ADHESIVE FILM FOR WAFER PROCESSING

[FIELD]

[0001] The present disclosure relates to an adhesive film used in wafer processing such as a process of grinding a backside of a thin film of a wafer, more particularly, an adhesive film for processing a wafer which is excellent in an effect (i.e., a buffering effect) of protecting a surface of the wafer during wafer polishing.

[BACKGROUND]

[0002] With the recent development of technology, miniaturization and thinning of semiconductor chips are required.

[0003] A typical method of reducing the thickness of a chip is to reduce the thickness by grinding a backside (or a back surface) of a wafer on which the chip is formed.

[0004] Recently, in order to obtain a thin chip is used a DBG (Dicing Before Grinding) method. In the DBG method, a groove is recessed from a surface of a wafer by using a dicing blade, and then grinding is performed from the backside of the wafer to obtain individualized chips from the wafer. The back side grinding of the wafer and the separation of the wafer are performed simultaneously in the DBG method so that a thin semiconductor chip may be efficiently manufactured.

[0005] In general, the backside grinding process of the wafer may be performed in a state where an adhesive film is attached to a wafer surface so as to maintain a semiconductor chip during the grinding of the backside of the wafer. The adhesive film includes an adhesive layer for adhesion to a substrate and a wafer surface, and a buffer layer or a shock absorbing layer (e.g., urethane acrylate) is formed on a back surface of the substrate for a buffering effect.

[0006] The buffer layer may effective protect the surface of the wafer as it has a lower modulus and has an excellent buffering effect. On the other hand, if a buffer layer has a low modulus, a problem might occur in that the buffer layer flows at a high temperature or the thickness thereof becomes non-uniform due to a temperature increase during the backside grinding process.

【Description of Disclosure】

【Technical Problems】

[0007] Accordingly, the present disclosure addresses at least one of the above-noted and other problems and to provide an adhesive film for wafer processing with improved flow control and thickness uniformity at high temperatures, while having an excellent buffering effect to protect a surface of the wafer in a process of grinding a back surface of the wafer.

[0008] Aspects according to the present disclosure are not limited to the above ones, and other aspects and advantages that are not mentioned above can be clearly understood from the following description and can be more clearly understood from the embodiments set forth herein. Additionally, the aspects and advantages in the present disclosure can be realized via means and combinations thereof that are described in the appended claims.

【Technical Solutions】

[0009] An adhesive film for wafer processing may include a multilayer substrate comprising an upper substrate layer and a lower substrate layer; a first adhesive layer disposed on the upper substrate layer; and a second adhesive layer disposed between the upper substrate layer and the lower substrate layer. The second adhesive layer may be formed of a second adhesive composition comprising an adhesive resin and core-shell nanoparticles.

[0009a] An adhesive film for wafer processing comprising a multilayer substrate comprising an upper substrate layer and a lower substrate layer; a first adhesive layer disposed on the upper substrate layer; and a second adhesive layer disposed between the upper substrate layer and the lower substrate layer, wherein the second adhesive layer is formed of a second adhesive composition comprising an adhesive resin and core-shell nanoparticles; wherein a core of the core-shell nanoparticles is a polyalkyl (meth) acrylate having a glass transition temperature of -50 to 40 ° C, and a shell of the core-shell nanoparticles is a polyalkyl (meth) acrylate having a glass transition temperature of 50 to 150° C; wherein the core-shell nanoparticles is 0.1 to 20 by weight with respect to 100 by weight of the adhesive resin of the second adhesive composition.

[0010] An average diameter of the core-shell nanoparticles may be 5 to 400nm.

[0011] A core of the core-shell nanoparticles may be a polyalkyl (meth) acrylate having a glass transition temperature of -50 to 40 ° C, and a shell of the core-shell nanoparticles a polyalkyl (meth) acrylate having a glass transition temperature of 50 to 150° C.

[0012] 4. The content of the core-shell nanoparticles may be 0.1 to 20 by weight with respect to 100 by weight of the adhesive resin of the second adhesive composition.

[0013] A modulus of the second adhesive layer in a temperature range of 60 to 90° C may be 0.05 to 2MPa.

[0014] A recovery force measured based on Equation 1 below may be 55 to 90%. A method of measuring the recovery force based on Equation 1 below will be described in detail.

[0015] [Equation 1]

[0016] Recovery force (%)=(1-(X_f/X_0))×100

[0017] In Equation 1, X_0 means the thickness that is 1/2 times the initial thickness of the adhesive film and X_f means the pressed thickness of the adhesive film when the pressure is not applied to the adhesive film by restoring it after holding for 10 seconds at X_0.

[0018] Each of the lower substrate layer and the upper substrate layer may have a modulus of 1000MPa or more at 23° C.

[0019] Each of the lower substrate layer and the upper substrate layer may include containing at least one selected from the group consisting of polyethylene terephthalate, polyethylene naphthalate, polybutylene terephthalate, wholly aromatic polyester, polyimide, polyamide, polycarbonate, polyacetal, modified polyphenylene oxide, polyphenylene sulfide. Phide, polysulfone, polyether ketone, and biaxially stretched polypropylene.

[0020] The lower base layer and the upper base layer may be made of a polyethylene terephthalate material.

[0021] The adhesive resin of the second adhesive layer may include a thermosetting acrylic adhesive resin.

【Advantageous Effect】

[0022] The adhesive film for wafer processing according to the present disclosure may include the second adhesive layer having the core-shell nanoplarticles, thereby having an excellent buffering effect with respect to the wafer surface in the backside grinding of the wafer and another effect of improved flow control and thickness uniformity at a high temperature.

[0023] The effects of the present disclosure are not limited to the above-mentioned effects, and other effects not mentioned will be clearly understood by those skilled in the art from the following description.

[0024] Specific effects are described along with the above-described effects in the section of Detailed Description.

[Brief Description of Drawings]

[0025] FIG. 1 is a sectional view schematically showing an adhesive film for wafer processing according to an embodiment of the present disclosure; and

[0026] FIG. 2 is a sectional view schematically showing an adhesive film for wafer processing according to another embodiment of the present disclosure.

[Detailed Description of Exemplary Embodiment]

[0027] The above-described aspects, features and advantages are specifically described hereunder with reference to the accompanying drawings such that one having ordinary skill in the art to which the present disclosure pertains can easily implement the technical spirit of the disclosure. In the disclosure, detailed descriptions of known technologies in relation to the disclosure are omitted if they are deemed to make the gist of the disclosure unnecessarily vague. Below, preferred embodiments according to the disclosure are specifically described with reference to the accompanying drawings. In the drawings, identical reference numerals can denote identical or similar components.

[0028] Expressions of 'a component is provided or disposed in an upper or lower portion' may mean that the component is provided or disposed in contact with an upper surface or a lower surface. The present disclosure is not intended to limit that other elements are provided between the components and on the component or beneath the component.

[0029] A singular representation may include a plural representation unless it represents a definitely different meaning from the context. Terms such as "include" or "has" are used herein and should be understood that they are intended to indicate an existence of several components, functions or steps, disclosed in the specification, and it is also understood that greater or fewer components, functions, or steps may likewise be utilized.

[0030] The terms "one surface", "the other surface" and "both surfaces" are used herein only to distinguish one component from another component. Thus, the components should not be limited by the terms.

[0031] Throughout the present disclosure, wafer processing may include a dicing operation, a pick-up operation of individualized semiconductor chips, etc. as well as a wafer backside grinding (or backgrinding) operation.

[0032] In describing the present disclosure, detailed descriptions of related well-known technologies that may unnecessarily obscure the gist of the present disclosure will be omitted.

[0033] Hereinafter, an adhesive film for wafer processing according to embodiments of the present disclosure will be described in detail.

[0034] The adhesive film for wafer processing may include a multilayer substrate including an upper substrate layer and a lower substrate layer; a first adhesive layer disposed on the upper substrate layer; and a second adhesive layer disposed between the upper substrate layer and the lower substrate layer. The second adhesive layer may be formed of a second adhesive composition configured of an adhesive resin and core-shell nanoparticles.

[0035] FIG. 1 is a sectional view schematically showing an adhesive film for wafer processing according to an embodiment of the present disclosure. Referring to FIG. 1, the adhesive film for wafer processing according to the present disclosure may include a multi-layer substrate 110, a first adhesive layer 120 disposed on an upper substrate layer 112 of the multilayer substrate, and a second adhesive layer 115 disposed between the upper substrate layer 112 and a lower substrate layer 111.

[0036] <Multilayer substrate>

[0037] The multilayer substrate 110 may include a lower substrate layer 111, an upper substrate layer 112 and a second adhesive layer 115. The first adhesive layer 120 may be disposed on the upper substrate layer 112. The second adhesive layer 115 may be disposed between the lower substrate layer 111 and the upper substrate layer 112. The multilayer substrate provided in the adhesive film for wafer processing according to the embodiment of the present disclosure may have a sandwich structure in which the second adhesive layer 115 is disposed between the lower substrate layer 111 and the upper substrate layer 112.

[0038] The lower substrate layer 111 and the upper substrate layer 112 may be formed of a material having a high modulus. More specifically, the lower substrate layer 111 and the upper substrate 112 may have a modulus of 1,000 MPa or more, for example, 1,200MPa or more, 1,500MPa or more, 2,000MPa or more, 3,000MPa or more. The modulus at this time may be based on a measured value at 23℃. The present disclosure is characterized in that not only the upper substrate layer 112 to which a wafer is adhered but also the lower substrate layer 111 is formed of a material having a high modulus.

[0039] When the modulus of the upper substrate layer 111 and the lower substrate layer is relatively low (e.g., less than 1,00MPa), the support force of a wafer or divided semiconductor chip is low and there is a possibility that semiconductor chips collide during the backgrinding process.

[0040] Each of the lower substrate layer 111 and the upper substrate layer 112 may include one or more selected from the group consisting of polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polybutylene terephthalate (PBT), wholly aromatic polyester, Polyimide (PI), polyamide (PA), polycarbonate (PC), polyacetal, modified polyphenylene oxide, polyphenylene sulfide, polysulfone, polyether ketone, and biaxially stretched polypropylene (Oriented Poly-propylene).

[0041] It is preferred that the lower substrate layer 111 and the upper substrate layer 112 are made of the same material.

[0042] The lower substrate layer 111 and the upper substrate 112 may have the same thickness, but the present disclosure may not be limited thereto. the lower substrate layer 111 and the upper substrate layer 112 may each have a thickness of about 10 to 150 ㎛. Meanwhile, the lower substrate layer 111 and the upper substrate layer 112 may have a high modulus. If the thickness of the lower substrate layer 111 and the upper substrate layer 112, in particular, the upper substrate 112 is too thick, it might be vulnerable to an impact generated during the wafer process such as the backgrinding. Accordingly, The thickness of the lower substrate layer 111 and the upper substrate layer 112 may be set to approximately 150 ㎛ or less.

[0043] Meanwhile, the lower substrate 111 and/or the upper substrate layer 112 may include a small amount of various additives such as a coupling agent, a plasticizer, an antistatic agent, and an antioxidant.

[0044] <First adhesive layer>

[0045] In FIG. 1, the first adhesive layer 120 is a portion to which the wafer is adhered.

[0046] The first adhesive layer 120 may not be particularly limited as long as it has proper adhesiveness at room temperature, and various pressure-sensitive adhesives such as well-known UV adhesives may be applied as the first adhesive layer 120.

[0047] The thickness of the first adhesive layer 120 may not be particularly limited, and may be approximately 10 to 100 ㎛, for example.

[0048] FIG. 2 is a sectional view schematically showing an adhesive film for wafer processing according to another embodiment of the present disclosure.

[0049] Referring to FIG. 2, a primer layer 113 may be further disposed on an upper surface of the upper substrate layer 112 provided in the multilayer substrate. The primer layer 113 may be configured to improve adhesiveness between the first adhesive layer 120 and the multilayer substrate 110.

[0050] The primer layer 113 may be formed as a separate layer disposed on the upper surface of the upper substrate layer 112, that is, the surface on which the first adhesive layer 120 is formed. As another example, the primer layer 113 may be formed of the same material of the upper surface of the upper substrate layer 112.

[0051] FIG. 2 shows an example in which the primer layer 113 is disposed on the upper surface of the upper substrate layer 112, but the present disclosure may not limited thereto. The primer layer 113 may be disposed on a lower surface of the upper substrate layer 112 or an upper surface of the lower substrate layer 111.

[0052] Although not shown in FIG. 2, a release film may be further provided. The release film may be disposed on the upper surface of the first adhesive layer and adhered by the adhesive layer. One surface of the release film may be release-treated. Various release treatments may be used without limitation as long as it uses a material conventionally well-known in the air, for example, silicone that may be used in the release treatment.

[0053] <Second adhesive layer>

[0054] The second adhesive layer according to the present disclosure may be an adhesive layer disposed between the upper substrate layer 112 and the lower substrate layer 111. The second adhesive layer may function as a buffer layer or a shock absorbing layer with a high buffering effect to protect the surface of the wafer during wafer processing.

[0055] The second adhesive layer according to the present disclosure may be formed of a second adhesive composition including an adhesive resin and core-shell nanoparticles. The second adhesive layer may be prepared by thermosetting the second adhesive composition.

[0056] The adhesive resin of the second adhesive composition may include a thermosetting acrylic adhesive resin, and the second adhesive composition may further include a thermosetting agent in addition to the adhesive resin.

[0057] The thermosetting acrylic adhesive resin may be an acrylate compound, as one example. Examples of the acrylate compound that may be used in the thermosetting acrylate adhesive may include (meth) acrylate, alkyl (meth) acrylate such as alkyl (meth)

acrylate having 4 or more carbon atoms in the alkyl group, and non-urethane-based polyfunctional (meth) acrylate, but the present disclosure may not be limited thereto.

[0058] A curing agent that may be added to the thermosetting acrylic adhesive resin may include an isocyanate curing agent, a carbodiimide curing agent, an oxazoline curing agent, an epoxy curing agent, an aziridine curing agent, a peroxide, and the like, but is not limited thereto. The curing agent may be included in an amount of 2 by weight or less with respect to 100 by weight of the adhesive resin of the second adhesive composition, but not limited thereto.

[0059] The second adhesive layer functioning as a buffer layer may be advantageous as it has a low modulus for a buffing effect. However, if the second adhesive layer has an excessively low modulus, a problem might occur in that the buffer layer flows at a high temperature or the thickness becomes non-uniformity due to a temperature increase during the back grinding process.

[0060] Accordingly, the inventors of the present disclosure have found out that the above problem can be solved by providing nanoparticles having a core-shell structure are provided in the second adhesive layer to control the flowability of the second adhesive layer due to heat generated during the backside grinding process of the wafer.

[0061] The average particle diameter of the nanoparticles having the core-shell structure may be 5 to 400nm, more preferably 100 to 300nm. If the average particle diameter of the nanoparticles is less than 5nm, non-uniform dispersion might occur due to aggregation caused by static electricity between particles disadvantageously. If the average particle diameter exceeds 400nm, the thickness uniformity might be disadvantageously deteriorated (e.g., unevenness of a surface of a coating layer).

[0062] The core of the core-shell nanoparticles may be configured to maintain the modulus at a high temperature by forming a cross-linked structure. Accordingly, the core may be formed of a material having a low glass transition temperature.

[0063] The glass transition temperature of the core of the core-shell nanoparticles may be -50 to 40℃. It may be preferred that the glass transition temperature thereof is -30 to 30℃ and it may be more preferred that the glass transition is 30 to 20℃. In the above glass transition temperature range, it is possible to implement the buffer effect required to prepare the impact generated in a process temperature section (i.e., 40 ~90 ℃) section during the backside grinding process.

[0064] If the glass transition temperature of the core exceeds 40 ℃, it may be limited in absorbing the impact generated in the process temperature section, which could

cause chip cracks. If the glass transition temperature of the core is less than -50℃, the particle shape will be likely to be deformed by the pressure during the processing, which might cause a problem in a shock absorption function.

[0065] The example, the core may include at least one polyalkyl (meth) acrylate having a glass transition temperature in the range of -50 to 40℃. Preferably, the core may include one or more of polymethyl acrylate, polyethyl acrylate, polycyclohexyl acrylate, polybenzyl acrylate, polyisopropyl acrylate, polybenzyl acrylate, polybutyl methacrylate, polyhexyl methacrylate, polycyanomethyl acrylic and poly-2-cyanoethyl methacrylate, but the present disclosure may not be limited thereto. More preferably, the core may include at least one of polymethyl acrylate and polybutyl methacrylate.

[0066] The shell of the core-shell nanoparticles may function to form a rigid structure and may be formed of a material having a high glass transition temperature in order to secure dispersibility in the adhesive layer.

[0067] The glass transition temperature of the shell provided in the core-shell nanoparticles may be 50~150℃, preferably 60~130℃, more preferably 80~130℃.

[0068] If the glass transition temperature of the shell is less than 50℃, the particle dispersibility might be lowered and aggregation is likely to occur or the organic particles might be deformed by the heat generated during the processing so that a problem could arise in that the recovery performance of the adhesive film due to impact is lowered.

[0069] For example, the shell may include a polyalkyl (meth) acrylate having a glass transition temperature of 50~150℃. Preferably, the shell may include one or more of polymethyl methacrylate (PMMA), polyethyl methacrylate, polypropyl methacrylate, polybutyl methacrylate, polyisopropyl methacrylate, polyisobutyl methacrylate and polycyclohexyl methacrylates, but the present disclosure may not be limited thereto. More preferably, the shell may include polymethyl methacrylate.

[0070] The shell may be 1 to 70 by weight, preferably 5 to 60 by weight, more preferably 10 to 50 by weigh with respect to 100 of the core-shell nanoparitcles by weight. If the content of the shell among the core-shell nanoparticles is less than 1 by weight, the core cannot be sufficiently surrounded, so that the surface protection effect might be reduced during the backside grinding. If the content of the shell exceeds 70 by weight, a hard shell portion might be so large enough to reduce the buffering effect and not to excellently maintain the recovery force of the adhesive film. Accordingly, the content of the shell must satisfy the range of 1 to 70 by weight among the core-shell nanoparticles, so that the buffering effect and the balance of the modulus may be maintained.

[0071] With respect to 100 by weight of the adhesive resin of the second adhesive composition, the content of the core-shell nanoparticles may be 0.1 to 20 by weight, preferably 1 to 10 by weight, more preferably 2 to 8 by weight. If the content of the core-shell nanoparticles is less than 0.1 by weight, there might be a problem in that the buffering effect of the nanoparticles is insignificant. If the content of the core-shell nanoparticles exceeds 20 by weight, the adhesive force might be lowered and the dispersibility of the particles might be deteriorated. Accordingly, non-uniform aggregation might occur only to reduce the impact buffering effect.

[0072] The modulus of the second adhesive layer in a temperature range of 60 to 90℃ may be 0.05 to 2 MPa, preferably 0.05 to 1 MPa.

[0073] Since it is advantageous to use a material having a low modulus to further improve the buffering effect, the modulus of the second adhesive layer may be 2 MPa or less. If the modulus is too low, the flowability of the adhesive layer might increase and the thickness might become non-uniform due to the pressure applied during the backside grinding of the wafer. Accordingly, it is preferred that the modulus of the second adhesive layer in a high temperature is 0.05 MPa or more.

[0074] The adhesive film of the present disclosure may have a recovery force of 55 to 90%, preferably 65 to 90%, more preferably 70 to 90%, as measured based on Equation 1 below.

[0075] [Equation 1]

[0076] Recovery Force (%)=$(1-(X_f/X_0))\times 100$

[0077] In Equation 1, X_0 means the thickness that is 1/2 times the initial thickness of the adhesive film and X_f means the pressed thickness of the adhesive film when the pressure is not applied to the adhesive film by restoring it after holding for 10 seconds at X0.

[0078] The adhesive film having the recovery force of 55 to 90% according to the present disclosure may not cause deformation of the adhesive film even under heat and pressure generated in the grinding process on the backside of the wafer, so that stable thickness uniformity of wafer chips may be maintained. If the recovery force is less than 55%, the surface protection effect is insufficient during the wafer processing. If the recovery force exceeds 90%, the buffering effect might be reduced and a problem of cracking might occur because the shock generated during the backside grinding is transmitted to the wafer.

[0079] The recovery force of the adhesive film according to the present disclosure may be to measure the restoring force of the film including the adhesive layer, and it may be

measured using TA,BT_Plus Texture Analyzer. The specific measurement method is as follows.

[0080] [Measurement method]

[0081] A PET film (polyethylene terephthalate, 50μm), an adhesive film (width × length, 20 mm × 20 mm, thickness: 60μm) and a PET film (50μm) may be adhered to specimen in the order, and fixed on the plate. After that, the adhesive film may be pressed at a high temperature (e.g., 60℃) using a spherical probe at a speed of 300mm/min until the thickness becomes X0 (unit: μm), which is 1/2 times the initial thickness of the adhesive film, and then held for 10 seconds. When the thickness of the adhesive film to which the pressure of 0kPa is applied by restoring it at the same speed as the pressing speed (300mm/min) is X_f (unit: μm), the recovery force (%) was calculated based on Equation 1.

[0082] Hereinafter, the configuration and operation of the present disclosure will be described in more detail through exemplary embodiments. Embodiments may be only exemplary, and may not limit the scope of the present disclosure.

[0083] <Preparation example>

[0084] Preparation Example 1 – Composition for the second adhesive layer (“M1”)

[0085] 42 of butyl acrylate by weight, 10 of ethylhexyl acrylate by weight, 30 of methyl acrylate by weight, 5 of 2-hydroxylethyl acrylate by weight, 13 of acrylic acid by weight and 0.05 of azobisisobuty by weight were mixed with 100 of ethyl acetate by weight. Then, the obtained mixture was polymerized for 6 hours at 60℃ under a nitrogen atmosphere to obtain an acrylic resin polymerization liquid A having an average molecular weight of 800,000.

[0086] With respect to 100 by weight of the polymerization solution of the acrylic resin A, 2 by weight of an isocyanate curing agent (manufactured by Nippon Polyurethane Kogyo Co., Ltd., trade name "Coronate C") was added and a composition for forming the second adhesive layer (indicated as “M1”) was obtained.

[0087] Preparation example 2 – Composition for forming the second adhesive layer (“M2)

[0088] 20 by weight of butyl acrylate, 10 by weight of ethylhexyl acrylate, 55 by weight of methyl acrylate, 7 by weight of 2-hydroxylethyl acrylate, 8 by weight of acrylic acid, 0.05 by weight of azobisisobuty ronitrile were mixed with 100 by weight of ethyl acetate to obtain a mixture. The obtained mixture was polymerized for 6 hours at 60℃

under a nitrogen atmosphere to obtain an acrylic resin polymerization liquid B having an average molecular weight of 600,000.

[0089] With respect to 100 by weight of the polymerization solution of the acrylic resin B, 3 by weight of an isocyanate curing agent (manufactured by Nippon Polyurethane Kogyo Co., Ltd., trade name "Coronate C") was added and a composition for forming the second adhesive layer (indicated as “M2”) was obtained.

[0090] Preparation example 3 – Composition for forming the first adhesive layer (“A1)

[0091] A mixture of monomers composed of 27g of butyl acrylate (BA), 48 g of methyl acrylate (MA) and 25 g of hydroxyethyl acrylate (HEA) was added into a reactor equipped with a cooling device to reflux nitrogen gas and facilitate temperature control.

[0092] Hence, 100 by weight of ethyl acetate (EAc) as a solvent was added to 100 by weight of the monomer mixture, and the mixture was sufficiently mixed at 30℃ for 30 minutes or more while injecting nitrogen in order to remove oxygen in the reactor. Hence, the temperature was maintained at 50℃ and a concentration of 0.1 by weight of azobisisobutyronitrile as a reaction initiator was added. After that, the reaction was initiated and polymerization was performed for 24 hours only to prepare a first reactant.

[0093] 24.6 by weight of 2-methacroyloxyethyl isocyanate (MOI) and 1% by weight of a catalyst (DBTDL: dibutyl tin dilaurate) compared to the MOI were mixed in the first reactant. The reaction was carried out at 40℃ for 24 hours and an acrylic polymer C having a weight average molecular weight of 500,000 was obtained.

[0094] With respect to 100 by weight of the acrylic polymer C, 0.1 by weight of irgacure 184 (manufactured by BASF, trade name) as a photoinitiator was blended and 2 by weight of an isocyanate-based curing agent (manufactured by Nippon Polyurethane Kogyo Co., Ltd., trade name “Coronate C”) was added, so that a composition for forming the first adhesive layer (indicated as “A1”) was obtained.

[0095] Preparation example 4 – Core-shell nanoparticles (“b1”)

[0096] The core-shell structure consists of the core formed of polymethyl acrylate (PMA, Tg: 10 ℃) and the shell formed of a core-shell structure consisting of polymethyl methacrylate (PMMA, Tg: 105 ℃). The core-shell nanoparitcles were used having the shell 30 by weight with respect to 100 by weight of the core-shell nanoparticles, and it has an average particle diameter of 130nm.

[0097] Preparation example 5 – Core-shell nanoparticles (“b2”)

[0098] The core-shell structure consists of the core made of polymethyl acrylate (PMA) and the shell made of polymethyl methacrylate (PMMA). The core-shell nanoparitcles were used having the shell 30 by weight with respect to 100 by weight of the core-shell nanoparticles, and it has an average particle diameter of 130nm.

[0099] <Embodiment 1>

[00100] Embodiment 1:

[00101] The composition ("A1") for forming the first adhesive layer of Preparation Example 3 was collated on the release-treated PED (polyethylene terephthalate) form (thickness of 50 μm), and the thickness of the first adhesive layer 20 was made to be 20 ㎛. After that, a PED base film (thickness of 50 μm) having a primer layer formed thereon was adhered to the first adhesive layer, thereby preparing a film having the first adhesive layer with a total thickness of 120μm.

[00102] The core-shell nanoparticles b1 of Preparation Example 4 was added to the composition for forming the second adhesive layer "M2" of Preparation Example 2. At this time, the content of the core-shell nanoparticles b1 is 4 by weight with respect to 100 by weight of the acrylic resin polymer solution B. after that, the mixture was coated on the PET film (thickness of 20 ㎛) to a thickness of 20 ㎛, so that a film with a total thickness of 40 ㎛ and the second adhesive layer was prepared.

[00103] A film having the second adhesive layer was bonded to the film having the first adhesive layer, thereby preparing a composite film with a total thickness of 160μm.

[00104] Embodiment 2:

[00105] Embodiment 2 is equal to Embodiment 1, except that the adhesive composition "M2" for forming the second adhesive layer of Preparation Example 1 was used as the second adhesive layer instead of the adhesive composition "M2" for forming the second adhesive layer of Preparation Example 2 and that "b2" of Preparation Example 5 was used as the core-shell nanoparticles instead of "b1" of Preparation Example 4.

[00106] Embodiment 3:

[00107] Embodiment 3 is equal to Embodiment 1, except that "M2" was used and coated on the PET film (thickness of 20 ㎛) to a total thickness of 50 ㎛, thereby preparing the second adhesive layer having a total thickness of 70 ㎛.

[00108] Embodiment 4:

[00109] Embodiment 4 is equal to Embodiment 2, except that "M1" was used and coated on the PET film (thickness of 20 ㎛) to a total thickness of 50 ㎛, thereby preparing the second adhesive layer having a total thickness of 70 ㎛ and that the content of the core-shell nanoparticles "b2" of Preparation Example 5 is 2 by weight.

[00110] Embodiment 5:

[00111] Embodiment 5 is equal Embodiment 1, except that "M2" was used and coated on the PET film (thickness of 20 ㎛) to a total thickness of 80 ㎛, thereby preparing the second adhesive layer having a total thickness of 100 ㎛ and that the content of the core-shell nanoparticles "b2" of Preparation Example 5 instead of "b1" of Preparation Example 4 is 8 by weight.

[00112] Embodiment 6:

[00113] Embodiment 6 is equal to Embodiment 2, except that "M1" was used and coated on the PET film (thickness of 20 ㎛) to a total thickness of 80 ㎛, thereby preparing the second adhesive layer having a total thickness of 100 ㎛ and that the content of the core-shell nanoparticles "b2" of Preparation Example 5 is 8 by weight.

[00114] Comparative Example 1:

[00115] Comparative Example 1 is equal to Embodiment 4, except that the second adhesive layer includes no core-shell nanoparticles.

[00116] Comparative Example 2:

[00117] Comparative Example 2 is equal to Embodiment 3, except that "b1" of Preparation Example 4 was used instead of the core-shell nanoparticles "b2" of Preparation Example 5 and that the content of the core-shell nanoparticles is 25 by weight.

[00118] <Experimental Example 1>

[00119] Experimental Example 1 – Modulus ((60 ℃ and 90 ℃) measurement of the adhesive film

[00120] Using a modulus measuring device of Rheometer (TA, instruments, ARES-G2), a single adhesive layer formed of a solution of the composition for forming the second adhesive layer used in Examples and Comparative Examples was disposed to obtain a sample having a size of a diameter of 8mm × a thickness of 1 mm. The modulus of the

sample was measured under an environment of -20°C to 120°C at 1 Hz, and the modulus at 60°C and 90°C was recorded, and is described in Table 1 below.

[00121] Experimental Example 2 – Recovery Force

[00122] The recovery force of the adhesive form may be to measure the restoring force of the film including the adhesive layer.

[00123] [Equation 1]

[00124] Recovery Force (%)=(1-(X_f/X_0))×100

[00125] [Measurement method]

[00126] A PET film (polyethylene terephthalate, 50μm), an adhesive film (width × length, 20 mm × 20 mm, thickness: 60μm) and a PET film (50μm) may be adhered to specimen in the order, and fixed on the plate. After that, the adhesive film may be pressed at a high temperature (e.g., 60°C) using a spherical probe at a speed of 300mm/min until the thickness becomes X0 (unit: μm), which is 1/2 times the initial thickness of the adhesive film, and then held for 10 seconds. When the thickness of the adhesive film to which the pressure of 0kPa is applied by restoring it at the same speed as the pressing speed (300mm/min) is X_f (unit: μm), the recovery force (%) was calculated based on Equation 1.

[00127] The recovery forces of the adhesive films of Embodiments 1 to 6 and Comparative Examples 1 to 2 were measured and shown Table 1 below.

[00128] Experimental Example 3 – Wafer grinding test (thickness uniformity)

[00129] After attaching each of the adhesive films of Examples 1 to 6 and Comparative Examples 1 to 2 to a semiconductor circuit surface, backside grinding was performed on a 725μm wafer to a thickness of 100μm. UV A of 00 mJ/cm2 was irradiated and the adhesive film was removed. Then, the average thickness uniformity of 10 points in the wafer was compared after the grinding. When the deviation average of the thickness of each point is 4μm or less, it was evaluated as O (Good), and when the deviation average was 6μm or more, it was evaluated as "X" (Poor).

[00130] [Table 1]

	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4	Embodiment 5	Embodiment 6	Comparative Example 1	Comparative Example 2
0°C Modulus (MPa)	0.36	0.27	0.36	0.19	0.76	0.62	0.18	0.84

0℃ Modulus (MPa)	.28	.21	.28	.15	.61	.49	.03	.33
ecovery force (%)	5.1	2.9	8.6	9.5	4.5	9.4	3.4	6.7
hickness uniformity	O	O	O	O	O	O	X	

[00131] As shown in Table 1, Embodiment 1 to 6 including the core-shell nanoparticles had an excellent recovery power and excellent thickness uniformity as compared to Comparative Examples 1. In Comparative Example 2, the modulus value of the second adhesive layer exceeded 2MPa and the recovery force exceeded 90%, so that the buffering property was insufficient and it was difficult to measure the thickness uniformity.

[00132] The embodiments are described above with reference to a number of illustrative embodiments thereof. However, the present disclosure is not intended to limit the embodiments and drawings set forth herein, and numerous other modifications and embodiments can be devised by one skilled in the art. Further, the effects and predictable effects based on the configurations in the disclosure are to be included within the range of the disclosure though not explicitly described in the description of the embodiments.

[00133] The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.

【Description of Numeral Reference】

[00134] Substrate 110 Lower substrate layer 111 Upper substrate layer 112

[00135] Primer layer 113 Second adhesive layer 115 First adhesive layer 120

[WHAT IS CLAIMED IS]

1. An adhesive film for wafer processing comprising:

a multilayer substrate comprising an upper substrate layer and a lower substrate layer;

a first adhesive layer disposed on the upper substrate layer; and

a second adhesive layer disposed between the upper substrate layer and the lower substrate layer,

wherein the second adhesive layer is formed of a second adhesive composition comprising an adhesive resin and core-shell nanoparticles;

wherein a core of the core-shell nanoparticles is a polyalkyl (meth) acrylate having a glass transition temperature of -50 to 40 ° C, and

a shell of the core-shell nanoparticles is a polyalkyl (meth) acrylate having a glass transition temperature of 50 to 150° C;

wherein the core-shell nanoparticles is 0.1 to 20 by weight with respect to 100 by weight of the adhesive resin of the second adhesive composition.

2. The adhesive film for wafer processing of claim 1, wherein an average diameter of the core-shell nanoparticles is 5 to 400nm.

3. The adhesive film for wafer processing of claim 1, wherein a modulus of the second adhesive layer in a temperature range of 60 to 90° C is 0.05 to 2MPa.

4. The adhesive film for wafer processing of claim 1, wherein a recovery force measured based on Equation 1 below is 55 to 90%,

[Equation 1]

Recovery force (%)=(1-(X_f/X_0))×100, and

In Equation 1, X_0 means the thickness that is 1/2 times the initial thickness of the adhesive film and X_f means the pressed thickness of the adhesive film when the pressure is not applied to the adhesive film by restoring it after holding for 10 seconds at X_0.

5. The adhesive film for wafer processing of claim 1, wherein each of the lower substrate layer and the upper substrate layer has a modulus of 1000MPa or more at 23° C.

6. The adhesive film for wafer processing of claim 1, wherein each of the lower substrate layer and the upper substrate layer comprises containing at least one selected from the group consisting of polyethylene terephthalate, polyethylene naphthalate, polybutylene terephthalate, wholly aromatic polyester, polyimide, polyamide, polycarbonate, polyacetal, modified polyphenylene oxide, polyphenylene sulfide. Phide, polysulfone, polyether ketone, and biaxially stretched polypropylene.

7. The adhesive film for the wafer processing of claim 6, wherein the lower base layer and the upper base layer are made of a polyethylene terephthalate material.

8. The adhesive film for the wafer processing of claim 1, wherein the adhesive resin of the second adhesive layer comprises a thermosetting acrylic adhesive resin.

9. The adhesive film for the wafer processing of claim 1, wherein a primer layer is further provided on at least one of an upper surface of the upper substrate layer, a lower surface of the upper substrate layer or an upper surface of the lower substrate layer.