polyester-based materials, such as polyethylene terephthalate and polybutylene terephthalate; 5 polyurethane-based materials; polyimide-based materials; ionomer resin-based materials; polyacrylic-based materials, such as homopolymer of alkyl (meth)acrylate and copolymer of alkyl (meth)acrylate; polystyrene-based materials; polycarbonate-based materials; fluorine resin-based 10 materials; and resin-based materials of which the primary materials are hydrogenated products or modified products of the above resin-based materials. The resin-based material may be a crosslinked product of any of the above materials and a crosslinker. The "(meth)acrylic acid" as used in the present 15 description means both acrylic acid and methacrylic acid. The same applies to other similar terms. The resin-based material for providing the above base film may be of one type or may also be a mixture of two or more types. In view of high laser transmittance, easy expansion in the in-plane direction, easy 20 local deformation in the thickness direction, and low environmental load, the base film according to an embodiment of the present invention may preferably contain a polyolefin-based material and may more preferably contain polypropylene, such as random copolymer polypropylene, among 25 polyolefin-based materials.

[0034]

When the resin-based material contained in the base film is a polyolefin-based material, control of the arithmetic average roughness Ra of both surfaces of the base film may 30 generally be performed by roll pressurization using two rolls to nip the base film therebetween. The arithmetic average roughness Ra of both surfaces of the base film can be set by adjusting materials that constitute the surfaces of the rolls

and/or the roughness of the surfaces. In a commonly-used conventional arrangement of these rolls, the surface of one roll is formed of a metal while the surface of the other is formed of an elastic material such as rubber. Accordingly, the arithmetic average roughness Ra of the surface of the base film brought into contact with the roll of which the surface is formed of a metal can be a relatively low value, but the arithmetic average roughness Ra of the surface of the base film brought into contact with the roll composed of an elastic material may be difficult to be a low value. When the arithmetic average roughness Ra of both surfaces of a base film should be reduced as in the base film according to the present embodiment, therefore, both the rolls for the roll pressurization may preferably have surfaces formed of metal. In this case, however, the relative arrangement of the rolls and the base film may have to be strictly controlled as compared with the case in which the surface of one roll is formed of an elastic material. When the resin-based material contained in the base film is a polyvinyl chloride-based material, the arithmetic average roughness Ra of both surfaces of the base film may be easily set to a low value because the base film can be manufactured through inflation molding. However, since the polyvinyl chloride-based material contains halogen, it may be preferred not to use the polyvinyl chloride-based material as a material of the base film when the environmental load should be reduced.

[0035]

The base film may further contain various additives, such as colorant, fire retardant, plasticizer, antistatic, glidant and filler, in the film of which the primary material is the above resin-based material. Examples of the colorant include pigments such as titanium dioxide and carbon black and various dyes. Examples of the filler include organic materials such as melamine resin, inorganic materials such as fumed silica,

and metal-based materials such as nickel particles. The content of such additives is not particularly limited, but may have to be within a range in which the base film exhibits a desirable function, in particular a function of transmitting
5 laser therethrough, and does not lose desirable flatness and/or flexibility.

[0036]

When ultraviolet rays are used as energy rays with which the pressure sensitive adhesive layer is irradiated to cure,
10 the base film may preferably allow the ultraviolet rays to transmit therethrough. When electron rays are used as the energy rays, the base film may preferably allow the electron rays to transmit therethrough.

[0037]

15 The thickness of the base film is not limited, provided that the pressure sensitive adhesive sheet can function appropriately in each of the previously described steps. The thickness may preferably be within a range of 20 to 450 μm , more preferably 25 to 200 μm , and particularly preferably 50 to 150
20 μm .

[0038]

The base film may preferably have a Young's modulus of 50 to 500 MPa. When the Young's modulus falls within this range, the base film can have an enhanced mechanical strength while
25 maintaining good expandability, thereby to achieve excellent suitability for the steps when forming a pressure sensitive adhesive layer. For example, when a film that contains a polyolefin-based resin to be the base film is set to a coater, the base film can be prevented from unintended expansion when
30 applied with tensile force.

In view of avoiding the blocking and other troubles and achieving better expandability while enhancing the mechanical strength, the above Young's modulus may more preferably be 60

to 450 MPa, further preferably 100 to 420 MPa, and furthermore preferably 150 to 300 MPa.

[0039]

(2) Pressure Sensitive Adhesive Layer

5 The pressure sensitive adhesive layer of the pressure sensitive adhesive sheet according to the present embodiment has a thickness of 2 μm or more and 12 μm or less. When the thickness of the pressure sensitive adhesive layer is within the above range and the arithmetic average roughness Ra of both
10 surfaces of the base film is within the previously-described range, defects are less likely to occur in the plan view and a pressure sensitive adhesive sheet having an excellent picking-up property can be obtained. In view of more stably reducing the possibility of occurrence of the above defects,
15 the thickness of the pressure sensitive adhesive layer may preferably be 3 μm or more and more preferably 4 μm or more. In view of more stably obtaining a pressure sensitive adhesive sheet having an excellent picking-up property, the thickness of the pressure sensitive adhesive layer may preferably be 10
20 μm or less, more preferably 8 μm or less, and particularly preferably 6 μm or less.

[0040]

 The pressure sensitive adhesive composition for forming the pressure sensitive adhesive layer of the pressure sensitive
25 adhesive sheet according to the present embodiment is not limited. Examples of the pressure sensitive adhesive contained in such a pressure sensitive adhesive composition include rubber-based, acrylic-based and silicone-based pressure sensitive adhesives, and polyvinyl ether and other
30 appropriate pressure sensitive adhesives. The description below will be made to an exemplary case in which the pressure sensitive adhesive composition for forming the pressure sensitive adhesive layer contains an acrylic-based pressure

sensitive adhesive. The acrylic-based pressure sensitive adhesive has excellent transparency and therefore allows laser light rays to easily transmit therethrough.

[0041]

5 The acrylic-based pressure sensitive adhesive contains an acrylic-based polymer. The acrylic-based polymer is a polymer that includes a constitutional unit based on an acrylic-based compound as a unit that constitutes the skeleton. The acrylic-based polymer may be a homopolymer formed such that
10 monomers of one type are polymerized or may also be a copolymer formed such that monomers of two or more types are polymerized. In view of easy control of physical characteristics and chemical characteristics of the polymer, the acrylic-based polymer may preferably be a copolymer.

15 [0042]

 The acrylic-based polymer may preferably have a glass-transition temperature T_g of -40°C or higher and -10°C or lower. When the pressure sensitive adhesive composition contains an acrylic-based polymer of which the glass-transition
20 temperature T_g is -40°C or higher, the pressure sensitive adhesive property of the pressure sensitive adhesive layer can decrease to more improve the picking-up property. In view of more stably obtaining such an effect of improving the picking-up property, the glass-transition temperature T_g of the
25 acrylic-based polymer may more preferably be -35°C or higher. In view of easily maintaining the performance of holding chips after a wafer is divided into chips, the glass-transition temperature T_g of the acrylic-based polymer may preferably be -20°C or lower.

30 [0043]

 The weight-average molecular weight (M_w) of the acrylic-based polymer is not limited. In general, it may preferably be 100,000 to 2,000,000 and more preferably 300,000

to 1,500,000. The molecular weight distribution (M_w/M_n , M_n represents a number-average molecular weight) is also not limited. In general, it may preferably be 1.0 to 10 and more preferably 1.0 to 3.0.

5 [0044]

Specific types of monomers for providing the acrylic-based polymer are not limited. Examples of such monomers include (meth)acrylic acid, (meth)acrylic ester, and acrylonitrile. Specific examples of the (meth)acrylic ester
10 include: alkyl (meth)acrylate of which the carbon number of the alkyl group is 1 to 18, such as methyl (meth)acrylate, ethyl (meth)acrylate, propyl (meth)acrylate, butyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, nonyl (meth)acrylate, dodecyl (meth)acrylate, pentadecyl (meth)acrylate and octadecyl
15 (meth)acrylate; (meth)acrylate having a cyclic skeleton, such as cycloalkyl (meth)acrylate, benzyl (meth)acrylate, isobornyl acrylate, dicyclopentanyl acrylate, dicyclopentenyl acrylate, dicyclopentenylloxyethyl acrylate and imide acrylate; (meth)acrylate having a hydroxyl group, such as
20 2-hydroxyethyl (meth)acrylate and 2-hydroxypropyl (meth)acrylate; and (meth)acrylate having an epoxy group, such as glycidyl methacrylate and glycidyl acrylate.

[0045]

In view of increasing the glass-transition temperature
25 T_g , the acrylic-based polymer may preferably contain methyl methacrylate. In view of more stably exhibiting the effect obtained by the acrylic-based polymer containing methyl methacrylate, the mass ratio of methyl methacrylate to total monomers for providing the acrylic-based polymer may preferably
30 be 5 mass% or more and 20 mass% or less and more preferably 7 mass% or more and 15 mass% or less.

[0046]

The acrylic-based polymer may also be a copolymer that

contains vinyl acetate, styrene and the like as the monomers.

[0047]

The acrylic-based polymer may have at least one of an energy ray polymerizable group and a reactive functional group that is able to react with a crosslinker (this reactive functional group will be simply referred to as a "reactive functional group," hereinafter).

[0048]

When the acrylic-based polymer contains an energy ray polymerizable group, the pressure sensitive adhesive layer can be irradiated with energy rays thereby to reduce the pressure sensitive adhesive property to an adherend and it is easy to obtain a pressure sensitive adhesive sheet having excellent picking-up property. Examples of the energy ray polymerizable group include a group that includes a polymerizable double bond. The method of preparing the acrylic-based polymer having an energy ray polymerizable group is not limited. As an example, such a method for preparation may be conducted such that an acrylic-based polymer having a functional group, such as a hydroxyl group, carboxylic group and amino group, which has active hydrogen is reacted with a substance having a functional group, such as an isocyanate group, which can react with the above functional group, and an energy ray polymerizable group (specific examples of such a substance include (meth)acryloyloxyethyl isocyanate). When the acrylic-based pressure sensitive adhesive contains an acrylic-based polymer that contains an energy ray polymerizable group as obtained in such a method for preparation, the above glass-transition temperature T_g of the acrylic-based polymer refers to T_g before the reaction with the substance having a functional group, which can react with the above functional group, and an energy ray polymerizable group.

[0049]

When the acrylic-based polymer has a reactive functional group, this reactive functional group and a crosslinker may be reacted thereby to adjust the cohesive property of the pressure sensitive adhesive layer and it is thus made easy to suppress the occurrence of a residue on the adherend after the pressure sensitive adhesive sheet is removed and to reduce the pressure sensitive adhesive property of the pressure sensitive adhesive layer to further improve the picking-up property. The combination of a reactive functional group and a crosslinker is not limited. Examples of the reactive functional group include a group having active hydrogen, such as a hydroxyl group, carboxylic group and amino group. Examples of the crosslinker include an isocyanate-based crosslinker, epoxy-based crosslinker, aziridine-based crosslinker, and metal chelate-based crosslinker.

The isocyanate-based crosslinker contains at least a polyisocyanate compound having a number of isocyanate groups. Specific examples of the polyisocyanate compound include: aromatic polyisocyanate, such as tolylene diisocyanate, diphenylmethane diisocyanate and xylylene diisocyanate; alicyclic isocyanate compound, such as dicyclohexylmethane-4,4'-diisocyanate, bicycloheptane triisocyanate, cyclopentylene diisocyanate, cyclohexylene diisocyanate, methylcyclohexylene diisocyanate and hydrogenated xylylene diisocyanate; and acyclic aliphatic isocyanate, such as hexamethylene diisocyanate, trimethyl hexamethylene diisocyanate and lysine isocyanate, a biuret product and isocyanurate product thereof, and a modified product such as an adduct product that is a reaction product of a compound having an isocyanate group and a non-aromatic low molecule active hydrogen-containing compound such as ethylene glycol, trimethylol propane and castor oil.

[0050]

Examples of the epoxy-based crosslinker include
 1,3-bis(N,N'-diglycidylaminomethyl)cyclohexane,
 N,N,N',N'-tetraglycidyl-m-xylylenediamine, ethylene glycol
 diglycidylether, 1,6-hexanedioldiglycidylether,
 5 trimethylolpropane diglycidylether, diglycidylaniline, and
 diglycidylamine.

[0051]

Examples of the aziridine-based crosslinker include
 diphenylmethane-4,4'-bis(1-aziridinecarboxamide),
 10 trimethylolpropane-tri- β -aziridinypropionate,
 tetramethylolmethane-tri- β -aziridinypropionate,
 toluene-2,4-bis(1-aziridinecarboxamide),
 triethylenemelamine, bis-isophthaloyl-1-(2-methylaziridine),
 tris-1-(2-methylaziridine)phosphine, and
 15 trimethylolpropane-tri- β -(2-methylaziridine)propionate.

[0052]

Examples of the metal chelate-based crosslinker include
 chelate compounds of which the metal atoms are aluminum,
 zirconium, titanium, zinc, iron, tin, or the like. Among these,
 20 aluminum chelate compounds may be preferred because of
 excellent performance. Examples of aluminum chelate compounds
 include diisopropoxyaluminum monooleyl acetoacetate,
 monoisopropoxyaluminum bisoleyl acetoacetate,
 monoisopropoxyaluminum monooleate monoethyl acetoacetate,
 25 diisopropoxyaluminum monolauryl acetoacetate,
 diisopropoxyaluminum monostearyl acetoacetate, and
 diisopropoxyaluminum monoisostearyl acetoacetate.

[0053]

When the pressure sensitive adhesive composition
 30 contains an acrylic-based polymer, the pressure sensitive
 adhesive composition may contain other components than the
 acrylic-based polymer. Examples of such materials include an
 energy ray polymerizable compound. The energy ray

polymerizable compound is a compound that is polymerized when irradiated with energy rays, such as ultraviolet rays and electron rays. Examples of the energy ray polymerizable compound include low molecular weight compounds having energy ray polymerizable groups (monofunctional and polyfunctional monomers and oligomers) and, specifically, include trimethylolpropane triacrylate, tetramethylolmethane tetraacrylate, pentaerythritol triacrylate, dipentaerythritol monohydroxy pentaacrylate, dipentaerythritol hexaacrylate, 1,4-butyleneglycol diacrylate, 1,6-hexanediol diacrylate, cyclic aliphatic skeleton-containing acrylate such as dicyclopentadiene dimethoxy diacrylate and isobornyl acrylate, polyethylene glycol diacrylate, oligoester acrylate, urethane acrylate oligomer, epoxy modified acrylate, polyether acrylate, and other acrylate-based compounds. Such a compound has at least one polymerizable double bond in a molecule and the molecular weight may ordinarily be 100 to 30,000 and preferably about 300 to 10,000. When the pressure sensitive adhesive composition is an acrylic-based pressure sensitive adhesive and contains an acrylic-based polymer that contains an energy ray polymerizable group, the pressure sensitive adhesive layer may be irradiated with energy rays thereby to reduce the pressure sensitive adhesive property to an adherend even if the pressure sensitive adhesive composition does not contain a low molecular weight compound having an energy ray polymerizable group or merely contains a small amount of such a low molecular weight compound. When the pressure sensitive adhesive composition contains a large content of a low molecular weight compound having an energy ray polymerizable group, the picking-up property tends to deteriorate. The pressure sensitive adhesive composition, which is an acrylic-based pressure sensitive adhesive, may therefore contain an acrylic-based

polymer that contains an energy ray polymerizable group, thereby to reduce the use amount of a low molecular weight compound having an energy ray polymerizable group, and the picking-up property can thus be further improved. When the
5 pressure sensitive adhesive composition is an acrylic-based pressure sensitive adhesive, the pressure sensitive adhesive composition may preferably contain 0 to 30 mass parts, more preferably 0 to 15 mass parts, and further preferably 0 to 10 mass parts of the energy ray polymerizable compound to 100 mass
10 parts of the acrylic-based polymer.

[0054]

When the pressure sensitive adhesive composition contains an acrylic-based polymer that has an energy ray polymerizable group, and/or contains an energy ray
15 polymerizable compound, the pressure sensitive adhesive composition may preferably further contain a photopolymerization initiator. Examples of the photopolymerization initiator include photo initiators, such as a benzoin compound, acetophenone compound, acyl phosphine
20 oxide compound, titanocene compound, thioxanthone compound and peroxide compound, and photo sensitizers, such as amine and quinone. Specifically, there may be exemplified 1-hydroxycyclohexyl phenyl ketone, benzoin, benzoin methyl ether, benzoin ethyl ether, benzoin isopropyl ether, benzyl
25 diphenyl sulfide, tetramethyl thiuram monosulfide, azobisisobutyronitrile, dibenzyl, diacetyl, β -chloroanthraquinone, 2,4,6-trimethyl benzoyl diphenyl phosphine oxide, and the like. When ultraviolet rays are used as the energy rays, such a photopolymerization initiator may
30 be compounded thereby to reduce the irradiation time and irradiation amount.

[0055]

Examples of the energy rays for reacting the energy ray

polymerizable group and the energy ray polymerizable compound include ionizing radiation, that is, X-rays, ultraviolet rays, electron rays or the like. Among these, ultraviolet rays may be preferred because the introduction of irradiation equipment
5 is relatively easy.

[0056]

When ultraviolet rays are used as the ionizing radiation, near-ultraviolet rays including rays of wavelengths of about 200 to 380 nm may be used in view of easy management. The amount
10 of ultraviolet rays may be appropriately selected in accordance with the type of the energy ray polymerizable group and energy ray polymerizable compound contained in the pressure sensitive adhesive layer and the thickness of the pressure sensitive adhesive layer, and may ordinarily be about 50 to 500 mJ/cm²,
15 preferably 100 to 450 mJ/cm², and more preferably 150 to 400 mJ/cm². The illuminance of ultraviolet rays may ordinarily be about 50 to 500 mW/cm², preferably 100 to 450 mW/cm², and more preferably 150 to 400 mW/cm². The ultraviolet ray source is not particularly restricted, and examples thereof to be used
20 include a high-pressure mercury lamp and metal halide lamp.

[0057]

When electron rays are used as the ionizing radiation, the accelerating voltage may be appropriately selected in accordance with the type of the energy ray polymerizable group
25 and energy ray polymerizable compound contained in the pressure sensitive adhesive layer and the thickness of the pressure sensitive adhesive layer, and may preferably be about 10 to 1,000 kV in general. The amount of irradiated rays may be set within a range in which the reaction of the energy ray
30 polymerizable group and energy ray polymerizable compound contained in the pressure sensitive adhesive layer appropriately progresses, and may ordinarily be selected within a range of 10 to 1,000 krad. The electron ray source is not

particularly restricted, and examples thereof to be used include various electron ray accelerators, such as of Cockcroft-Walton type, Van de Graaff type, resonance transformer type, insulated core transformer type, linear type, dynamitron type, and high-frequency type.

[0058]

(3) Optical Characteristics

In the pressure sensitive adhesive sheet according to an embodiment of the present invention, the haze as defined in JIS K7136: 2000 (ISO 14782: 1999) may preferably be 0.01% or more and 10% or less when light for measurement is incident on the surface more proximal to the base film than to the pressure sensitive adhesive layer. The haze being 10% or less allows the laser light to be effectively utilized when the laser light is incident on the pressure sensitive adhesive sheet. In view of more stably realizing the effective utilization of laser light incident on the pressure sensitive adhesive sheet, the above haze may preferably be 5% or less and more preferably 2.5% or less. The lower limit of the above haze may not be set from the viewpoint of the effective utilization of laser light incident on the pressure sensitive adhesive sheet. In view of enhancing the production stability and the like, the above haze may preferably be about 0.01% or more.

[0059]

In the pressure sensitive adhesive sheet according to an embodiment of the present invention, the total luminous transmittance as defined in JIS K7375: 2000 may preferably be 85% or more when light for measurement is incident on the surface more proximal to the base film than to the pressure sensitive adhesive layer. The total luminous transmittance being 85% or more allows the laser light to be effectively utilized when the laser light is incident on the pressure sensitive adhesive sheet. In view of more stably realizing the effective utilization of

laser light incident on the pressure sensitive adhesive sheet, the above total luminous transmittance may preferably be 90% or more. The upper limit of the above total luminous transmittance may not be set from the viewpoint of the effective
5 utilization of laser light incident on the pressure sensitive adhesive sheet. In view of enhancing the production stability and the like, the above total luminous transmittance may preferably be about 99.99% or less.

[0060]

10 (4) Additional Layer

The pressure sensitive adhesive sheet according to an embodiment of the present invention may be provided with an additional layer on the surface at the pressure sensitive adhesive layer side and, when the pressure sensitive adhesive
15 sheet is used, the above additional layer may be attached to a plate-like member that is an adherend for the pressure sensitive adhesive sheet. The structure of the additional layer is not limited. Specific examples of the additional layer include a case in which the additional layer comprises a film
20 for protection film formation and a case in which the additional layer comprises a die bonding layer.

[0061]

The film for protection film formation may be composed of a material that can be cured by external energy, such as heat,
25 to form a protection film. The film for protection film formation or the protection film may be separated from the pressure sensitive adhesive layer in a state in which divided bodies of the film are attached to chip-like members that are obtained by dividing the plate-like member into individual
30 pieces. When the additional layer is a film for protection film formation, therefore, processed articles can be obtained in which the divided bodies of the film for protection film formation or of the protection film are laminated on surfaces

of the chip-like members at one side.

[0062]

Also when the additional layer is a die bonding layer, divided bodies of the die bonding layer may be separated from the pressure sensitive adhesive layer in a state of being
5 attached to chip-like members that are obtained by dividing the plate-like member into individual pieces. When the additional layer is a die bonding layer, therefore, processed articles can be obtained in which the divided bodies of the die bonding layer
10 are laminated on surfaces of the chip-like members at one side.

[0063]

(5) Release sheet

For the purpose of protecting the pressure sensitive adhesive layer or the additional layer before the pressure
15 sensitive adhesive layer or the additional layer is attached to the plate-like member as an adherend, the pressure sensitive adhesive sheet according to an embodiment of the present invention may be configured such that the release surface of a release sheet is provisionally attached to a surface of the
20 pressure sensitive adhesive sheet more proximal to the pressure sensitive adhesive layer than to the base film, specifically, the surface of the pressure sensitive adhesive layer or the surface of the additional layer. The release sheet may be arbitrarily configured and examples thereof include those in
25 which a plastic film is coated with a release agent. Specific examples of the plastic film include a film of polyester, such as polyethylene terephthalate, polybutylene terephthalate and polyethylene naphthalate, and a film of polyolefin, such as polypropylene and polyethylene. Examples of the release agent
30 to be used include silicone-based, fluorine-based and long-chain alkyl-based ones, among which the silicone-based release agent may be preferred because a stable property can be obtained at low cost. The above plastic film of the release

sheet may be substituted by a paper substrate, such as glassine paper, coated paper and high-quality paper, or a laminated paper obtained by laminating a thermoplastic resin, such as polyethylene, on a paper substrate. The thickness of the
5 release sheet may ordinarily be about 20 μm or more and 250 μm or less, but is not limited thereto.

[0064]

2. Method of Manufacturing Processed Articles

The pressure sensitive adhesive sheet according to an
10 embodiment of the present invention can be used to manufacture processed articles from a plate-like member, as will be described below.

[0065]

(1) Attaching step

15 First, the surface of the above pressure sensitive adhesive sheet according to an embodiment of the present invention, which surface is more proximal to the pressure sensitive adhesive layer than to the base film, specifically, the surface of the pressure sensitive adhesive layer or the
20 surface of an additional layer, may be attached to one surface of an adherend that includes a plate-like member, to obtain a first laminate comprising the pressure sensitive adhesive sheet and the plate-like member. The plate-like member is not limited. Examples of the plate-like member include a semiconductor wafer,
25 such as a silicon wafer, and a laminate having a structure based on TSV. The thickness of the plate-like member is also not limited. As an example, the thickness may fall within a range of tens to hundreds of micrometers.

[0066]

30 The first laminate may further comprise an additional layer. Examples of the additional layer include a film for protection film formation, a protection film formed from the film for protection formation, and a die bonding layer. The

additional layer may be attached to the plate-like member, as a part of the pressure sensitive adhesive sheet, or may also be preliminarily laminated on one surface of the plate-like member. In the latter case, the surface of the additional layer
5 opposite to the surface facing the plate-like member is to be a surface, as one surface of the adherent including the plate-like member, to which the pressure sensitive adhesive sheet is attached.

[0067]

10 (2) Dividing Step

The base film of the first laminate is expanded thereby to divide the plate-like member on the pressure sensitive adhesive sheet to obtain a second laminate in which a plurality of chips is arranged on the pressure sensitive adhesive sheet.

15 The chips comprise divided bodies of the plate-like member. When the first laminate includes an additional layer, the additional layer may also be divided through expanding the base film. After the dividing step is performed, a portion of the base film in which the extent of expansion is large may be
20 contracted by means of heating and the like to eliminate excessive loosening of the pressure sensitive adhesive sheet.

[0068]

(3) Modified Part Forming Step

Before the above dividing step is started, the plate-like
25 member is irradiated with laser light so that the laser light is focused on a focal spot set inside the plate-like member, to form modified parts in the plate-like member. The wavelength and irradiation method of the laser light may be appropriately set in accordance with the structure of the plate-like member,
30 such as a composition and thickness. When the modified part forming step is performed after the above attaching step, the plate-like member may be irradiated with laser light via the pressure sensitive adhesive sheet. Even in such a case, the

pressure sensitive adhesive sheet according to an embodiment of the present invention is less likely to cause defects in the plan view and troubles may thus be avoided, in that the extent of irradiation with laser light fluctuates at such defects and
5 in the vicinities of such defects, so that the modified parts may be locally inappropriately formed in the plate-like member. If the modified parts are locally inappropriately formed in the plate-like member, the plate-like member may not be appropriately divided. It may be highly possible that such
10 inappropriate division of the plate-like member deteriorates the quality of the processed articles.

[0069]

(4) Picking-up Step

Each of the plurality of chips of the second laminate is
15 separated from the pressure sensitive adhesive sheet and the chips can thereby be obtained as processed articles. The method of separation is not limited. In an ordinary method, pins or the like are lifted up to locally deform the pressure sensitive adhesive sheet from the opposite side to the side facing the
20 chips, thereby to reduce the pressure sensitive adhesive property of the pressure sensitive adhesive layer to the chips which are to be separated. Then, the chips to be separated are released from the pressure sensitive adhesive sheet, such as by using a suction collet, to separate the chips from the
25 pressure sensitive adhesive sheet. During this operation, the chips may receive some force acting to remove the pressure sensitive adhesive layer from the chips when the pins are lifted up and/or when the chips are pulled up using a suction collet. If the chips are thin and/or have a structure based on TSV, the
30 chips may possibly crack during the release action. In this context, the pressure sensitive adhesive sheet according to an embodiment of the present invention has an appropriately-controlled thickness of the pressure sensitive

adhesive layer thereby to appropriately reduce the possibility that the chips crack during the release action. That is, the pressure sensitive adhesive sheet according to an embodiment of the present invention is excellent in the picking-up
5 property.

[0070]

When the first laminate includes an additional layer, the chips to be separated from the pressure sensitive adhesive sheet through the picking-up step comprise the divided bodies of the
10 plate-like member and divided bodies of the additional layer that are formed on surfaces of the divided bodies of the plate-like member, which surfaces are located proximally to the pressure sensitive adhesive sheet. That is, in the picking-up step, delamination occurs between the pressure sensitive
15 adhesive layer and the divided bodies of the additional layer and the processed articles are thus separated from the pressure sensitive adhesive sheet.

[0071]

When the additional layer for providing the divided
20 bodies of the additional layer is a protection film, the time when the protection film is formed from a film for protection film formation is not limited. The additional layer of the first laminate may be a film for protection film formation and, before the start of the dividing step, a work for forming a
25 protection film from the film for protection film formation may be performed. The additional layer for providing the divided bodies of the additional layer may be a film for protection film formation and protection films may be formed from divided bodies of the film for protection film formation which are possessed
30 by the processed articles.

[0072]

The embodiments heretofore explained are described to facilitate understanding of the present invention and are not

described to limit the present invention. It is therefore intended that the elements disclosed in the above embodiments include all design changes and equivalents to fall within the technical scope of the present invention.

5 [Examples]

[0073]

Hereinafter, the present invention will be described more specifically with examples, etc., but the scope of the present invention is not limited to these examples, etc.

10 [0074]

«Example 1»

(1) Production of Base Film

A compact T-die extruder ("Labo-plastomill" available from Toyo Seiki Seisaku-sho, LTD) was used for extrusion molding
15 of a resin composition composed of a random copolymer polypropylene resin to produce a film as the base film in which the arithmetic average roughness Ra of one surface (corresponding to the pressure sensitive adhesive processing surface) was 0.03 μm and the arithmetic average roughness Ra
20 of the other surface (corresponding to the laser incident surface) was also 0.03 μm . The surface roughness of the base film was measured using a surface roughness tester ("SV-3000" available from Mitutoyo Corporation).

[0075]

25 (2) Preparation of Pressure Sensitive Adhesive Composition

A copolymer (glass-transition temperature T_g : -34°C) was obtained by copolymerization of 62 mass parts of butyl acrylate, 10 mass parts of methyl methacrylate, and 28 mass parts of 2-hydroxyethyl acrylate (HEA). Methacryloyloxyethyl
30 isocyanate (MOI) was reacted with the copolymer at 80 mol% with respect to the HEA of the copolymer to obtain an acrylic-based polymer (weight-average molecular weight: 500,000) having an energy ray polymerizable group.

A pressure sensitive adhesive composition diluted with a solvent was obtained by compounding 3.0 mass parts of a photopolymerization initiator ("Irgacure 184" available from BASF, concentration: 100%) and 1.0 mass part of an isocyanate compound ("BHS-8515" available from TOYO INK CO., LTD.) to 100 mass parts of the above acrylic-based polymer.

[0076]

(3) Production of Pressure Sensitive Adhesive Sheet

The release surface of a release sheet was coated with the above pressure sensitive adhesive composition. The obtained coated film together with the release sheet was maintained in an environment of 80°C for one minute to obtain a laminate comprising the release sheet and a pressure sensitive adhesive layer (measured thickness was 10 μm).

The surface of the above laminate at the pressure sensitive adhesive layer side was attached to the pressure sensitive adhesive processing surface of the previously-described base film to obtain a pressure sensitive adhesive sheet comprising the base film and the pressure sensitive adhesive layer in a state in which the release sheet was further laminated on the surface at the pressure sensitive adhesive layer side.

[0077]

«Example 2»

A pressure sensitive adhesive sheet was obtained in a state in which the release sheet was laminated on the surface at the pressure sensitive adhesive layer side in the same manner as in Example 1 except that the thickness of the pressure sensitive adhesive layer was 5 μm .

[0078]

«Example 3»

A pressure sensitive adhesive sheet was obtained in a state in which the release sheet was laminated on the surface

at the pressure sensitive adhesive layer side in the same manner as in Example 1 except the following change.

(Change) Molding conditions for the base film were changed so that the arithmetic average roughness Ra of the pressure sensitive adhesive processing surface of the base film was 0.16 μm and the arithmetic average roughness Ra of the laser incident surface was 0.03 μm .

[0079]

«Comparative Example 1»

10 A pressure sensitive adhesive sheet was obtained in a state in which the release sheet was laminated on the surface at the pressure sensitive adhesive layer side in the same manner as in Example 3 except that the thickness of the pressure sensitive adhesive layer was 15 μm .

15 [0080]

«Comparative Example 2»

A pressure sensitive adhesive sheet was obtained in a state in which the release sheet was laminated on the surface at the pressure sensitive adhesive layer side in the same manner as in Example 1 except the following changes 1 and 2.

(Change 1) Molding conditions for the base film were changed so that the arithmetic average roughness Ra of the pressure sensitive adhesive processing surface of the base film was 1.3 μm and the arithmetic average roughness Ra of the laser incident surface was 0.04 μm .

(Change 2) The thickness of the pressure sensitive adhesive layer was 15 μm .

[0081]

«Comparative Example 3»

30 A pressure sensitive adhesive sheet was obtained in a state in which the release sheet was laminated on the surface at the pressure sensitive adhesive layer side in the same manner as in Comparative Example 2 except that the thickness of the

pressure sensitive adhesive layer was 10 μm .

[0082]

«Comparative Example 4»

5 A pressure sensitive adhesive sheet was obtained in a state in which the release sheet was laminated on the surface at the pressure sensitive adhesive layer side in the same manner as in Example 1 except the following change.

(Change) Molding conditions for the base film were changed so that the arithmetic average roughness Ra of the pressure sensitive adhesive processing surface of the base film was 0.04 μm and the arithmetic average roughness Ra of the laser incident surface was 1.3 μm .

[0083]

«Exemplary Test 1» <Measurement of Haze>

15 The release sheet was removed from the pressure sensitive adhesive sheet produced in each of the examples and comparative examples and the pressure sensitive adhesive sheet was cut into an appropriate size to obtain a test specimen. The haze of the test specimen was measured in accordance with JIS K7136: 2000 using a HAZE METER ("NDH-5000" available from NIPPON DENSHOKU INDUSTRIES CO., LTD). Light for measurement was incident to the pressure sensitive adhesive sheet from the surface at the base film side. Results are listed in Table 1.

[0084]

25 «Exemplary Test 2» <Observation of Defects>

The release sheet was removed from the pressure sensitive adhesive sheet produced in each of the examples and comparative examples and the observation area was set as an arbitrarily-selected area of 100 mm×100 mm on the surface of the pressure sensitive adhesive sheet at the pressure sensitive adhesive layer side. The observation area was observed using an optical microscope to make evaluation based on the degree of existence of defects in accordance with the criteria as

below:

A: no defects were recognized within the observation area;

5 B: five or less defects were observed within the observation area; and

C: six or less defects were observed within the observation area.

Results are listed in Table 1.

[0085]

10 «Exemplary Test 3» <Evaluation of Picking-up Property>

The pressure sensitive adhesive sheet produced in each of the examples and comparative examples was cut into a circular shape in the plan view and the release sheet was removed therefrom. The surface of the pressure sensitive adhesive
15 layer of the pressure sensitive adhesive sheet was attached to a silicon wafer (thickness: 100 μm) and a ring frame.

[0086]

The silicon wafer was irradiated with laser via the pressure sensitive adhesive sheet from the side of the wafer
20 facing the pressure sensitive adhesive layer, using a laser irradiation apparatus. The irradiation with laser, which was focused inside the wafer, was performed while scanning the laser along planned cutting lines that were set so as to form chips of 8 mm×8 mm. After all of the planned cutting lines were
25 irradiated with laser, the pressure sensitive adhesive sheet was pulled down by 10 mm at a speed of 10 mm/second using an expanding apparatus to expand the region, to which the silicon wafer was attached, of the surface of the pressure sensitive adhesive sheet at the pressure sensitive adhesive layer side
30 in outward directions in the main surface.

[0087]

In this state, the pressure sensitive adhesive sheet was irradiated with ultraviolet rays under the condition as below:

illuminance: 220 mW/cm²; and

light amount: 190 mJ/cm².

[0088]

Subsequently, the load during the picking up was measured
 5 using a push-pull gauge (lifting jig: one pin) available from
 AIKOH ENGINEERING CO., LTD. The load required for the lifting
 was measured and the measured value was used as the basis to
 evaluate the picking-up property in accordance with the
 criteria as below:

10 A: 1.7 N or less; and

B: larger than 1.7 N.

Results are listed in Table 1.

[0089]

[Table 1]

	Ra of base film (μm)		Thickness of pressure sensitive adhesive layer (μm)	Haze (%)	Observation of defects	Picking-up property
	Pressure sensitive adhesive processed surface	Laser incident surface				
Example 1	0.03	0.03	10	1.39	A	A
Example 2	0.03	0.03	5	1.37	A	A
Example 3	0.16	0.03	10	3.28	B	A
Comparative Example 1	0.16	0.03	15	3.17	A	B
Comparative Example 2	1.3	0.04	15	8.07	B	B
Comparative Example 3	1.3	0.04	10	8.30	C	Not measured
Comparative Example 4	0.04	1.3	10	87.60	A	Not measured

15

[0090]

As found from Table 1, the pressure sensitive adhesive
 sheets of the examples which satisfy the conditions of the
 20 present invention have a low haze, are less likely to cause
 defects and excellent in the picking-up property, thus suitable
 as laser dicing sheets.

[Industrial Applicability]

[0091]

25 The pressure sensitive adhesive sheet according to the
 present invention can be suitably used as a laser dicing sheet.

[Name of Document] Claims

[Claim 1]

A pressure sensitive adhesive sheet used when irradiating
a plate-like member with laser light to form a modified part
5 and dividing the plate-like member into chips,

the pressure sensitive adhesive sheet comprising a base
film and a pressure sensitive adhesive layer provided on one
surface of the base film,

wherein each of the one surface and a surface opposite
10 to the one surface of the base film has an arithmetic average
roughness Ra as defined in JIS B0601: 2013 (ISO 4287: 1997) of
0.01 μm or more and 0.2 μm or less, and

the pressure sensitive adhesive layer has a thickness of
2 μm or more and 12 μm or less.

15

[Claim 2]

The pressure sensitive adhesive sheet as recited in claim
1, wherein the pressure sensitive adhesive sheet has a haze as
defined in JIS K7136: 2000 (ISO 14782: 1999) of 0.01% or more
20 and 10% or less when the base film side is an incident side.

[Claim 3]

The pressure sensitive adhesive sheet as recited in claim
1 or 2, wherein the pressure sensitive adhesive layer contains
25 an acrylic-based polymer and the acrylic-based polymer has a
glass-transition temperature Tg of -40°C or higher and -10°C
or lower.

[Claim 4]

30 The pressure sensitive adhesive sheet as recited in claim
3, wherein the acrylic-based polymer includes a constitutional
unit originated from methyl methacrylate and a mass ratio of
the methyl methacrylate to total monomers for providing the

acrylic-based polymer is 5 mass% or more and 20 mass% or less.

[Claim 5]

5 The pressure sensitive adhesive sheet as recited in claim 3 or 4, wherein the acrylic-based polymer has an energy ray polymerizable group.

[Claim 6]

10 The pressure sensitive adhesive sheet as recited in any one of claims 1 to 5, wherein the base film contains a polyolefin-based material.

[Claim 7]

15 The pressure sensitive adhesive sheet as recited in any one of claims 1 to 6, wherein the arithmetic average roughness Ra of the base film is set through a procedure including roll pressurization for the base film.

[Claim 8]

20 The pressure sensitive adhesive sheet as recited in claim 7, wherein rolls used for the roll pressurization are rolls each having a surface formed of a metal material.

[Claim 9]

25 A method of manufacturing processed articles, the method comprising:

an attaching step of attaching a surface of the pressure sensitive adhesive sheet as recited in any one of claims 1 to 8 to one surface of an adherend including the plate-like member to obtain a first laminate comprising the pressure sensitive adhesive sheet and the plate-like member, the surface of the pressure sensitive adhesive sheet being located more proximally to the pressure sensitive adhesive layer than to the base film;

30

a dividing step of expanding the base film of the first laminate thereby to divide the plate-like member on the pressure sensitive adhesive sheet to obtain a second laminate in which a plurality of chips is arranged on the pressure sensitive adhesive sheet, the plurality of chips comprising divided bodies of the plate-like member; and

a picking-up step of separating each of the plurality of chips of the second laminate from the pressure sensitive adhesive sheet to obtain the chips as the processed articles,

wherein a modified part forming step is performed before the dividing step is started, wherein the modified part forming step is a step in which the plate-like member is irradiated with laser light so that the laser light is focused on a focal spot set inside the plate-like member, to form a modified part in the plate-like member.

[Claim 10]

The method of manufacturing processed articles as recited in claim 9, wherein the first laminate supplied to the dividing step comprises an additional layer between the pressure sensitive adhesive layer and the plate-like member, the additional layer is also divided through the dividing step, and the chips to be separated from the pressure sensitive adhesive sheet through the picking-up step comprise the divided bodies of the plate-like member and divided bodies of the additional layer, wherein the divided bodies of the additional layer are formed on surfaces of the divided bodies of the plate-like member, wherein the surfaces of the divided bodies of the plate-like member are located proximally to the pressure sensitive adhesive sheet.

[Claim 11]

The method of manufacturing processed articles as recited

in claim 10, wherein the additional layer comprises a protection layer.

[Claim 12]

5 The method of manufacturing processed articles as recited in claim 11, further comprising a protection film forming step of, before the dividing step is started, forming the protection layer of the first laminate from a film for protection film formation.

10

[Claim 13]

 The method of manufacturing processed articles as recited in claim 10, wherein the additional layer comprises a die bonding layer.

15