ADHESIVE FILM FOR WAFER PROCESSING

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The disclosure relates to an adhesive film for wafer processing, which is used in wafer processing, such as a wafer backgrinding. More specifically, the disclosure relates to an adhesive film for wafer processing, which is excellent in preventing chips from collisions during the wafer processing.

[0002] Further, the disclosure relates to a wafer & adhesive-film assembly in which an adhesive film adhered to a wafer.

Description of the Related Art

[0003] With the recent development of technology, a semiconductor chip has been required to be miniaturized and thinner.

[0004] As a representative method of making the chip thinner, a back of a wafer, on which the chip is formed, is ground to be decreased in thickness.

[0005] In order to obtain a thin chip, there has recently been used a dicing-before-grinding (DBG) method, in which grooves are cut from a surface of a wafer by a dicing blade, and then the back of the wafer is ground to thereby obtain diced chips from the wafer. The DBG method is efficient at manufacturing a thin

semiconductor chip because the backgrinding of the wafer and the dicing of the wafer are performed simultaneously

[0006] In general, the backgrinding of the wafer is performed while an adhesive film adheres to the surface of the wafer in order to hold the semiconductor chips even when the back of the wafer is ground. The adhesive film includes a substrate and an adhesive layer for adhering to the surface of the wafer, and the back of the substrate is formed with a buffering or shock-absorbing layer made of urethane acrylate or the like for shock-absorbing effects.

[0007] The buffering or shock-absorbing layer made of urethane acrylate is formed by energy-ray curing. During the energy-ray curing, polymers with a functional group having a double bond are formed as one macromolecule, thereby causing a high modulus and lowering the shock-absorbing effect.

SUMMARY OF THE INVENTION

[0008] The disclosure is proposed to solve these problems and aims to provide an adhesive film for wafer processing, which has an excellent effect on preventing chips from collision.

[0009] Further, the disclosure is to provide a wafer & adhesive-film assembly suitable for backgrinding and the like wafer processing.

[0010] The technical problems to be achieved in the disclosure are not limited to the foregoing technical problems, and other technical problems not mentioned above will be clearly understood by those skilled in the art from the following description.

An adhesive film for wafer processing according to an embodiment of the disclosure includes a multi-layered substrate; and a first adhesive layer disposed on a top surface of the multi-layered substrate. the multi-layered substrate has a sandwich structure in which a second adhesive layer is interposed between an upper substrate layer and a lower substrate layer, the lower substrate layer and the upper substrate layer has a modulus of 1,000MPa or higher, and the second adhesive layer have a modulus of 10MPa or lower.

[0010a] Disclosed herein is an adhesive film for wafer processing, comprising a multi-layered substrate, and a first adhesive layer disposed on a top surface of the multi-layered substrate, wherein the multi-layered substrate includes a sandwich structure in which a second adhesive layer is interposed between an upper substrate layer and a lower substrate layer, and wherein the lower substrate layer has a modulus of 1,200 MPa to 2,700 MPa, and the upper substrate layer has a modulus of 2,700 MPa to 3,200 MPa, and the second adhesive layer has a modulus of 0.005 MPa to 1.3 MPa, and the second adhesive layer has a glass transition temperature of -31℃ to 7℃.

[0011] The lower substrate layer and the upper substrate layer may each include one or more selected from a group consisting of polyethylene terephthalate, polyethylene naphthalate, polybutylene terephthalate, wholly aromatic polyester, polyimide, polycarbonate, polyacetal, modified polyphenylene oxide, polyphenylene sulfide, polysulfone, polyetherketone and biaxially oriented polypropylene.

[0012] The lower substrate layer and the upper substrate layer may include polyethylene terephthalate (PET).

[0013] The second adhesive layer may have a glass transition temperature of 10℃ or lower.

[0014] The second adhesive layer may include a thermosetting acrylic adhesive.

[0015] The second adhesive layer may have a thickness of 100 μm or lower.

[0016] A primer layer may be added onto at least one of top surfaces of the upper substrate layer, a bottom surface of the upper substrate layer, and a top surface of the lower substrate layer.

[0017] A wafer and adhesive-film assembly according to an embodiment of the disclosure includes the foregoing adhesive film, which adheres to a surface of a wafer formed with a plurality of semiconductor chips.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] FIG. 1 is a schematic cross-sectional view showing an adhesive film for wafer processing according to an embodiment of the disclosure.

[0019] FIG. 2 is a schematic cross-sectional view showing an adhesive film for wafer processing according to an embodiment of the disclosure.

DETAILED DESCRIPTION OF THE INVENTION

[0020] Objectives, specific advantages and novel features of the disclosure will become more apparent from the following detailed description and embodiments taken in conjunction with the accompanying drawings. In this specification, the terms "one side," "the other side," "both sides," etc. are used to distinguish one element from another element, and do not limit the elements. In the following description, detailed descriptions about the related well-known art, which may unnecessarily obscure the gist of the disclosure, will be omitted.

[0021] Below, an adhesive film for wafer processing according to the disclosure will be described in detail with reference to the accompanying drawings.

[0022] The wafer processing according to the disclosure may include a wafer backgrinding process, a dicing process, a process of picking up diced semiconductor chips, etc.

[0023] FIG. 1 is a schematic cross-sectional view showing an adhesive film for wafer processing according to an embodiment of the disclosure.

[0024] Referring to FIG. 1, the adhesive film for the wafer processing according to the disclosure includes a multi-layered substrate 110, and a first adhesive layer 120 disposed on the top surface of the multi-layered substrate 110.

MULTI-LAYERED SUBSTRATE

[0025] The multi-layered substrate 110 includes a lower substrate layer 111, an upper substrate layer 112, and a second adhesive layer 115. The second adhesive layer 115 is sandwiched between the lower substrate layer 111 and the upper substrate layer 112. In the adhesive film for the wafer processing according to the disclosure, the multi-layered substrate has a sandwich structure where the second adhesive layer 115 is interposed between the lower substrate layer 111 and the upper substrate layer 112.

[0026] The lower substrate layer 111 and the upper substrate layer 112 may be made of a material having a high modulus. More specifically, the lower substrate layer 111 and the upper substrate layer 112 may have a modulus greater than or equal to 1,000 MPa, for example, greater than or equal to 1,200 MPa, greater than or equal to 1,500 MPa, greater than or equal to 2,000MPa, or greater than or equal to 3,000MPa. The modulus is

based on a value measured at 23℃. The disclosure is characterized in that not only the upper substrate layer 112 where a wafer adheres but also the lower substrate layer 111 is made of a material having a high modulus.

[0027] When the upper substrate layer 112 and the lower substrate layer 111 have a relatively low modulus lower than 1,000MPa, the wafer or the diced semiconductor chips are weakly supported and thus the semiconductor chips are likely to collide in the backgrinding process. On the other hand, according to the disclosure, the moduli of the lower substrate layer 111 and the upper substrate layer 112 are high enough to strongly support the wafer or the diced semiconductor chip, thereby having an effect on preventing the semiconductor chips from colliding during the wafer backgrinding and the like wafer processing.

[0028] Further, the lower substrate layer 111 and the upper substrate layer 112 having the high modulus may reduce the stress applied to the wafer or the semiconductor chip when the wafer adheres to the adhesive film or when the wafer or the semiconductor chip is separated from the wafer adhesive film.

[0029] Each of the lower substrate layer 111 and the upper substrate layer 112 may include one or more selected from a group consisting of polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polybutylene terephthalate (PBT), wholly aromatic polyester or the like polyester, polyimide (PI),

polyamide (PA), polycarbonate (PC), polyacetal, modified polyphenylene oxide, polyphenylene sulfide, polysulfone, polyetherketone, and biaxially oriented polypropylene.

[0030] Preferably, the lower substrate layer 111 and the upper substrate layer 112 may be made of the same material. For instance, the lower substrate layer 111 and the upper substrate layer 112 may be made of polyethylene terephthalate (PET). The PET may have a modulus of 1,000 MPa or higher, and is thus suitable for the lower substrate layer 111 and the upper substrate layer 112.

[0031] The moduli of the lower substrate layer 111 and the upper substrate layer 112 may be adjusted. For example, the moduli of the substrate layers may be increased by reducing the ethylene content of copolymerized composition in PET synthesis.

[0032] The lower substrate layer 111 and the upper substrate layer 112 may have the same thickness but are not limited thereto. Each of the lower substrate layers 111 and the upper substrate layer 112 may have a thickness of about 10 to 150 ㎛. Meanwhile, the lower substrate layer 111 and the upper substrate layer 112 according to the disclosure have the high modulus, and therefore, when the lower substrate layer 111 and the upper substrate layer 112, in particular, the upper substrate layer 112 is too thick, they are vulnerable to shocks generated during the backgrinding and the like wafer processing. Thus, the lower substrate layer

111 and the upper substrate layer 112 may preferably be set to have a thickness of about 150 μm or lower.

[0033] Meanwhile, the lower substrate layer 111 and/or the upper substrate layer 112 may include a small number of various additives such as a coupling agent, a plasticizer, an antistatic agent, an antioxidant, etc.

SECOND ADHESIVE LAYER

[0034] According to the disclosure, the second adhesive layer 115 has a modulus of 10 MPa or lower. To satisfy this, the second adhesive layer 115 may for example be formed of a thermosetting acrylic adhesive. The thermosetting acrylic adhesive may be manufactured by thermally curing a composition including a resin and a thermally curing agent.

[0035] A typical shock-absorbing layer of urethane acrylate, which is polymerizable by energy rays, has a high modulus because the entire layer is formed of one macromolecule by energy-ray curing, and such a high modulus may act as an obstacle to absorbing shocks. On the other hand, the second adhesive layer 115 according to the disclosure is formed of the thermosetting acrylic adhesive and has a low modulus of 10 MPa or lower, thereby exhibiting better shock-absorbing capability. Meanwhile, the modulus or glass transition temperature of the second adhesive layer 115 may be varied depending on the composition of the resin, the content of the curing agent, etc.

[0036] In the thermosetting acrylic adhesive, the resin may for example be an acrylate compound. The acrylate compound usable for the thermosetting acrylic adhesive may include (meth)acrylate, an alkyl(meth)acrylate such as alkyl(meth)acrylate having four or more carbon atoms, non-urethane-based multifunctional (meth)acrylate, etc.

[0037] The curing agent usable for the thermosetting acrylic adhesive may include an isocyanate-based crosslinking agent, a carbodiimide-based crosslinking agent, an oxazoline-based crosslinking agent, an epoxy-based crosslinking agent, an aziridine-based crosslinking agent, peroxide, etc. The content of the curing agent may be 0.1~2 parts by weight with respect to 100 parts by weight of the resin, but is not limited thereto.

[0038] According to the disclosure, the second adhesive layer 115 between the lower substrate layer 111 and the upper substrate layer 112 has a low modulus of 10 MPa or lower and thus exhibits a sufficient shock-absorbing function even though the lower substrate layer 111 and the upper substrate layer 112 have a high modulus of 1,000 MPa or higher. For example, compressive and shearing stress generated during the wafer backgrinding process may cause the semiconductor chips to vibrate or move, and therefore the semiconductor chips may collide with each other. However, according to the disclosure, shocks are absorbable by the second adhesive layer 115 having the low modulus, which is sandwiched between the lower substrate layer 111 and the upper

substrate layer 112 having the high modulus, thereby preventing the semiconductor chips from colliding.

[0039] As described above, the second adhesive layer 115 has a modulus of 10 MPa or lower, preferably higher than or equal to 0.01MPa and lower than or equal to 5 MPa, and more preferably higher than or equal to 0.05MPa and lower than or equal to 5 MPa. When the modulus of the second adhesive layer is higher than 10 Mpa, the shock-absorbing function is less effective, and therefore the shock transferred through the substrate having the high modulus during the grinding is not absorbed, thereby causing the wafer to crack and making it difficult to prevent the chips from colliding. Further, when the modulus of the second adhesive layer is lower than 0.01MPa, the adhesive is too soft, thereby causing the adhesive to flow and contaminate the wafer by heat and pressure applied during the wafer backgrinding and lowering accuracy in the thickness of the wafer after the processing.

[0040] Meanwhile, the second adhesive layer 115 may have a thickness of 100㎛ or lower. When the thickness of the second adhesive layer is higher than 100㎛, the second adhesive layer having the low modulus may for example be deformed by the stress applied to the adhesive film during the wafer backgrinding, thereby causing the chips held on the adhesive film to be displaced or separating the second adhesive layer due to the shocks of the wafer processing. In other words, thickness

uniformity may deteriorate after the grinding. Accordingly, the second adhesive layer may be set to have a thickness of preferably less than or equal to 100 μm, and more preferably 5 to70 μm.

[0041] Further, the second adhesive layer 115 may have a glass transition temperature (Tg) of less than or equal to 10℃, preferably between -40 and 10℃, more Preferably between -35℃ and 10℃, and the most preferably between -30℃ and 8℃. Such a low glass transition temperature of the second adhesive layer causes the second adhesive layer to have strong adhesion, thereby preventing the first substrate and the second substrate from separating even though the wafer backgrinding is performed at room temperature up to 90℃. However, when the second adhesive layer 115 has an excessively low glass transition temperature lower than -40℃, the adhesive may flow and contaminate the wafer by heat and pressure applied during the wafer backgrinding.

FIRST ADHESIVE LAYER

[0042] In FIG. 1, the first adhesive layer 120 refers to a layer to which the wafer adheres.

[0043] The first adhesive layer 120 may employ various adhesives such as a publicly known ultraviolet (UV) adhesive without specific limitations as long as it has moderate adhesion at room temperature.

[0044] The thickness of the first adhesive layer 120 may for example be 10 to 100 μm without specific limitations.

[0045] FIG. 2 is a schematic cross-sectional view of an adhesive film for wafer processing according to an embodiment of the disclosure.

[0046] Referring to FIG. 2, a primer layer 113 may be additionally formed on the top surface of the upper substrate layer 112 of the multi-layered substrate. The primer layer 113 may be provided to enhance adhesion between the first adhesive layer 120 and the multi-layered substrate 110.

[0047] The primer layer 113 may be formed as a separate layer on the top surface of the upper substrate layer 112, i.e., at the side on which the first adhesive layer 120 is formed. Alternatively, the primer layer 113 may be formed by reforming the top surface of the upper substrate layer 112.

[0048] FIG. 2 shows an example that the primer layer 113 is formed on the top surface of the upper substrate layer 112, but the disclosure is not limited to this example. The primer layer may be formed on the bottom surface of the upper substrate layer 112 or the top surface of the lower substrate layer 111.

[0049] The wafer processing may be carried out in a state that the adhesive film according to the disclosure adheres to the surface of the wafer.

[0050] An example of the wafer backgrinding process is as follows. First, grooves or reforming regions are formed on the wafer, to which the adhesive film according to the disclosure adheres, by laser dicing, plasma dicing, etc. This may be carried out from the surface of the wafer or from the back of the wafer. Then, the wafer backgrinding is carried out by a grinding process, so that the wafer can be diced into a plurality of chips through the grooves or the reforming regions. Thereafter, the adhesive film is peeled off.

<EMBODIMENT>

[0051] Below, an exemplary embodiment is provided to help understanding of the disclosure. However, the following embodiment is merely to more easily understand the disclosure, and does not limit the disclosure.

1. PREPARATION OF ADHESIVE RESIN FOR SECOND ADHESIVE LAYER

[0052] 120 parts of ethyl acetate were put into a reaction vessel equipped with a cooling tube, a nitrogen introduction tube, a thermometer and a stirrer, air in an apparatus was substituted with nitrogen gas so as to exclude oxygen, and then the internal temperature of the vessel was raised to 75℃. After entirely adding the solution obtained by dissolving 0.05 parts of azobisisobutyronitrile (polymer initiator) in 5 parts of ethyl acetate, a monomer mixture having a composition shown in Table 1 was dropped into a reaction system for 2 hours while maintaining

the internal temperature at 74℃ to76℃. Further, a reaction was completed by keeping the internal temperature of 74℃ to76℃ for 5 hours. Last, a (meth)acrylic resin was adjusted to have a concentration of 40% by adding ethyl acetate, thereby preparing the resin.

[0053] The weight-average molecular weight (Mw), number-average molecular weight (Mn), and glass transition temperature (Tg) of the prepared resin were measured. The molecular weights (Mw and Mn) of the prepared resin were measured as follows. Columns were arrayed in series in a GPC apparatus (model name; AGILENT-1200), and tetrahydrofuran was used as an effluent, thereby measuring the molecular weights (Mw and Mn) of the prepared resin-based on standard polystyrene conversion under the conditions of a sample concentration of 5 mg/mL, a sample introduction amount of 100 μL, a temperature of 40℃, and a flow rate of 1 mL/min.

[0054] The glass transition temperature (Tg) of the prepared resin was measured by the TA instruments' dynamic mechanical analyzer Q-800, under the conditions of a temperature measurement range of -80~50℃ and a heating rate of 10℃/min. The monomer composition (wt%) of the monomer mixture used in the second adhesive preparation, and the weight-average molecular weight (Mw), molecular weight distribution (Mw/Mn), and glass transition temperature (Tg) of the prepared resin were tabulated in Table 1.

[Table 1]

	Monomer composition (wt%)					Mw	MW/Mn	Tg(℃)
	BA	EHA	MA	HEA	AA			
Resin 1	42	10	30	5	13	720,000	5.2	-25
Resin 2	20	10	55	7	8	600,000	4.8	-13
Resin 3	20	35	38	5	2	280,000	6.4	-37

[0055] BA: n-butyl acrylate

[0056] EHA: 2-ethylhexyl acrylate

[0057] MA: methyl acrylate

[0058] HEA: 2-hydroxylethyl acrylate

[0059] AA: acrylic acid

2. PREPARATION OF ADHESIVE FILM

[0060] The second adhesive layer was formed by applying and thermally curing an adhesive composition having the composition shown in Table 2 between the upper substrate and the lower substrate shown in FIG. 3.

[Table 2]

	Resin 1	Resin 1	Resin 1	Curing agent	additives	filler
Embodiment 1	100			2		
Embodiment 2	100			1		
Embodiment 3		100		2		
Embodiment 4			100	0.3	0.1	
Embodiment 5		100		2		
Comparative example 1		100		1		
Comparative example 2			100	0.3		
Comparative example 3	100			1		20

[0061] In Table 2, U-CAT 5003 (manufactured by San-Apro Ltd.) was used as the curing agent, KBM-403 (manufactured by Shinetsu) was used as an epoxy silane coupling agent for the additives, and SFP-30M (average particle diameter of 0.7 ㎛)(manufactured by

electrochemical Industry Co., Ltd.) was used as silica for the filler.

[0062] Then, the adhesive film samples were prepared by forming the first adhesive layer with the same UV adhesive on the upper substrate.

3. BACKGRINDING CHARACTERISTIC EVALUATION OF ADHESIVE FILM

[0063] The wafer with 320 semiconductor chips was adhered to the prepared adhesive films and then subjected to grinding under the same conditions. After the grinding, an evaluation of wafer thickness uniformity, sludge intrusion, and chip corner cracks was performed.

[0064] In Table 3, the thickness uniformity and the sludge intrusion after the grinding were evaluated under the following conditions.

[0065] A: Wafer thickness deviation less than or equal to 10 μm after grinding

[0066] B: Wafer thickness deviation greater than 10 μm after grinding

[0067] C: no sludge intrusion

[0068] D: sludge intrusion

[0069] [Table 3]

Chip corner cracks (cracked chips/total chips)	0/320	0/320	0/320	63/320	24/320	263/320	320/320	241/320

Upper substrate thickness (μm)	Lower substrate thickness (μm)	Second adhesive layer thickness (μm)	Resin used for Second adhesive layer	Upper substrate modulus (Mpa)	Lower substrate modulus (Mpa)	Second adhesive layer modulus (MPa)	Second adhesive layer Tg (℃)	Thickness uniformity after grinding	Sludge intrusion
PET(25)	PET(50)	40	Resin 1	2700	2700	0.25	-65	A	C
PET(38)	PET(50)	20	Resin 1	2700	2700	0.1	-125	A	C
PI(25)	OPP(50)	60	Resin 2	3200	1200	1.3	-7	A	C
PET(25)	PET(50)	50	Resin 3	2700	2700	0.005	-31	B	C
PET(38)	PET(50)	150	Resin 2	2700	2700	1.3	7	B	C
PE(25)	PET(50)	40	Resin 2	350	2700	0.25	-1	B	D
OPP(50)	PE(25)	60	Resin 3	1200	350	0.005	-31	B	D
PET(38)	PET(50)	100	Resin 1	2700	4000	150	-125	B	D

	Embodiment 1	Embodiment 2	Embodiment 3	Embodiment 4	Embodiment 5	Comparative example 1	Comparative example 2	Comparative example 3

[0070] Referring to Table 3, the samples according to the embodiments 1 to 5, in which the upper substrate and the lower substrate have a modulus of 1000 MPa or higher and the second adhesive layer has a modulus of 10 MPa or lower, exhibited relatively small chip corner cracks. On the other hand, the samples according to the comparative examples 1 and 2, in which the substrate has a modulus lower than 1000MPa, and the sample according to the comparative example 3, in which the second adhesive layer has a modulus higher than 10 MPa, exhibited relatively large chip corner cracks.

[0071] Further, among the samples according to embodiments 1 to 5, the samples according to the embodiments 1 to 3 exhibited batter characteristics in the evaluation of the thickness uniformity after the grinding. In other words, the samples according to the embodiments 1 to 3 exhibited better characteristics in the evaluation of the thickness uniformity after the grinding than those of the samples according to embodiment 4, in which the modulus of the second adhesive layer is merely 0.005MPa, and the embodiment 5, in which the thickness of the second adhesive layer is greater than 100 μm.

[0072] As described above, the adhesive film for the wafer processing according to the disclosure includes the multi-layered substrate having the sandwiched structure, in which the second adhesive layer having the low modulus is sandwiched between the substrate layers having the high modulus. While the substrate layers having the high modulus have an effect on preventing the chips from colliding during the wafer backgrinding process and the like wafer processing process, the second adhesive layer having the low modulus has an effect on sufficiently absorbing shocks.

[0073] Although the disclosure has been described as above, it is apparent that the disclosure is not limited by the embodiments disclosed in this specification and various modifications may be made by those skilled in the art without departing from the scope of the disclosure. In addition, it is natural that expectable effects of elements according to disclosure should be recognized even though the effects of the corresponding elements are not explicitly described while the embodiments of the disclosure are described as above.

[0074] The adhesive film for the wafer processing according to the disclosure includes a multi-layered substrate, in which the second adhesive layer having a low modulus lower than or equal to 10 MPa is sandwiched between the substrate layers having a high modulus higher than or equal to 1,000 MPa. The substrate layers having the high modulus of 1,000 MPa or higher provides a

modulus enough to support the wafer during the wafer backgrinding process and the like wafer processing process. Further, the second adhesive layer having the low modulus better absorbs the shocks transferred from the substrate layers having the high modulus during the wafer backgrinding and the like wafer processing, thereby preventing the semiconductor chips from colliding and cracking.

[0075] Further, when the second adhesive layer has not only a low modulus of 10 MPa or lower but also a low glass transition temperature of 10℃ or lower, it is possible to provide a higher shock-absorbing effect.

[0076] Furthermore, when the second adhesive layer has not only a low modulus of 10 MPa or lower but also a thickness of 100 ㎛ or lower, it is possible to prevent the adhesive film from being deformed or the second adhesive layer from being separated during the wafer backgrinding and the like wafer processing.

DESCRIPTION OF REFERENCE NUMERALS

110: substrate

111: lower substrate layer

112: upper substrate layer

113: primer layer

115: second adhesive layer

120: first adhesive layer

WHAT IS CLAIMED IS:

1. An adhesive film for wafer processing, comprising:

a multi-layered substrate; and

a first adhesive layer disposed on a top surface of the multi-layered substrate,

wherein the multi-layered substrate includes a sandwich structure in which a second adhesive layer is interposed between an upper substrate layer and a lower substrate layer, and

wherein the lower substrate layer has a modulus of 1,200 MPa to 2,700 MPa, and the upper substrate layer has a modulus of 2,700 MPa to 3,200 MPa, and the second adhesive layer has a modulus of 0.005 MPa to 1.3 MPa, and the second adhesive layer has a glass transition temperature of -31℃ to 7℃.

2. The adhesive film for the wafer processing according to claim 1, wherein the lower substrate layer and the upper substrate layer each comprise one or more selected from a group consisting of polyethylene terephthalate, polyethylene naphthalate, polybutylene terephthalate, wholly aromatic polyester, polyimide, polycarbonate, polyacetal, modified polyphenylene oxide, polyphenylene sulfide, polysulfone, polyetherketone and biaxially oriented polypropylene.

3. The adhesive film according to claim 2, wherein the lower substrate layer and the upper substrate layer comprise polyethylene terephthalate.

4. The adhesive film according to claim 1, wherein the second adhesive layer comprises a thermosetting acrylic adhesive.

5. The adhesive film according to claim 1, wherein the second adhesive layer comprises a thickness of less than or equal to 100 μm.

6. The adhesive film according to claim 1, further comprising a primer layer on at least one of a top surface of the upper substrate layer, a bottom surface of the upper substrate layer, and a top surface of the lower substrate layer.

7. A wafer and adhesive-film assembly comprising the adhesive film according to any one of claims 1 to 6, which adheres to a surface of a wafer formed with a plurality of semiconductor chips.