ADHESIVE FILM FOR WAFER BACK GRINDING

FIELD

[0001] The present disclosure relates to an adhesive film used to protect a surface of a wafer in a process for grinding a back face of the wafer.

[0002] More specifically, the present disclosure relates to an adhesive film for grinding a back face of a wafer in which the adhesive film has uniform adhesion, excellent fillability on a curved portion, and excellent wafer surface protection effect (shock-absorbing effect) in a process for grinding the back face of the wafer on which bumps have been formed, and the adhesive film reduces or suppresses occurrence of adhesive residue when removing (peeling) the adhesive film after grinding the back face, thereby exhibiting excellent workability.

BACKGROUND

[0003] With the recent development of technology, miniaturization, high density, and thinning of a semiconductor chip are required, and accordingly, thinning of a wafer is also required. A typical method for thinning the semiconductor chip is to grind a back face of the wafer. The thinning of the wafer may be achieved by performing a grinding process based on a type or a specification of an electronic device in which the semiconductor chip is used.

[0004] A process of grinding the back face of the wafer of the semiconductor chip is a process in which a physical impact is applied to the wafer. Thus, in order to protect a surface of the wafer, grinding is performed on the back face of the wafer while the adhesive film for grinding the back face of the wafer is attached to the wafer.

[0005] On a circuit forming face of the semiconductor wafer, not only a circuit but also unevenness with a relatively large step such as a bump may be formed. When attaching the adhesive film for grinding the back face of the wafer to the wafer, a gap is formed between the

adhesive film for grinding the back face of the wafer and the unevenness on the circuit formation face of the semiconductor wafer due to the bump structure. Thus, when grinding a non-circuit forming face of the semiconductor wafer, a stress distribution occurs across the semiconductor wafer surface, such that there is a problem that the semiconductor wafer is easily damaged.

[0006] Further, in order to remove the adhesive film for grinding the back face of the wafer from the surface of the wafer after grinding the back face of the wafer, energy rays are irradiated to the adhesive film to lower adhesion thereof such that the adhesive film peels off from the wafer. At this time, the irradiated energy ray may not sufficiently reach the gap formed due to the bump structure, and thus a shaded area may occur. In such a shaded area, curing based on the energy ray is insufficient and thus a peeling force of the adhesive film is lowered. As a result, adhesive residues derived from the adhesive film are easily left on the surface of the wafer, which impairs workability and consequently adversely affects the quality of the resulting semiconductor chip.

SUMMARY

[0007] A purpose of the present disclosure is to provide an adhesive film for grinding a back face of a wafer in which the adhesive film prevents wafer damage during the grinding process of the back face of the wafer, especially the wafer having a bump structure, and minimizes residue therefrom when the adhesive film is removed after the process for grinding the back face of the wafer.

[0008] Purposes according to the present disclosure are not limited to the above-mentioned purpose. Other purposes and advantages according to the present disclosure that are not mentioned may be understood based on following descriptions, and may be more clearly understood based on embodiments according to the present disclosure. Further, it will be easily

understood that the purposes and advantages according to the present disclosure may be realized using means shown in the claims and combinations thereof.

[0009] An aspect of the present disclosure provides an adhesive film for grinding a back face of a wafer, the adhesive film comprising: a rigid base layer having a light-scattering pattern formed thereon; a first adhesive layer disposed on the rigid base layer; a second adhesive layer disposed on the first adhesive layer; and a third adhesive layer disposed on the second adhesive layer, wherein the second adhesive layer is made of a second adhesive composition, wherein the second adhesive composition includes a second (meth)acrylate-based adhesive resin and an epoxy-based binder resin having a softening point in a range of 30 to 70°C.

[0009a] Disclosed herein is an adhesive film for grinding a back face of a wafer, the adhesive film comprising:

a rigid base layer having a light-scattering pattern formed thereon;

a first adhesive layer disposed on the rigid base layer;

a second adhesive layer disposed on the first adhesive layer; and

a third adhesive layer disposed on the second adhesive layer,

wherein the second adhesive layer is made of a second adhesive composition, wherein the second adhesive composition includes a second (meth)acrylate-based adhesive resin and an epoxy-based binder resin having a softening point in a range of 30 to 70°C,

wherein a total transmittance of the adhesive film for grinding the back face of the wafer is 70% or greater,

wherein a diffuse transmittance of the adhesive film for grinding the back face of the wafer is in a range of 6% or greater.

[0010] In one implementation of the adhesive film for grinding the back face of the wafer, the second adhesive composition contains 5 to 45 parts by weight of the epoxy-based binder resin based on 100 parts by weight of the second adhesive composition.

[0011] In one implementation of the adhesive film for grinding the back face of the wafer, a total transmittance of the adhesive film for grinding the back face of the wafer is 70% or greater, wherein a diffuse transmittance of the adhesive film for grinding the back face of the wafer is in a range of 6% or greater.

[0012] In one implementation of the adhesive film for grinding the back face of the wafer, a shear storage modulus of the second adhesive layer at 23°C is in a range of 0.1 to 10 MPa.

[0013] In one implementation of the adhesive film for grinding the back face of the wafer, the first adhesive layer is made of a first adhesive composition including a first (meth)acrylate-based adhesive resin, wherein a shear storage modulus of the first adhesive layer at 23°C is in a range of 0.01 to 1 MPa.

[0014] In one implementation of the adhesive film for grinding the back face of the wafer, the third adhesive layer is made of a third adhesive composition including a third (meth)acrylate-based adhesive resin, wherein a shear storage modulus of the third adhesive layer at 23°C is in a range of 0.01 to 1 MPa.

[0015] In one implementation of the adhesive film for grinding the back face of the wafer, the rigid base layer has a tensile modulus at 23°C in a range of 1,000 MPa or greater.

[0016] In one implementation of the adhesive film for grinding the back face of the wafer, the rigid base layer includes a base layer made of polyethylene terephthalate (PET).

[0017] In one implementation of the adhesive film for grinding the back face of the wafer, a total transmittance of the rigid base layer is in a range of 80% or greater, and a diffuse transmittance of the rigid base layer is in a range of 5 to 20%.

[0018] In one implementation of the adhesive film for grinding the back face of the wafer, the adhesive film for grinding the back face of the wafer satisfies a following Relationship (1):

[0019] [Relationship (1)]: $T_{(S)} \times 0.05 \leq T_{max(P)} \leq T_{(S)} \times 0.5$

[0020] wherein in the Relationship (1), $T_{(S)}$ denotes a thickness of the rigid base layer, and $Tmax_{(P)}$ denotes a maximum height of the light-scattering pattern.

[0021] In one implementation of the adhesive film for grinding the back face of the wafer, the light-scattering pattern is made of a material having a pencil hardness of 2H or greater measured according to ASTM D 3363.

[0022] In one implementation of the adhesive film for grinding the back face of the wafer, the light-scattering pattern is formed by photocuring a coating composition, wherein the coating composition includes a urethane (meth)acrylate oligomer, a multifunctional (meth)acrylate monomer, and a photoinitiator.

[0023] In one implementation of the adhesive film for grinding the back face of the wafer, the adhesive film for grinding the back face of the wafer satisfies following Relationships (2) and (3):

[0024] [Relationship (2)]: $T_{(PSA_1)} \leq T_{(PSA_2)} \leq T_{(PSA_1)} \times 10$

[0025] [Relationship (3)]: $T_{(PSA_3)} \leq T_{(PSA_2)} \leq T_{(PSA_3)} \times 10$

[0026] wherein in the Relationships (2) and (3), $T_{(PSA_1)}$, $T_{(PSA_2)}$ and $T_{(PSA_3)}$ denote a thickness of the first adhesive layer, a thickness of the second adhesive layer, and a thickness of the third adhesive layer, respectively.

[0027] In one implementation of the adhesive film for grinding the back face of the wafer, the adhesive film for grinding the back face of the wafer is applied to a process for grinding a back face of a wafer on which a bump has been formed.

[0028] When the adhesive film for grinding the back face of the wafer according to the present disclosure is applied to the process for grinding the back face of the wafer, the damage to the wafer due to stress distribution imbalance may be prevented even when there is a void due to the bump structure of the wafer. At the same time, when removing the adhesive film after the back face grinding process, an amount of the adhesive residue may be significantly reduced or the formation of the residue may be suppressed. Thus, wafer workability and quality of the resulting semiconductor chip may be improved.

[0029] In addition to the above effects, specific effects of the present disclosure are described together while describing specific details for carrying out the present disclosure.

BRIEF DESCRIPTION OF DRAWINGS

[0030] FIG. 1 shows a cross-sectional view of an adhesive film for grinding a back face of a wafer according to one aspect of the present disclosure.

[0031] FIG. 2 shows a three-dimensional view of an adhesive film for grinding a back face of a wafer according to one aspect of the present disclosure.

[0032] FIG. 3 shows an enlarged cross-sectional view of a light-scattering pattern formed on a rigid base layer of an adhesive film for grinding a back face of a wafer according to one aspect of the present disclosure.

[0033] FIG. 4 shows an example of a cross section of a bump structure formed on a wafer surface.

[0034] FIG. 5 shows a simplified flowchart of a process of applying an adhesive film for grinding a back face of a wafer to a process for grinding a back face of a wafer and then peeling the film off from the wafer according to one aspect of the present disclosure.

DETAILED DESCRIPTIONS

[0035] The foregoing purposes, features, and advantages will be described later in detail with reference to the accompanying drawings, and accordingly, those skilled in the art to which the present disclosure belongs will be able to easily implement the technical idea of the present disclosure.

[0036] In describing the present disclosure, when it is determined that a detailed description of a known component related to the present disclosure may unnecessarily obscure the gist of the present disclosure, the detailed description is omitted.

[0037] Description that may be sufficiently technically inferred by those skilled in the art among descriptions that are not described herein will be omitted.

[0038] As used herein, "excellent fillability on a bump structure, a curved portion, a light-scattering patterns, etc." may mean i) that when attaching the adhesive film to the semiconductor wafer, the adhesive film adheres well to and along the curved portion without lift-off of the film or a void formation which may occur due to the curved portion that occurs due to the bump structure formed on the semiconductor wafer; and ii) that when adhesive layers of the adhesive film according to the present disclosure are bonded to each other, the adhesive layer excellently adheres to and along a curved portion due to a light-scattering pattern formed on a rigid base layer.

[0039] As used herein, "room temperature" may be interpreted as indicating a temperature of approximately 23 to 25 °C unless there is a specific temperature value limitation.

[0040] As used herein, each of "total transmittance (abbreviated as 'T.T') (%)" and "diffuse transmittance (abbreviated as 'D.T')" is measured according to the ASTM D1003 method using haze meter equipment (Nippon Denshoku Co., NDH5000).

[0041] As used herein, "(meth)acrylate" may mean including both acrylate and methacrylate.

[0042] As used herein, it will also be understood that when a first element or layer is referred to as being present "on" or “beneath” a second element or layer, the first element may be disposed directly on or beneath the second element or may be disposed indirectly on or beneath the second element with a third element or layer being disposed between and connected to the first and second elements or layers.

[0043] As used herein, terms such as "one side", "the other side", and "both opposing sides" are used to distinguish one component from another component. A component is not limited by the above terms.

[0044] As used herein, "parts by weight" may mean a ratio between weights of components.

[0045] As used herein, the singular forms "a" and "an" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprise", "comprising", "include", and "including" when used in this specification, specify the presence of the stated features, integers, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, operations, elements, components, and/or portions thereof.

[0046] As described above, the adhesive film for griding the back face of the wafer according to the present disclosure overcomes the limitations that may occur in the grinding process of the back face of the wafer on which the bump structure has been formed. Specifically, the adhesive film for griding the back face of the wafer according to the present disclosure may have excellent fillability on the bump structure to prevent wafer damage and may minimize or suppress formation of the residue in removing the adhesive film. This will be described in detail.

[0047] First, FIG. 4 is an actual enlarged photographic image of a bump structure 300 formed on a surface of a wafer 200. Due to a round shape of the bump 300, a void (as indicated by a dotted circle) is formed between the wafer 200 and the bump 300. FIG. 4 shows one bump. As

numerous bumps are formed on the wafer, the number of the voids also increases. Therefore, as the stress applied to the wafer when grinding the wafer back face is non-uniformly distributed across the wafer due to the voids, the wafer is damaged. Further, the void serves as a shaded area which energy rays irradiated to remove the adhesive film for griding the back face of the wafer cannot reach. This is described in detail with reference to FIG. 5 which shows a process for grinding the back face of the wafer.

[0048] FIG. 5 shows an example of a flowchart of a process in which an adhesive film 100 for grinding the back face of the wafer according to one aspect of the present disclosure is applied on the wafer, and grinding of the back face is performed, and then the film is removed form the wafer by irradiating energy rays to reduce adhesion of the adhesive film.

[0049] Specifically, S1 in FIG. 5 is a step (wafer loading) of preparing a wafer before the process of grinding the back face of the wafer. The bump 300 is formed on a surface of the wafer 200. The bump 300 is shown as having a layer structure having a face for simplicity of the illustration. However, the bump does not actually have the layer structure.

[0050] S2 of FIG. 5 is a step of attaching the adhesive film 100 for grinding the back face of the wafer according to the present disclosure to the surface of the wafer. The adhesive film 100 serves to protect the surface of the wafer 200 when grinding the back face.

[0051] S3 in FIG. 5 schematically shows the grinding process of the back face. In the process of grinding the back face, various back face grinding equipment as used in the present technical field may be used without limitation. For example, equipment capable of loading the wafer on a chuck table and of rotating a grinding wheel may be used.

[0052] S4 of FIG. 5 is a step of irradiating energy rays (typically, ultraviolet rays (UV)) to peel off the adhesive film 100 for grinding the back face of the wafer after the back face grinding process. For convenience of illustration, it is illustrated that a thickness of the wafer

210 after the back face grinding process has become smaller than that of the wafer 200 before the back face grinding process. Accordingly, it is general that the adhesive layer of the adhesive film 100 for grinding the back face of the wafer is made of an energy ray curable adhesive composition.

[0053] S5 of FIG. 5 briefly shows a step of peeling the adhesive film 100 for grinding the back face of the wafer after the back face grinding process. At this time, when the exposure of energy rays reaching the adhesive film 100 for grinding the back face of the wafer to the adhesive film is insufficient, the adhesion of the adhesive film is not sufficiently lowered to a level at which the adhesive film can be detached from the wafer. Thus, residues of the adhesive film 100 for grinding the back face of the wafer may remain in the peeling step. An area R where the residue of the adhesive remains is exemplarily shown in FIG. 5.

[0054] When the residue of the adhesive film 100 for grinding the back face of the wafer remains on the wafer, this may adversely affect workability and quality of the resulting semiconductor chip. Further, as the number of the voids and the amount of the curved portion due to the bump formed on the wafer 200 increase, the shaded area which the energy rays cannot reach increases, such that the above problem becomes more serious.

[0055] The inventor of the present disclosure has conducted intensive research to overcome the above problem. Thus, the inventor has invented the adhesive film for grinding the back face of the wafer in which the adhesive film has excellent fillability on the bump structure so that the stress applied to the wafer when grinding the wafer back face may be evenly distributed across the wafer, and the energy rays irradiated to the adhesive film when removing the adhesive film can reach the adhesive film uniformly and sufficiently.

[0056] In one preferred aspect of the present disclosure, as shown in FIGS. 1 and 2, the adhesive film 100 for grinding the back face of the wafer of the present disclosure may include

a rigid base layer S on which a light-scattering pattern P is formed; a first adhesive layer 10 disposed on the rigid base layer S; a second adhesive layer 20 disposed on the first adhesive layer 10; and a third adhesive layer 30 disposed on the second adhesive layer 20. The adhesive film 100 for grinding the back face of the wafer and each of the structural layers thereof are described in detail.

[0057] **Rigid base layer S having light-scattering pattern P formed thereon**

[0058] A base layer of the adhesive film for grinding the back face of the wafer according to the present disclosure may be the rigid base layer S made of a rigid material having a high tensile modulus. Preferably, the rigid base layer S may have a tensile modulus of 1,000 MPa or greater, for example, 1,200 MPa or greater, 1,500 MPa or greater, 2,000 MPa or greater, or 3,000 MPa or greater. An upper limit value of the tensile modulus is not particularly limited, but may be, for example, 5,000 MPa or lower. In this regard, the tensile modulus is based on a value measured at 23℃. When the tensile modulus is relatively low, that is, lower than 1,000 MPa, there may be a problem in that the adhesive film has a low supporting force to support the wafer or semiconductor chip thereon, such that collision of the semiconductor chip may occur in the back face grinding process.

[0059] The rigid base layer S may be made of, for example, one selected from a group consisting of polyester such as polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polybutylene terephthalate (PBT), or fully aromatic polyester, polyimide (PI), polyamide (PA), polycarbonate (PC), polyacetal, modified polyphenylene oxide, polyphenylene sulfide, polysulfone, polyetherketone, and biaxially-oriented poly-propylene. Preferably, the base layer S may be made of polyethylene terephthalate (PET).

[0060] The rigid base layer S according to the present disclosure is characterized in that the light-scattering pattern P is formed thereon. The light-scattering pattern P is formed to scatter

light so that energy rays can evenly reach the shaded area occurring due to the bump structure. In order that the light-scattering pattern P can endure the stress resulting from the process for grinding the back face of the wafer, the light-scattering pattern P may be made of a material having a pencil hardness of 2H or greater, preferably 3H or greater, more preferably 4H or greater, and most preferably 5H or greater, as measured in accordance with ASTM D 3363. A type of a material of the light-scattering pattern P is not particularly limited as long as the purpose of the present disclosure can be achieved.

[0061] For example, the light-scattering pattern P may be formed by photocuring a coating composition including urethane (meth)acrylate oligomer; multifunctional (meth)acrylate monomer; and a photoinitiator. Preferably, an example of the multifunctional (meth)acrylate monomer may include 4 to 6 functional (meth)acrylate monomers including (di)pentaerythritol. The photoinitiator may include a conventional photoinitiator used in the art, for example, an acetophenone-based photoinitiator.

[0062] Further, as shown exemplarily in FIG. 3, a geometric shape of the light-scattering pattern P may be applied without particular limitation thereto. For example, the geometric shapes of the pattern may be rectangular, square, triangular, trapezoidal, hemispherical, etc. A solid arrow in FIG. 3 represents the energy ray irradiated toward the rigid base layer S, and a dotted arrow represents scattering of the radiated energy ray due to the light-scattering pattern P.

[0063] The total transmittance of the rigid base layer S may be 80% or greater, and the diffuse transmittance thereof may be in a range of 5 to 20%. When the total transmittance of the rigid base layer is lower than 80%, a cured amount of the adhesive film is lowered during the UV exposure, thus making it difficult to sufficiently lower the adhesion, such that the wafer chip may be damaged in removing the adhesive film. When the diffuse transmittance is lower than

5%, there may be a problem that the residual adhesive may remain in the shaded area caused by the bump. When the diffuse transmittance exceeds 20%, there may be a problem in that a haze increases such that pattern visibility is lowered.

[0064] Further, a relationship between a thickness of the rigid base layer S and a thickness of the light-scattering pattern P may satisfy a following Relationship (1):

[0065] [Relationship (1)]: $T_{(S)} \times 0.05 \leq T_{max(P)} \leq T_{(S)} \times 0.5$

[0066] In the Relationship (1), $T_{(S)}$ denotes the thickness of the rigid base layer, and $Tmax_{(P)}$ denotes a maximum height of the light-scattering pattern.

[0067] **First adhesive layer 10**

[0068] The first adhesive layer 10 according to the present disclosure is disposed on top of the rigid base layer S. The first adhesive layer 10 is located between the second adhesive layer 20 and the rigid base layer S and serves as an interlayer adhesive layer. Thus, physical properties required in the first adhesive layer 10 are related to properties of the second adhesive layer 20 and the rigid base layer S.

[0069] Specifically, because, as described later, the second adhesive layer 20 has a high shear storage modulus value, it is necessary to secure adhesion between the second adhesive layer 20 and the rigid base layer S. Further, because the rigid base layer S has an non-uniform thickness due to the light-scattering pattern P formed thereon, it is necessary to compensate for the non-uniformity. The voids caused by the bump on the wafer should be filled.

[0070] From this point of view, the shear storage modulus of the first adhesive layer 10 at 23 °C may be in a range of preferably 0.01 to 1 MPa, more preferably 0.05 to 1 MPa, and most preferably 0.05 to 0.5 MPa. When the shear storage modulus of the first adhesive layer 10 is lower than 0.01 MPa, there may be a problem that the adhesive sticks to a blade when cutting the wafer after attaching the adhesive film to the wafer. When the shear storage modulus of the

first adhesive layer 10 exceeds 1 MPa, there may be a problem that when the rigid base layer and the first adhesive layer 10 are bonded to each other, air bubbles may occur due to insufficient fillability on the light-scattering pattern, such that the bonding between the rigid base layer and the first adhesive layer may be poor.

[0071] The first adhesive layer 10 according to the present disclosure may be formed by thermally curing a first adhesive composition including a first (meth)acrylate-based adhesive resin.

[0072] An example of the first (meth)acrylate-based adhesive resin may be generally used in the art and may be selected without limitation within a range capable of achieving the purpose of the present disclosure. For example, the example of the first (meth)acrylate-based adhesive resin may be a polymer of a (meth)acrylate-based monomer having an alkyl group having 1 to 14 carbon atoms, specifically, may be at least one polymer selected from a group consisting of ethylhexyl acrylate, butyl acrylate, ethyl acrylate, methyl acrylate, acrylic acid, hydroxyethyl acrylate, and hydroxybutyl acrylate. Preferably, the example of the first (meth)acrylate-based adhesive resin may be a polymer obtained by polymerizing a monomer to which a carboxyl group or a hydroxyl group is bonded.

[0073] Further, the first adhesive composition may further include a crosslinking agent. A type of the crosslinking agent is not particularly limited as long as the type of the crosslinking agent is commonly used in the art. For example, an isocyanate-based crosslinking agent may be used as the crosslinking agent.

[0074] In one example, a thickness of the first adhesive layer 10 is not particularly limited, and may be, for example, in a range of about 10 to 100 μm. For example, the thickness of the first adhesive layer 10 may be in a range of about 10 to 70 μm. For example, the thickness of the first adhesive layer 10 may be in range of about 10 to 50 μm.

[0075] **Second adhesive layer 20**

[0076] The second adhesive layer 20 according to the present disclosure can withstand the stress applied thereto when grinding the wafer back face and can achieve excellent fillability on the curved portion (unevenness) and the void formed due to the bump structure. Thus, the second adhesive layer 20 may act as an unevenness removing layer.

[0077] The second adhesive layer 20 according to the present disclosure preferably has a shear storage modulus in a range of 0.1 to 10 MPa, more preferably, 0.1 to 5 MPa at 23° C. When the shear storage modulus of the second adhesive layer 20 is lower than 0.1 MPa, there may be problem in fixing and supporting the wafer chip during the grinding process. When the shear storage modulus of the second adhesive layer 20 exceeds 10 MPa, there may be a problem that the fillability on the bump is lowered.

[0078] Generally, the adhesive layer that is included in a conventional adhesive film for grinding the back face of the wafer may include an acrylate-based adhesive resin. The conventional adhesive layer may not secure excellent adhesion (filling) on a wafer having a void due to the bump.

[0079] From this point of view, the inventor of the present disclosure has conducted intensive research to overcome this problem. The inventor has added an additive having a softening point of 30 to 70 °C to a (meth)acrylate-based adhesive resin when preparing the adhesive layer. Thus, it has been experimentally identified that the adhesion (filling) on the void due to the bump may be significantly improved in a range of a room temperature to 70 °C as a general bonding process temperature range, and thus the phenomenon of the lift-off of the adhesive film for grinding the back face of the wafer on the wafer and a void formation therebetween may be suppressed.

[0080] More specifically, when the adhesive film for grinding the back face of the wafer is bonded to the wafer for the grinding process thereof, lamination occurs at a temperature of about room temperature to 70 °C. Thus, a softening point of a binder resin used as the additive may be in a range of preferably 30 to 70 ° C, more preferably 30 to 60 ° C. The binder resin having the above softening point may be preferably an epoxy-based binder resin.

[0081] Accordingly, the second adhesive layer may be made of a second adhesive composition including a second (meth)acrylate-based adhesive resin and the epoxy-based binder resin having the softening point in a range of 30 to 70°C.

[0082] The epoxy-based binder resin is not particularly limited as long as the epoxy-based binder resin has the softening point in a range of 30 to 70 ° C. For example, the epoxy-based binder resin may include a bisphenol A type epoxy resin, a bisphenol F type epoxy resin, a cresol novolac type epoxy resin, an ortho-cresol novolac type epoxy resin, a xylok type epoxy resin, etc. Preferably, the epoxy-based binder resin may be the ortho-cresol novolac type YDCN-500-1P (Kukdo Chemical company).

[0083] Further, the second adhesive composition may further include a crosslinking agent. A type of the crosslinking agent is not particularly limited as long as the crosslinking agent is commonly used in the art. For example, an isocyanate-based crosslinking agent may be used as the crosslinking agent.

[0084] An example of the second (meth)acrylate-based adhesive resin may be generally used in the art and may be selected without limitation within a range capable of achieving the purpose of the present disclosure. A specific example of the second (meth)acrylate-based adhesive resin may be the same as that as described above in relation to 'the first (meth)acrylate-based adhesive resin'.

[0085] The second adhesive composition may contain the epoxy-based binder resin at a content of 5 to 45 parts by weight, for example, 5 to 40 parts by weight, for example, 5 to 30 parts by weight, for example, 5 to 20 parts by weight, for example, 10 to 20 parts by weight, based on 100 parts by weight of the second adhesive composition. When the content of the epoxy binder resin is lower than 5 parts by weight, the modulus at room temperature may be lowered, which may cause a problem in that a support function of the adhesive film to support the wafer chip thereon may be lowered during the grinding process. When the content thereof exceeds 45 parts by weight, the fillability on the bump when bonding the adhesive film to the wafer may be lowered.

[0086] In one example, a thickness of the second adhesive layer 20 is not particularly limited, and may be, for example, in a range of approximately 10 to 200 μm, about 20 to 150 μm, or about 30 to 100 μm.

[0087] **Third adhesive layer 30**

[0088] The third adhesive layer 30 according to the present disclosure is a portion of the adhesive film 100 attached to the wafer. A material of the third adhesive layer 30 is not particularly limited as long as the material has appropriate adhesiveness at room temperature. The third adhesive layer 30 may be made of each of various adhesive compositions such as an acrylate-based adhesive composition, a silicone-based adhesive composition, a polyester-based adhesive composition, a polyamide-based adhesive composition, a urethane-based adhesive composition, and a styrene-diene block copolymer adhesive composition as a known UV (ultraviolet) curable adhesive composition. Preferably, the third adhesive layer 30 may be made of the acrylate-based adhesive composition.

[0089] The third adhesive layer 30 according to the present disclosure may be formed by photocuring a third adhesive composition including a third (meth)acrylate-based adhesive resin,

and may have a shear storage modulus in a range of 0.01 to 1 MPa at 23 °C. When the shear storage modulus at 23℃ is lower than 0.01 MPa, aggregation may be too low such that a transfer problem may occur when removing the adhesive film. When the shear storage modulus at 23℃ is exceeds 1 MPa, the adhesion related problem may occur when bonding the adhesive film to the wafer.

[0090] The third adhesive composition may further include a photopolymerization initiator and a crosslinking agent. A type of each of the photopolymerization initiator and the crosslinking agent is not particularly limited as long as it is commonly used in the art.

[0091] The photopolymerization initiator is a material that initiates a UV curing reaction via UV irradiation. A type and a content thereof may be appropriately selected and used in consideration of a curing rate of the resin composition.

[0092] For example, an example of the photopolymerization initiator may include hydroxycyclohexylphenylketone (Irgacure 184), 2-methyl-1[4-(methylthio)phenyl]-2-morpholino-propan-1-one (Irgacure 907), α,α-methoxy-α-hydroxyacetophenone (Irgacure 651), 2-hydroxy-2-methyl-1-phenyl-propan-1-one (Irgacure 1173), and the like.

[0093] Further, the third adhesive composition may further include the crosslinking agent. A type thereof is not particularly limited as long as it is commonly used in the art. For example, an isocyanate-based crosslinking agent may be used as the crosslinking agent.

[0094] An example of the third (meth)acrylate-based adhesive resin may be generally used in the art and may be selected without limitation within a range capable of achieving the purpose of the present disclosure. A specific type of the third (meth)acrylate-based adhesive resin may be the same as that as described above in relation to 'the first (meth)acrylate-based adhesive resin'.

[0095] In one example, a thickness of the third adhesive layer 30 is not particularly limited, and may be, for example, in a range of approximately 10 to 100 μm, about 10 to 70 μm thick, or about 10 to 50 μm.

[0096] A**dhesive film 100 for grinding back face of wafer**

[0097] When the adhesive film 100 for grinding the back face of the wafer according to the present disclosure is applied to the grinding process on the back face of the wafer on which the bumps have been formed, the adhesive film 100 may have excellent coverage on the curved portion occurring due to the bump and may remove the void and the shade area which may otherwise occur due to the bump.

[0098] The adhesive film 100 for grinding the back face of the wafer according to the present disclosure preferably has a total transmittance of 70% or greater and a diffuse transmittance of 6% or greater.

[0099] Specifically, in order to peel the adhesive film 100 for grinding the back face of the wafer from the wafer, energy rays (typically, UV) may be irradiated to the adhesive film so that a curing reaction proceeds so as to reduce the adhesion thereof. In this regard, it is preferable that the total transmittance of the adhesive film is 70% or greater so that the curing reaction via the energy ray irradiation may be sufficiently realized.

[00100] In one example, the rigid base layer S according to the present disclosure includes the light-scattering pattern P formed thereon to induce light scattering or light diffusion in an entire structure of the adhesive film 100 for grinding the back face of the wafer. In order that the adhesive film sufficiently exhibits the light scattering or light diffusion effect, the diffuse transmittance of the entire structure of the adhesive film 100 for grinding the back face of the wafer may be preferably 6% or greater. However, the present disclosure is not limited thereto, the diffuse transmittance may be 35% or smaller.

[00101] Further, the thicknesses of the first adhesive layer 10, the second adhesive layer 20, and the third adhesive layer 30 of the adhesive film 100 for grinding the back face of the wafer may satisfy following Relationships (2) and (3) in order to achieve sufficient fillability on bumps of various heights. The following Relationships (2) and (3) limit a feature that the thickness of the second adhesive layer 20 should be within a range of 1 to 10 times of the thickness of each of the first adhesive layer 10 and the third adhesive layer 30.

[00102] [Relationship (2)]: $T_{(PSA_1)} \leq T_{(PSA_2)} \leq T_{(PSA_1)} \times 10$

[00103] [Relationship (3)]: $T_{(PSA_3)} \leq T_{(PSA_2)} \leq T_{(PSA_3)} \times 10$

[00104] In the above Relationships (2) and (3), $T_{(PSA_1)}$, $T_{(PSA_2)}$ and $T_{(PSA_3)}$ mean the thickness of the first adhesive layer, the thickness of the second adhesive layer, and the thickness of the third adhesive layer, respectively.

[00105] Hereinafter, a configuration and an effect of the adhesive film according to the present disclosure will be described in more detail based on preferred Present Examples of the present disclosure. However, Present Examples are merely examples of the present disclosure and should not be interpreted as limiting the present disclosure in any sense. Contents as not described herein may be technically inferred by a person skilled in the art, and descriptions thereof will be omitted.

[00106] **Preparation Example 1: Preparation of first adhesive composition to form first adhesive layer**

[00107] 42 parts by weight of butyl acrylate, 10 parts by weight of ethylhexyl acrylate, 30 parts by weight of methyl acrylate, 5 parts by weight of 2-hydroxyethyl acrylate, 13 parts by weight of acrylic acid, 0.05 part by weight of azobisisobutyronitrile, and ethyl acetate 100 parts by weight were mixed with each other to obtain a mixture. The mixture was polymerized

at 60°C for 6 hours under a nitrogen atmosphere to obtain an acrylate-based adhesive resin having a weight average molecular weight of 600,000.

[00108] 3 parts by weight of an isocyanate-based crosslinking agent (Nippon Polyurethane Industry Co., Ltd, a trade name "Coronate C") was added to 100 parts by weight of the acrylate-based adhesive resin. Thus, the first adhesive composition to form the first adhesive layer was prepared.

[00109] **Preparation Example 2: Preparation of second adhesive composition to form second adhesive layer**

[00110] 20 parts by weight of butyl acrylate, 10 parts by weight of ethylhexyl acrylate, 55 parts by weight of methyl acrylate, 7 parts by weight of 2-hydroxyethyl acrylate, 8 parts by weight of acrylic acid, 0.1 part by weight of azobisisobutyronitrile, and 100 parts by weight of ethyl acetate were mixed each other to obtain a mixture. The mixture was polymerized at 60°C for 6 hours under a nitrogen atmosphere to obtain an acrylate-based adhesive resin having a weight average molecular weight of 500,000.

[00111] 3 parts by weight of an isocyanate-based crosslinking agent (Nippon Polyurethane Industry Co., Ltd. a trade name "Coronate C") was added to 100 parts by weight of the acrylate-based adhesive resin. Thus, the second adhesive composition for forming the second adhesive layer was prepared.

[00112] **Preparation Example 3: Preparation of third adhesive composition to form third adhesive layer**

[00113] A mixture of monomers composed of 50 g of butyl acrylate (BA), 40 g of methyl acrylate (MA), and 4 g of hydroxyethyl acrylate (HEA) was input to a reactor in which a nitrogen gas was refluxed and which was equipped with a cooling device so that a temperature was easily controlled. Thus, the monomer mixture was obtained.

[00114] Subsequently, 100 parts by weight of ethyl acetate (EAc) as a solvent was added to 100 parts by weight of the monomer mixture. Then, the mixture was sufficiently mixed at 30° C for 30 minutes or greater while nitrogen was injected into the reactor to remove oxygen. Thereafter, the temperature was raised to and maintained at 50°C. 0.1 part by weight of azobisisobutyronitrile as a reaction initiator was added thereto, and the reaction was initiated, followed by polymerization for 24 hours to prepare a first reaction product.

[00115] 4 parts by weight of 2-metacroyloxyethyl isocyanate (MOI) and a catalyst (DBTDL: dibutyl tin dilaurate) at a content of 1% by weight relative to a content of the MOI were added to the first reaction product. Then, a reaction was performed thereon at 40°C for 24 hours to obtain an acrylate-based adhesive resin having a weight average molecular weight of 500,000.

[00116] 0.1 parts by weight of Irgacure 184 (BASF company) as the photopolymerization initiator and 2 parts by weight of an isocyanate-based crosslinking agent (Nippon Polyurethane Industry Co., Ltd, a trade name: Coronate C) as the crosslinking agent were added to 100 parts by weight of the acrylate-based adhesive resin. Thus, the third adhesive composition to form the third adhesive layer was prepared.

[00117] **Preparation example 4: Preparation of rigid base layer having light-scattering pattern formed thereon**

[00118] 1030 g of a mixture in which 3% by weight of pentaerythritol diacrylate, 52% by weight of pentaerythritol triacrylate, and 45% by weight of pentaerythritol tetraacrylate were mixed with other was input to a reactor. A temperature of the reactor was raised to 70°C. Then, for 1 hour, 2 equivalents of isophorone diisocyanate was added thereto in a dropwise manner. A reaction was performed for 6 hours to prepare a reaction product.

[00119] It was identified that the reaction product had no NCO peak using infrared spectrophotometry (IR). Then, the reaction product was cooled to 60°C, and was diluted with 537.3 g of 2-hydroxyethyl methacrylate to prepare a urethane acrylate oligomer.

[00120] 50% by weight of the prepared urethane acrylate oligomer, 31% by weight of pentaerythritol triacrylate, 10% by weight of dipentaerythritol hexaacrylate, 8% by weight of 1-hydroxydimethylphenyl ketone as the acetophenone-based photoinitiator, and 1% by weight of an additive were uniformly mixed with each other to prepare a UV curable coating composition.

[00121] The UV curable coating composition was diluted to 50% by weight using a mixed solvent of ethyl acetate/butyl acetate at a ratio 1:1. Then, the diluted coating composition was applied onto a PET film (a thickness: 50 μm, a tensile modulus: 2400 MPa) as a rigid base layer so as to have a coating thickness of 5 μm. Then, a pattern forming roll having a specific shape passed on and by the applied coating composition. UV curing of the coating composition was fully performed using an ultraviolet curing machine (800~^{2}) to form a light-scattering pattern.

[00122] **Present Example 1**

[00123] The first adhesive composition of Preparation Example 1 was coated on the PET (polyethylene terephthalate) film of a thickness 50 ㎛ having the light diffusion pattern (maximum height: 5 ㎛) of Preparation Example 4 in a curved shape (a semicircular shape) to form a first stack. 10 parts by weight of an epoxy-based binder resin YDCN-500-1P (softening point: 50 to 54 ℃) was added to the second adhesive composition of Preparation Example 2. Then, the second adhesive composition was coated on a released polyethylene terephthalate (PET) of a thickness 50 ㎛ so as to have a thickness of 100 ㎛ to form a second stack. Then,

the first stack and the second stack were bonded to each other such that a first composite film including the first adhesive layer and the second adhesive layer and having a thickness of 225 ㎛ was produced.

[00124] Then, 100 parts by weight of the third adhesive composition of Preparation Example 3 was coated on a biaxially stretched polyethylene terephthalate (PET) film having a thickness of 25 μm so as to have a thickness of 25 μm. Thus, a second composite film including the second adhesive layer and having a thickness of 50 μm was produced.

[00125] The released PET film of the first composite film was removed therefrom. The second composite film was bonded to the first composite film to prepare an adhesive film for grinding the back face of the wafer, wherein the adhesive film had a total thickness of 200 ㎛ (the thickness of the released PET was excluded from the total thickness).

[00126] **Present Example 2**

[00127] An adhesive film was prepared in the same manner as that in Present Example 1, except that 20 parts by weight of YDCN-500-1P as the epoxy-based binder resin was included instead of 10 parts by weight thereof when preparing the second adhesive composition, and that the light-scattering pattern was formed using a trapezoidal pattern (maximum height: 5 μm) forming roll instead of the curved pattern forming roll.

[00128] **Present Example 3**

[00129] An adhesive film is prepared in the same manner as that in Present Example 1, except that 40 parts by weight of YDCN-500-1P as the epoxy-based binder resin was included instead of 10 parts by weight thereof when preparing the second adhesive composition, and that the light-scattering pattern was formed using a triangular pattern (maximum height: 5 μm) forming roll instead of the curved pattern forming roll.

[00130] **Comparative Example 1**

[00131] An adhesive film was prepared in the same manner as that in Present Example 1, except that when preparing the second adhesive composition, 50 parts by weight of YDCN-500-1P as the epoxy-based binder resin was included instead of 10 parts by weight thereof.

[00132] **Comparative Example 2**

[00133] An adhesive film was prepared in the same manner as that in Present Example 1, except that the second adhesive layer was directly bonded onto the rigid base layer while the first adhesive layer was absent.

[00134] **Comparative Example 3**

[00135] An adhesive film was prepared in the same manner as that in Present Example 1, except that when preparing the second adhesive composition, YDCN-500-1P as the epoxy-based binder resin was excluded.

[00136] **Comparative Example 4**

[00137] An adhesive film was prepared in the same manner as that in Present Example 1, except that only a PET film (thickness: 50 μm, tensile modulus: 2400 MPa) was used as the rigid base layer, and a light-scattering pattern was not formed.

[00138] **Comparative Example 5**

[00139] An adhesive film was prepared in the same manner as that in Present Example 1, except that when preparing the second adhesive composition, 30 parts by weight of YDCN-90P (softening point: 90℃) is included instead of YDCN-500-1P as the epoxy-based binder resin.

[00140] Results of measurement and evaluation of the product as obtained in accordance with each of Preparation Example, Present Examples, and Comparative Examples

as described above under following Experimental Examples 1 to 4 are shown in Tables 1 to 3 below.

[00141] **Experimental Example 1: Evaluation of optical Characteristics**

[00142] The total transmittance (T.T, %) and the diffuse transmittance (D.T, %) of each of the rigid base layer as prepared in Preparation Example 4 and the adhesive film for grinding the back face of the wafer as prepared in each of Present Examples and Comparative Examples were measured using a hazemeter (Nippon Denshoku, NDH5000).

[00143] **Experimental Example 2: Measurement of shear storage modulus**

[00144] The shear storage modulus of an adhesive layer (8 mm of diameter × 1 mm of thickness) of a single-layer structure made of each the first adhesive composition, the second adhesive composition and the third adhesive composition solution as respectively prepared in Preparation Examples 1 to 3 was measured using a Rheometer (TA instruments; ARES-G2) as a shear storage modulus measurement device under an environment of -20 °C to 120 °C at 1 Hz. The shear storage modulus at 23 °C was recorded.

[00145] **Experimental Example 3: Measurement of dimple**

[00146] The adhesive film for grinding the back face of the wafer was attached to a semiconductor circuit face (= wafer surface) on which the bump was formed. The back face of the wafer of a thickness of 725 ㎛ was subjected to the grinding process using back face grinding equipment (DISCO company ; DGP8760) such that the thickness thereof was reduced to a thickness of 80 ㎛.

[00147] After the grinding process of the back side has been finished, a thickness step on the grinding target face of the wafer was identified using reflected light. The resulting wafer was placed on a stage of a 3D profiler (Profilm3D, FILMETRICS) such that the grinding target

face faces upwardly. The thickness step was measured. When a size of the thickness step relative to a normally ground face was greater than or equal to ±1 ㎛, the grinding result was evaluated as 'poor (×)'. When a size of the thickness step relative to a normally ground face was smaller than ±1 ㎛, the grinding result was evaluated as 'good (○)'.

[00148] **Experimental Example 4 : Evaluation of wafer crack occurrence**

[00149] The adhesive film for grinding the back face of the wafer was attached to a semiconductor circuit face (= wafer surface). The back face of the wafer of a thickness of 725 ㎛ was subjected to the grinding process using back face grinding equipment (DISCO company; DGP8760) such that the thickness thereof was reduced to a thickness of 100 ㎛.

[00150] After finishing the grinding process of the back face, 3 chips were sampled from each of upper/lower/left/right/center positions of the wafer and were observed under a microscope to observe the number of cracks. When the number of cracks was smaller than 3, the grinding result was evaluated as 'good (○)'. When the number of cracks was 3 or greater, the grinding result was evaluated as 'poor (X)'.

[00151] **Experimental Example 5 : Test of residue after grinding wafer back face**

[00152] The adhesive film for grinding the back face of the wafer was attached to a semiconductor circuit face (= wafer surface). The back face of the wafer of a thickness of 725 ㎛ was subjected to the grinding process using back face grinding equipment (DISCO company; DGP8760) such that the thickness thereof was reduced to a thickness of 80 ㎛.

[00153] After the grinding process of the back face of the wafer was completed, UV A of 300 mJ/cm^2 was irradiated thereto using exposure equipment (Semyung Vactron Co., Ltd.;

TRSJ-3000). Then, a heat sealing tape (MBS-100R) was thermally compressed on one outer portion of the adhesive film for grinding the back face of the wafer at 230℃. Then, the adhesive film for grinding the back face of the wafer was removed from the wafer.

[00154] After the grinding process of the back face was completed, whether the adhesive residue remained at 20 points on a surface of the wafer from which the adhesive film was removed was identified based on microscopic observation. A specific method thereof is as follows.

[00155] A size of the residue was measured at each of 20 points on the wafer that had been subjected to the back face grinding process. When there was no residue, the grinding result was evaluated as 'good (○)'. When the residue was larger than or equal to 10 ㎛, the grinding result was evaluated as 'poor (×)'.

[00156] Table 1

Examples	Optical characteristics of rigid base layer		Optical characteristics of adhesive film for grinding back face	
	Total transmittance (%)	Diffuse transmittance (%)	Total transmittance (%)	Diffuse transmittance (%)
Present Example 1	85.9	12.1	78.2	13.7
Present Example 2	84.7	16.3	77.1	17.2
Present Example 3	81.2	19.4	73.9	21.1
Comparative Example 1	85.9	12.1	78.2	13.7
Comparative Example 2	85.9	12.1	78.2	13.7

Comparative Example 3	85.9	12.1	78.2	13.7
Comparative Example 4	90.3	3.4	90.3	3.5
Comparative Example5	90.3	3.3	90.3	3.5

[00157] Table 2

Examples	Shear storage modulus (MPa) of first adhesive layer	Shear storage modulus (MPa) of second adhesive layer	Shear storage modulus (MPa) of third adhesive layer
Present Example 1	0.08	1.6	0.13
Present Example 2	0.08	3.4	0.13
Present Example 3	0.08	7.4	0.13
Comparative Example 1	0.08	12.6	0.13
Comparative Example 2	-	1.6	0.13
Comparative Example 3	0.08	0.08	0.13
Comparative Example 4	0.08	5.8	0.13
Comparative Example5	0.08	6.2	0.13

[00158] Table 3

Examples	Dimple measurement	Crack occurrence	Residue test
Present Example 1	o	o	o
Present Example 2	o	o	o
Present Example 3	o	o	o
Comparative Example 1	o	x	o
Comparative Example 2	x	x	o
Comparative Example 3	o	x	o
Comparative Example 4	o	o	x
Comparative Example5	x	x	x

[00159] The present disclosure has been described above with reference to Examples of the present disclosure. However, the present disclosure is not limited to Examples disclosed herein. It is obvious that various modifications may be made by a person skilled in the art within the scope of the technical idea of the present disclosure. In addition, even though the effect of the configuration of the present disclosure was not explicitly described while describing the Examples of the present disclosure, the effects predictable from the configuration should also be appreciated.

WHAT IS CLAIMED IS:

1. An adhesive film for grinding a back face of a wafer, the adhesive film comprising:

a rigid base layer having a light-scattering pattern formed thereon;

a first adhesive layer disposed on the rigid base layer;

a second adhesive layer disposed on the first adhesive layer; and

a third adhesive layer disposed on the second adhesive layer,

wherein the second adhesive layer is made of a second adhesive composition, wherein the second adhesive composition includes a second (meth)acrylate-based adhesive resin and an epoxy-based binder resin having a softening point in a range of 30 to 70°C,

wherein a total transmittance of the adhesive film for grinding the back face of the wafer is 70% or greater,

wherein a diffuse transmittance of the adhesive film for grinding the back face of the wafer is in a range of 6% or greater.

2. The adhesive film for grinding the back face of the wafer of claim 1, wherein the second adhesive composition contains 5 to 45 parts by weight of the epoxy-based binder resin based on 100 parts by weight of the second adhesive composition.

3. The adhesive film for grinding the back face of the wafer of claim 1, wherein a shear storage modulus of the second adhesive layer at 23°C is in a range of 0.1 to 10 MPa.

4. The adhesive film for grinding the back face of the wafer of claim 1, wherein the first adhesive layer is made of a first adhesive composition including a first (meth)acrylate-based adhesive resin,

wherein a shear storage modulus of the first adhesive layer at 23°C is in a range of 0.01 to 1 MPa.

5. The adhesive film for grinding the back face of the wafer of claim 1, wherein the third adhesive layer is made of a third adhesive composition including a third (meth)acrylate-based adhesive resin,

wherein a shear storage modulus of the third adhesive layer at 23°C is in a range of 0.01 to 1 MPa.

6. The adhesive film for grinding the back face of the wafer of claim 1, wherein the rigid base layer has a tensile modulus at 23°C in a range of 1,000 MPa or greater.

7. The adhesive film for grinding the back face of the wafer of claim 6, wherein the rigid base layer includes a base layer made of polyethylene terephthalate (PET).

8. The adhesive film for grinding the back face of the wafer of claim 1, wherein a total transmittance of the rigid base layer is in a range of 80% or greater, and a diffuse transmittance of the rigid base layer is in a range of 5 to 20%.

9. The adhesive film for grinding the back face of the wafer of claim 1, wherein the adhesive film for grinding the back face of the wafer satisfies a following Relationship (1):

[Relationship (1)]: $T_{(S)} \times 0.05 \leq T_{max(P)} \leq T_{(S)} \times 0.5$

wherein in the Relationship (1), $T_{(S)}$ denotes a thickness of the rigid base layer, and $Tmax_{(P)}$ denotes a maximum height of the light-scattering pattern.

10. The adhesive film for grinding the back face of the wafer of claim 1, wherein the light-scattering pattern is made of a material having a pencil hardness of 2H or greater measured according to ASTM D 3363.

11. The adhesive film for grinding the back face of the wafer of claim 1, wherein the light-scattering pattern is formed by photocuring a coating composition, wherein the coating composition includes a urethane (meth)acrylate oligomer, a multifunctional (meth)acrylate monomer, and a photoinitiator.

12. The adhesive film for grinding the back face of the wafer of claim 1, wherein the adhesive film for grinding the back face of the wafer satisfies following Relationships (2) and (3):

[Relationship (2)]: $T_{(PSA_1)} \leq T_{(PSA_2)} \leq T_{(PSA_1)} \times 10$

[Relationship (3)]: $T_{(PSA_3)} \leq T_{(PSA_2)} \leq T_{(PSA_3)} \times 10$

wherein in the Relationships (2) and (3), $T_{(PSA_1)}$, $T_{(PSA_2)}$ and $T_{(PSA_3)}$ denote a thickness of the first adhesive layer, a thickness of the second adhesive layer, and a thickness of the third adhesive layer, respectively.

13. The adhesive film for grinding the back face of the wafer of one of claims 1 to 12, wherein the adhesive film for grinding the back face of the wafer is applied to a process for grinding a back face of a wafer on which a bump has been formed.