

STRUCTURAL MEMBER FOR POLISHINGTECHNICAL FIELD

The present invention relates to a structural member for polishing.

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BACKGROUND

Given the miniaturization of electronic components and increasing precision of optical devices in recent years, there have been calls for the planarization of the various substrates used therein (such as silicon wafers, sapphire wafers, glass substrates used in hard disks, and the like). Additionally, the planarization of these various types of substrates is normally performed using a polishing device with a polishing material adhered to a base (platen). At this time, a machining fluid, that may include surfactants and the like, is often used in order to promote the machining planarization process.

The bonding of a polishing pad to a base is usually performed through the use of double-sided adhesive tape. As this double-sided tape there is, for example, that which is disclosed in Japanese Unexamined Patent Application Publication 2008-111008 as "a double-sided adhesive tape for securing a polishing material, provided with a removable adhesive agent on one face of a base material and a strong adhesive layer on the other side of the base material, wherein the strong adhesive layer is formed from an adhesive agent that includes a styrene-isoprene-styrene copolymer resin elastomer as a basic elastomer, and includes, as a tackifier resin, at least a petrochemical resin and a terpene phenol resin", and that which is disclosed in Japanese Unexamined Patent Application Publication 2001-354926 as a "double-sided tape for securing a polishing material, wherein a thermal active acrylic adhesive layer is provided on one side of a base material and a removable adhesive agent layer is provided on the other surface of the base material". In Japanese Translation of Published PCT Application 2002-503559, "a polishing product for polishing glass, including a plurality of polishing composites formed integrally on a base material" is disclosed. In Japanese Translation of Published PCT Application 2002-542057, "a polishing article including at least one three-dimensional polishing coating joined to surfaces of a front material and a rear material" is disclosed.

In the polishing method set forth above, the polishing material preferably is changed after being used until the polishing surface is reduced through wear, making polishing difficult. The polishing material that has been used is removed from the polishing device and replaced.

In order to avoid, insofar as is possible, situations wherein it is necessary to replace the polishing material prior to the surface of the polishing material being used up, it is desirable to prevent (a) a reduction in the adhesive strength through the machining working fluid soaking into the interface between the polishing material and the double-sided adhesive tape for securing the polishing material, (b) the occurrence of peeling, due to loads received during the rubbing motion at the time of polishing in contact with the object being polished, or the like, by the adhesive agent layers of the double-sided adhesive tape for securing the polishing material, and the like. Note that it can also be considered that this peeling is caused by the adhesive agent layers of the double-sided adhesive tape for securing the polishing material becoming swelled with the machining fluid.

Embodiments of the present invention seek to provide a structural member for polishing a substrate that can be used with stability over an extended period of time, provided with an adhesive agent layer that is able to maintain full adhesive strength even when soaked in the machining fluid, and that fully controls swelling with the machining fluid.

SUMMARY

An aspect of the present invention relates to a structural member for polishing having a supporting member, a polishing material, and an adhesive agent layer bonding the support member and the polishing material; wherein the adhesive agent layer includes a polymer of monomers including from 58 to 85% of a first monomer, from 2 to 7% of a second monomer, and from 10 to 40% of a third monomer; the first monomer is an alkyl (meth)acrylate having an alkyl group with carbon counts from 8 to 18 carbon atoms and provides a homopolymer with a glass transition temperature of 0°C or less; the second monomer is a polar monomer that provides a homopolymer with a glass transition temperature of 50°C or greater; and the third monomer is an alkyl (meth)acrylate having an alkyl group with carbon counts from 4 to 18 carbon atoms or an aralkyl group having carbon counts from 7 to 18 carbon atoms and provides a homopolymer with a glass transition temperature of 10°C or greater.

The adhesive agent layer in the structural member for polishing includes the polymer set forth above, and thus can maintain adequate adhesive strength even when soaked in the machining fluid, and is able to adequately control swelling with the machining fluid. Because of this, the structural member for polishing set forth above may make it possible to prevent delamination of the polishing material and the adhesive agent layer caused by a

decrease in the adhesive strength and able to prevent peeling of the adhesive agent layer caused by swelling of the adhesive agent layer, thus enabling polishing operations to be performed with stability over extended periods of time.

In an embodiment, the glass transition temperature of the polymer can be between -25 and 10°C, between -20 and 10°C or even between -15 and 10°C. An adhesive agent layer that includes this type of polymer may be able to adequately prevent the adhesive agent from being pushed out the side faces of the structural member, and the like, due to the pressure that is applied at the time of polishing. Additionally, the structural member for polishing, set forth above, may have a plurality of polishing materials bonded on the adhesive agent layer, and at this time, gaps may be produced between the polishing materials. The adhesive agent layer that includes the polymer set forth above may be able to adequately prevent, at this time, the adhesive agent from being pushed out into the gaps between the polishing materials.

Moreover, in another embodiment, the polishing material may have a base material and a polishing layer. The polishing layer may include a plurality of solid elements orderly disposed on the base material. The solid elements may include a plurality of abrasive grains and a binding agent thereof.

Additionally, in another embodiment the thickness of the adhesive agent layer may be between 50 and 500 μm.

In yet another embodiment, the structural member for polishing may be provided further with a removable adhesive agent layer, provided on the other surface of the supporting member. This type of structural member for polishing can be attached to and removed from the base of the polishing device easily through the removable adhesive agent layer.

Embodiments of the present invention provide a structural member for polishing that can be used with stability over an extended period of time. The structural member is provided with an adhesive agent layer, wherein the adhesive strength may be maintained adequately if soaked with machining fluid and that adequately controls swelling with the machining fluid.

Unless otherwise indicated, all percentages recited herein are percent by weight.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 (a) is a perspective view and (b) is a cross-sectional diagram showing a section on the cross-sectional line I-I, of a structural member for polishing according to a first form of embodiment.

FIG. 2 (a) is a perspective view and (b) is a cross-sectional diagram showing a section on the cross-sectional line II-II, of a structural member for polishing according to a second form of embodiment.

FIG. 3 (a) is a perspective view and (b) is a cross-sectional diagram showing a section on the cross-sectional line III-III, of a structural member for polishing according to a third form of embodiment.

FIG. 4 is a schematic cross-sectional diagram illustrating a method for polishing using the structural member for polishing as set forth in the second form of embodiment.

DETAILED DESCRIPTION

While embodiments according to the present invention are explained in detail below in reference to the figures, the structural member for polishing according to the present invention is not limited to the embodiments set forth below. Note that in the following descriptions, identical or similar parts are assigned the same reference number and a duplicate description is omitted.

Unless otherwise indicated, all numbers expressing feature sizes, amounts, and physical properties used in the specification and claims are to be understood as being modified in all instances by the term "about". Accordingly, unless indicated to the contrary, the numerical parameters set forth in the foregoing specification and attached claims are approximations that can vary depending upon the desired properties sought to be obtained by those skilled in the art utilizing the teachings disclosed herein. The use of numerical ranges by endpoints includes all numbers within that range (e.g. 1 to 5 includes 1, 1.5, 2, 2.75, 3, 3.80, 4, and 5) and any range within that range.

FIG. 1 (a) is a perspective view and (b) is a cross-sectional diagram showing a section on the cross-sectional line I-I, of a structural member for polishing according to a first form of embodiment. A structural member for polishing according to the first form of embodiment is provided with a supporting member 10, an adhesive agent layer 12 that is provided on one face of the supporting member 10, a polishing material 14 that is bonded to the supporting member 10 by the adhesive agent layer 12, and a removable adhesive agent layer 16 that is provided on the other face of the supporting member 10.

While there is no particular limitation on the supporting member 10, the supporting member 10 may use a plastic film made from polyester, polyamide, polyurethane, polyethylene, polypropylene, a vinyl ethylene acetate polymer, polyvinyl chloride,

polycarbonate, or the like; a multilayer film wherein these plastic films are stacked, a foam that uses, as a primary raw material, polyethylene, polyurethane, synthetic rubber, or the like; a woven fabric, a non-woven fabric; or the like.

While there is no particular limitation on the thickness of the supporting member 10, the thickness of the supporting member 10 may be between 25 and 5,000 μm , or may be further between 50 and 2,000 μm .

The adhesive agent layer 12 includes a polymer of monomers (hereafter, may be referred to as "monomer components") including from 58 to 85% of a first monomer (hereafter, may be referred to as "Component (a)"), from 2 to 7% of a second monomer (hereafter, may be referred to as "Component (b)"), and from 10 to 40% of a third monomer (hereafter, may be referred to as "Component (c)"). Component (a) is an alkyl (meth)acrylate having an alkyl group with carbon counts from 8 to 18 carbon atoms and provides a homopolymer with a glass transition temperature of 0°C or less, Component (b) is a polar monomer that provides a homopolymer with a glass transition temperature of 50°C or greater; and Component (c) is an alkyl (meth)acrylate having an alkyl group with carbon counts from 4 to 18 carbon atoms or an aralkyl group having carbon counts from 7 to 18 carbon atoms and provides a homopolymer with a glass transition temperature of 10°C or greater. The Components (a) through (c) will be described in detail below.

Here the "glass transition temperature" (also written as "Tg") of the homopolymer refers to the temperature of the change to a glass state when a thermally melted polymer is cooled under a specific set of conditions to pass through a super-cooled liquid to arrive at the glass state. Specifically, the glass transition temperature of the homopolymer is the value that is measured based on JIS K 7121.

Component (a) is an alkyl (meth) acrylate having an alkyl group with carbon counts between 8 and 18 carbon atoms, being a monomer that provides a homopolymer with a glass transition temperature of no more than 0°C. Mixtures of one or monomers meeting this criteria may be used as Component (a).

Component (a) provides, to the adhesive agent layer 12, adequate softness and adequate wettability in relation to the supporting member 10 and the polishing material 14. Additionally, Component (a) provides hydrophobicity to the adhesive agent layer 12, to thereby adequately prevent the swelling of the adhesive agent layer 12 by the machining working fluid.

Component (a) may be 2-ethylhexyl (meth) acrylate, isooctal (meth) acrylate, isooctyl (meth) acrylate, isodecyl (meth) acrylate, lauryl (meth) acrylate, isomyristyl

(meth) acrylate, isocetyl (meth) acrylate (meth) acrylate, 2-octodecyl (meth) acrylate, isostearyl acrylate, or the like. Of these, the 2-ethylhexyl acrylate and isooctyl acrylate are preferred from the perspective of a substantial improvement in the adhesiveness of the adhesive agent layer 12.

5 The amount of Component (a) included in the monomer components is between 58 and 85% by weight, based on the total amount of the monomer components, and preferably is between 65 and 80% by weight. If the amount of Component (a) included were less than 58% by weight, then the adhesive agent layer 12 would not be given adequate hydrophobicity, so that there would not be adequate protection against swelling
10 of the adhesive agent layer 12 by the machining fluid. Additionally, if the amount of Component (a) included were to exceed 85% by weight, then in some cases the adhesive strength of the adhesive agent layer 12 would not be adequate.

 Component (b) is a polar monomer that provides a homopolymer wherein the glass transition temperature is 50°C or greater. Mixtures of one or monomers meeting this
15 criteria may be used as Component (b).

 The cohesive strength of the adhesive agent layer 12 is increased by Component (b), to provide superior adhesive performance of the supporting member 10 and the polishing material 14 to the adhesive agent layer 12. Note that in a conventional adhesive agent layer, even if strong adhesion is achieved through an anchor effect to an adherend
20 that has surface roughness (a urethane foam for example), in some cases peeling happens easily if, for an adherend having a smooth surface, a machining fluid, for example water or the like, incurs into the interface with the adherend. However, the adhesive agent layer 12, because of Component (b), exhibits superior adhesive performance even for adherends having a smooth surface. Because of this, it is possible for the adhesive agent layer 12 to
25 bond the supporting member 10 and the polishing material 14 over an extended period of time, even in the presence of a machining fluid.

 Component (b) may be, for example: an ethylenically unsaturated monomer having a functional group such as sulfo; vinyl ester; vinylamide ; N-vinyl lactam; (meth) acrylamide; a substituted acrylamide such as N-alkyl (meth) acrylamide, N,N-dialkyl
30 (meth) acrylamide, or the like; or the like.

 Additionally, Component (b) may be: acrylic acid, methacrylic acid, itaconic acid, maleic acid, styrenesulfonic acid, acryloyloxyethyl phthalate, acryloyloxypropyl phthalate, maleic med, N,N-dimethyl (meth) acrylamide, N,N-diethyl (meth) acrylamide, N-t-butyl (meth) acrylamide, N,N-isopropyl (meth) acrylamide, N-t-alkyl (meth) acrylamide,

N,N-dimethylamino ethyl (meth) acrylamide, N,N-dimethylamino propyl (meth) acrylamide, diacetone acrylamide, (meth) acrylonitrile, or N-vinyl pyrrolidone; or a N-vinyl captolactam, or the like. Of these, at least one monomer that includes acid groups is preferred due to the particular superiority of the adhesive strength and cohesive strength of the adhesive agent layer 12, and of these, (meth) acrylic acid and (meth) acryloyloxyethyl phthalate are particularly preferred.

The amount of the Component (b) included in the monomer components is between 2 and 7% by weight, based on the total weight of the monomer components, and preferably is between 3 and 6% by weight. If the amount of Component (b) is less than 2% by weight, then in some cases it would not be possible to achieve adequate adhesive strength in the adhesive agent layer 12, and in particular, it would not be possible to achieve adequate adhesive strength to a smooth surface. Additionally, while if the object were simply to increase the adhesive strength alone, it would be good to increase the amount of Component (b), one of the objects in the present invention is to control the swelling due to the machining fluid, as described above. Having the amount of Component (b) included be within the range set forth above makes it possible to achieve both superior adhesive strength and control of swelling due to the machining fluid.

Component (c) is an alkyl (meth) acrylate having an alkyl group with carbon counts between 4 and 18 carbon atoms or aralkyl groups with carbon counts between 7 and 18 carbon atoms, and is a monomer that provides a homopolymer with a glass transition temperature of 10°C or greater. Mixtures of one or monomers meeting these criteria may be used as Component (c).

Component (c) is able to control the glass transition temperature of the polymer while maintaining the hydrophobicity. Because of this, Component (c) makes it possible for the adhesive agent layer 12 to achieve both adequate hydrophobicity and adequate adhesive strength.

Component (c) may be t-butyl (meth) acrylate, n-butyl methacrylate, isobutyl methacrylate, or another linear or branched alkyl (meth) acrylate; an alicyclic alkyl (meth) acrylate such as cyclohexyl (meth) acrylate, 4-t-butyl cyclohexyl (meth) acrylate, or isobornyl (meth) acrylate; or the like.

The amount of Component (c) included in the monomer components set forth above is between 10 and 40% by weight, based on the total weight of the monomer components set forth above, and, preferably, is between 20 and 40% by weight. If the amount of Component (c) included were less than 10% by weight, then the glass transition

temperature of the polymer would not be increased adequately, and adequate adhesive strength would not be achieved. Additionally, if greater than 40% by weight, then the glass transition temperature of the polymer would be too high, which could make adhesion difficult.

5 The monomer components may contain monomers other than Components (a) through (c). For example, the monomer components may include cross-linking monomers.

 The cross-linking monomers are monomers having a plurality of functional groups wherein radical polymerization is possible, such as (meth) acryloyl functional groups, or the like. The cross-linking monomers form cross-linking structures in the polymer, to
10 further increase the cohesion of the adhesive agent layer 12.

 The cross-linking monomer may be a polyfunctional (meth) acrylate monomer such as 1,2-ethylene glycol di (meth) acrylate, 1,4-butane diol di (meth) acrylate, 1,6-hexane diol di (meth) acrylate, or the like.

 The amount of the cross-linking monomer included in the monomer components
15 set forth above is preferably between 0.01 and 2% by weight, based on the total weight of the monomer components, and more preferably between 0.02 and 1% by weight.

 Monomers other than those listed above (other than Component (a), Component (b), Component (c), and the cross-linking monomers) may also be included in the monomer components, listed above, in a range wherein the characteristics of the adhesive
20 agent layer 12 are not lost. The amount of the other monomers included is preferably no more than 15% by weight, based on the total weight of the monomer components.

 The other monomers may be, for example: acrylic monomers such as benzyl acrylate, pentamethyl piperidyl methacrylate, N,N-dimethyl amino ethylacrylate, 3-ethacryloxypropylmethyldimethoxysilane, 3-methacryloxypropyltrimethoxysilane,
25 3-methacryloxypropylmethyldiethoxysilane, 3-methacryloxypropyltriethoxysilane, and 3-acryloxypropyltrimethoxysilane; a vinyl monomer such as vinyl acetate, vinyl propionate, vinyl versatic acid, styrene, vinylpyridine, vinylimidazole; or the like.

 The polymer included in the adhesive agent layer 12 can be formed through polymerizing the monomer components in the presence of a polymerization initiating
30 agent. The polymerization method for the monomer components, although not limited in particular, may be a normal radical polymerization method, such as solvent polymerization, emulsion polymerization, suspension polymerization, or bulk polymerization, or the like.

 The polymerization of the aforementioned monomer components can be performed using a thermal polymerization method using a thermal polymerization initiating agent.

The thermal polymerization initiating agent may be, for example, an organic peroxide such as benzoyl peroxide; t-butyl perbenzoate, cumene hydroperoxide, diisopropyl peroxydicarbonate; di-n-propyl peroxydicarbonate, di (2-ethoxyethyl) peroxydicarbonate; t-butyl peroxyneodecanoate, t-butylperoxy pivalate, (3,5,5-trimethyl hexanoyl) peroxide, dipropionyl peroxide, or diacetyl peroxide; azo compounds such as 2,2'-azobisisobutyronitrile; 2,2'-azobis (2-methylbutylol nitril), 1,1'-azobis (cyclohexane-1-carbonitrile), 2,2'-azobis (2,4-dimethyl valeronitrile), 2,2'-azobis (2,4-dimethyl-4-methoxy valeronitrile), dimethyl 2,2'-azobis (2-methyl propionate), 4,4'-azobis (4-cyanovalaic acid), 2,2'-azobis (2-hydroxymethyl propionitril), or 2,2'-azobis [2-(2-imidazolin-2-yl) propane; or the like.

The aforementioned polymerization of the monomer components may also be performed using a photopolymerization method using a photopolymerization initiating agent. Specifically, the polymer can be obtained through polymerization of the monomer compounds, which have been mixed together and include a photopolymerization initiator, by radiating the mixture with activating radiation, such as ultraviolet (UV) radiation.

The photopolymerization initiating agent may be, for example: acetophenone, diethoxyacetophenone, 2-[4-(methylthio)-methyl-phenyl]-2-morpholineopropanone, benzoin, benzoin ethyl ether, benzyl methylketal, benzophenone, 2-ethyl anthraquinone, thioxanthone, diethylthioxanthone, 2,4,6-trimethylbenzoyl diphenylphosphine oxide (such as "Lucirin™ TPO," manufactured by BASF), 2,4,6-trimethylbenzoyl diethoxyphosphine oxide (such as "Lucirin™ TPO-L," manufactured by BASF), bis (2,4,6-trimethylbenzoyl) phenylphosphine (such as "IRGACURE™ 819, manufactured by Chiba, Japan), 2-hydroxy-methyl-1-phenylpropane-1-one (such as "DAROCURE™ 1173," manufactured by Chiba, Japan), 4-(2-hydroxyethoxy) phenyl (2-hydroxy-propyl) ketone (such as "IRGACURE™ 2959," manufactured by Chiba, Japan), 4-(2-acryloyloxyethoxy) phenyl-(2-hydroxy-propyl) ketone, 1-hydroxycyclohexyl (such as "IRGACURE™ 184," manufactured by Chiba, Japan), 1-(4-isopropylphenyl)-2-Hydroxy-2-methylpropane 1-one, 1-(4-dodecylphenyl)-2-Hydroxy-2-methylpropane 1-one, 2-methyl-2-morpholino (4-thiomethylphenyl) propane 1-one (such as "IRGACURE™ 907," manufactured by Chiba, Japan), 2-benzyl 2-dimethylamino 1-(4-morpholinophenyl)-butanone (such as "IRGACURE™ 369," manufactured by Chiba, Japan), N,N'-bis octamethylene acridine (such as "ADEKA Optomer™ N1717"), acryloyl benzophenone (such as "Daicel UCBEbercyl™ P36"), or the like.

The polymer included in the adhesive agent layer 12 may be cross-linked by a cross-linking agent. The cross-linking agent is preferably a compound able to form a cross-linked structure with a functional group in the polymer, for example. This compound may be, for example, a polyfunctional isocyanate, an epoxy compound, an aziridine compound, or the like. The cross-linking agent is preferably added at between 0.01 and 3 parts by weight, relative to 100 parts by weight of the monomers, and preferably added at between 0.1 and 2 parts by weight.

The adhesive agent layer 12 may include components other than the polymer, such as tackifying agents, oxidation inhibiting agents, UV absorbing agents, fillers, and the like.

The amount of the polymer included in the adhesive agent layer 12 is preferably between 70 and 100% by weight, based on the total weight of the adhesive agent layer 12, and, more preferably, between 90 and 100% by weight.

The thickness of the adhesive agent layer 12 has no particular limitation, insofar as the thickness is one wherein planarity does not become a problem, and, for example, may be between 0.025 and 1 mm. If the adhesive agent layer 12 is too thick, then even though there will be strong adhesive strength with the supporting member 10 and the polishing material 14, the amount of deformation of the adhesive agent layer 12 when polishing the polishing surface of the substrate will become large, which may cause the adhesive agent layer to bulge out. On the other hand, if the adhesive agent layer 12 is too thin, then, if there is roughness on the surface of the polishing material 14 that is contacted by the adhesive agent layer 12, it may not be possible to achieve adequate conformity and adhesion between the adhesive agent layer 12 and the polishing material 14.

The polishing material 14 is bonded to the supporting member 10 by the adhesive agent layer 12, to polish the polishing object using the surface (the polishing surface) that is opposite the surface that is in contact with the adhesive agent layer 12.

The polishing material 14 can be an appropriate selection depending on the object being polished. For example, the polishing material 14 may be structured from a well-known polishing material that is made from a hard material or a soft material. The polishing material made from a hard material may be, for example, a hard urethane foam sheet (for example, MHTM C-14A (W) or SupremeTM RN-H, manufactured by Nitta Haas Inc.). The polishing material made from a soft material may be, for example, a polishing pad manufactured by Nitta Haas Inc. (SUBATM 400 or MHTM S15A), an artificial leather suede, velour, or the like.

The polishing material 14 may be fabricated from only the polishing layer that will polish the object being polished, or may have multiple layers, including, for example, a base material and a polishing layer that has a structured polishing surface that is provided on the base material.

5 The base material supports the polishing layer on one surface thereof, and contacts the adhesive agent layer 12 on the other surface thereof. The material for the base material, while not limited in particular, may be a polymer film, paper, a metal film, a vulcanized fiber, a non-woven base material, a combination of the above, a treated product of the above, or the like. The base material preferably is made from a material that is flexible,
10 from the perspective of conformance to the object being polished.

The polishing layer can be fabricated from, for example, abrasive grains and a binding agent.

The binding agent is a matrix in which the abrasive grains are dispersed, and includes, for example, a phenol resin, an amino resin, a urethane resin, an epoxy resin, an
15 acrylate resin, an acrylated isocyanurate resin, a urea-formaldehyde resin, an isocyanurate resin, an acrylated urethane resin, an acrylated epoxy resin, a combination of the above, or the like.

The dimension of the abrasive grains may vary depending on the type of abrasive grain and on the polishing application. For example, in final polishing the dimension is
20 preferably between 0.01 and 1 μm , and more preferably between 0.01 and 0.5 μm , and even more preferably between 0.01 and 0.1 μm . In rough polishing or lapping, in order to form a curved surface for example, the dimension is preferably between 0.5 and 20 μm , and more preferably between 0.5 and 10 μm .

Examples of the abrasive grains include diamond, cubic boron nitride, cerium
25 oxide, molten aluminum oxide, heat-treated aluminum oxide, aluminum oxide sol-gel, silicon carbide, chromic oxide, silica, zirconia, alumina zirconia, iron oxide, and garnet. Of these, diamond, cubic boron nitride, aluminum oxide, and silicon carbide are preferred for rough polishing, and silica and alumina oxide are preferred for fine polishing.

A removable adhesive agent layer 16 is provided on the side of the supporting
30 member 10 that is on the opposite side from the side whereon the adhesive agent layer 12 is provided, and is a layer for bonding the structural member for polishing 100 to a platen, or the like, of the polishing device.

The structural member for polishing 100 is removed from the platen of the polishing device and replaced with a new structural member for polishing when the

polishing material 14 becomes worn through polishing, making polishing difficult. Here, in order to enable the removal from the platen of the polishing device, the bonding between the structural member for polishing 100 and the platen of the polishing device is performed through the removable adhesive agent layer 16, which has the property of enabling removability. Because of this, the removable adhesive agent layer 16 preferably can be peeled from the platen of the polishing device without leaving residue when the structural member for polishing 100 is changed.

While there is no particular limitation to the adhesive agent that structures the removable adhesive agent layer 16, natural rubber, synthetic rubber, acrylic, or the like may be used. For example, a mixture may be used that has, as its main component, a copolymer of ester (meth) acrylate and a monomer having carboxyl groups and/or hydroxyl groups, such as (meth) acrylate or 2-hydroxyethyl methacrylate, with a tackifying resin mixed therein, and that further includes a cross-linking agent such as an isocyanate, and that is adjusted to have a low adhesive strength.

The removable adhesive agent layer 16 does not necessarily contact the machining fluid, and even if caused to swell by the machining fluid, does not easily contact the object being polished. Because of this, the effect of suppressing swelling due to the machining fluid, such as in the adhesive agent layer 12, is not necessary in the removable adhesive agent layer 16.

The thickness of the removable adhesive agent layer 16, while not limited in particular, may be between 10 and 100 μm . Additionally, in another aspect, the thickness may be between 20 and 50 μm .

In the structural member for polishing 100 according to the first form of embodiment, the adhesive agent layer 12 includes a polymer of the characteristics set forth above, and thus adequate adhesive strength is maintained even when soaked with the machining fluid, and swelling due to the machining fluid is adequately suppressed. Because of this, the structural member for polishing 100 is able to prevent delamination of the polishing material 14 and the adhesive agent layer 12 caused by a reduction in adhesive strength, and able to prevent peeling of the adhesive agent layer 12 caused by swelling of the adhesive agent layer 12, thus making it possible to perform polishing operations with stability over an extended period of time.

Next follows a description of a second form of embodiment in which the polishing material has a base material and a polishing layer. The polishing layer includes a plurality

of solid elements orderly disposed on the base material. The solid elements may include a plurality of abrasive grains and a binding agent thereof.

FIG. 2 (a) is a perspective view and (b) is a cross-sectional diagram showing a section on the cross-sectional line II-II, of a structural member for polishing 110 according to a second form of embodiment. A structural member for polishing 110 according to the second form of embodiment is provided with a supporting member 20, an adhesive agent layer 22 that is provided on one face of the supporting member 20, a polishing material 24 that is bonded to the supporting member 20 by the adhesive agent layer 22, and a removable adhesive agent layer 26 that is provided on the other face of the supporting member 20.

In the structural member for polishing 110, the supporting member 20, the adhesive agent layer 22, and the removable adhesive agent layer 26 can be illustrated as being identical to the respective supporting member 10, adhesive agent layer 12, and removable adhesive agent layer 16 in the structural member for polishing 100, described above.

In the structural member for polishing 110, the polishing material 24 has a base material 24b and a polishing layer 24a, and a plurality of solid elements 28 is orderly formed on the polishing layer 24a. Here, the base material 24b and the polishing layer 24a can be illustrated as being identical to the base material and the polishing layer described above. There is no particular limitation upon the shape and the like of the solid element 28, but a preferred example is described below.

It is preferable that adjacent solid elements 28 be separated from each other by a planar area 29. Having the solid elements 28 separated in this way allows machining fluid to freely flow across the entire surface of the structural member for polishing 110 through a channel formed between the solid elements 28. Having the machining fluid freely flow allows a better metal removal rate to be obtained, and the surface finish to be improved.

The number of solid elements 28 can fall within a range from 0.3 to approximately 100 per 1 cm². One preferred shape for the solid elements 28 is the pyramidal frustum shown in FIG. 2. The height (distance from the surface formed by the planar area 29 to the upper surface of the solid element 28) of the solid element 28 can be, for example, approximately from 10 to 15,000 μm. The area of the upper surface of the pyramidal frustum formed by the solid element 28 can be from 0.0001 to 400 mm².

The base material 24b is bonded with the adhesive agent layer 22, and serves a role of supporting the polishing layer. From considerations of improving conformance with the

object to be polished, the base material 24b is preferably a base material having flexibility. From considerations of improving the durability of the structural member for polishing 110, the base material 24b preferably is strong and durable.

The material for the base material 24b can be selected from, for example, a polymer film, paper, vulcanized fibers, a nonwoven base material, a cloth base material, or the like. The base material 24b is preferably a polymer film. Examples of polymer film include a polyester film, a polyimide film, a polyamide film, a polypropylene film, a polycarbonate film, a polyurethane film, and the like; of these, a polyester film is preferable. Polyester film has the property of having superior strength, smoothness, heat resistance, water resistance, and oil resistance. In order to improve adhesion with the polishing layer 24a, the base material 24b may be treated for easy adhesion by means of an undercoat of an ethylene-acrylate copolymer or the like.

In the structural member for polishing 110 according to the second form of embodiment, the adhesive agent layer 22 includes a polymer of the characteristics set forth above, and thus adequate adhesive strength is maintained even when soaked with the machining fluid, and swelling due to the machining fluid is adequately suppressed. Because of this, the structural member for polishing 110 is able to prevent delamination of the polishing material 24 and the adhesive agent layer 22 caused by a reduction in adhesive strength, and able to prevent peeling of the adhesive agent layer 22 caused by swelling of the adhesive agent layer 22, thus making it possible to perform polishing operations with stability over an extended period of time.

FIG. 3 (a) is a perspective view and (b) is a cross-sectional diagram showing a section on the cross-sectional line III-III, of a structural member for polishing 120 according to a third form of embodiment. A structural member for polishing 120 according to the third form of embodiment is provided with a supporting member 30, an adhesive agent layer 32 that is provided on one face of the supporting member 30, a polishing material 34 that is bonded to the supporting member 30 by the adhesive agent layer 32, and a removable adhesive agent layer 36 that is provided on the other face of the supporting member 30.

In the structural member for polishing 120, the supporting member 30, the adhesive agent layer 32, and the removable adhesive agent layer 36 can be illustrated as being identical to the respective supporting member 10, adhesive agent layer 12, and removable adhesive agent layer 16 in the structural member for polishing 100, described above.

In the structural member for polishing 120, a plurality of polishing materials 34 is provided arranged on the adhesive agent layer 32. Each polishing material 34 has a base material 34b and a polishing layer 34a, where a plurality of solid elements is formed orderly in the polishing layer 34a. Here, the base material 34b and the polishing layer 34a can be illustrated as being identical to the base material and the polishing layer described above.

In the structural member for polishing 120, the polishing material 34 is provided along with the grooves 38 as illustrated in FIG. 3 (b). When such grooves 38 are present, there is the risk that the pressure, and the like, at the time of polishing will cause the adhesive agent layer 32 to flow into the grooves 38. Here having the glass transition temperature of the polymer that is included in the adhesive agent layer 32 be between -15 and 10°C, or more preferably between -10 and 10°C, and even more preferably between -5 and 5°C makes it possible to adequately prevent the adhesive agent layer 32 from flowing into groove 38.

In the structural member for polishing 120 according to the third form of embodiment, the adhesive agent layer 32 includes a polymer of the characteristics set forth above, and thus adequate adhesive strength is maintained even when soaked with the machining fluid, and swelling due to the machining fluid is adequately suppressed. Therefore, because of the improvement in this adhesive agent layer 32, the structural member for polishing 120 is able to prevent delamination of the polishing material 34 and the adhesive agent layer 32 caused by a reduction in adhesive strength, and able to prevent peeling of the adhesive agent layer 32 caused by swelling of the adhesive agent layer 32, thus making it possible to perform polishing operations with stability over an extended period of time.

Additionally, in the structural member for polishing 120 as set forth in the third form of embodiment, the glass transition temperature of the polymer that is included in the adhesive agent layer 32 being within the specified range makes it possible to prevent the adhesive agent layer 32 from flowing into the grooves 38 that are produced between the polishing materials 34, in addition to the effects set forth above.

FIG. 4 is a schematic cross-sectional diagram illustrating a polishing method using the structural member for polishing as set forth in the second form of embodiment. In FIG. 4, the structural member for polishing, which is provided with the supporting member 20, the adhesive agent layer 22, the polishing material 24, and the removable

adhesive agent layer 26 is bonded to a platen 40 of a polishing device by the removable adhesive agent layer 26.

The object being polished 50 is placed so as to contact the polishing surface (the polishing layer 24a) of the polishing material 24 of the structural member for polishing 110, so as to be polished by the polishing surface (the polishing layer 24a).

When polishing, preferably a machining fluid exists at the surface wherein there is contact between the object being polished 50 and the polishing layer 24a. The machining fluid can reduce the polishing friction, can remove heat that is produced through polishing and provide cooling, and can prevent the adhesion of polishing debris to the polishing surface of the object being polished 50.

That which is known conventionally can be used for the machining fluid. The machining fluid is usually a solution that has water as its primary component, and additives are added to the solution. The additives may include surfactants, lubricating agents, and the like, and, specifically, may include chelated compounds, alkyl phosphates, alkylcarboxylic phosphates, alkyl phosphate salts, alkyl aryl sulfonates, alkylaryl carboxylates, alkylaryl phosphates, alkyls, polyalkylenes, polyalkylene alkyls, polyalkylene glycol alkyl aryl ethers, polyalkylene glycol alkyls, alkylamines, polyalkylene amines, alkanolamine, tetraalkylammonium salts, and tetraalkyl ammonium betaines.

The surfactant may be an anionic surfactant, a nonionic surfactant, or a cationic surfactant, and may be highly hydrophilic. An anionic surfactant or cationic surfactant having strongly hydrophilic groups within the molecules is preferred, and preferably is of HLB 8 or above, and, particularly preferably, is of HLB 10 or above (using the Davis HLB). In a nonionic surfactant, a strong HLB of 8 through 20, or, particularly, an HLB of between 10 and 20 (Griffin HLB) is preferred. Here the HLB value is obtained based on the Davis method for the anionic surfactant and the cationic surfactant, or based on the Griffin method for the a nonionic surfactant.

HLB is a well-known calculated value expressing the degree of a surfactant's affinity to water and oil. With regards to Griffin HLB, the *Journal of the Society of Cosmetic Chemists* 1 (1949): 311, or *Journal of the Society of Cosmetic Chemists* 5 (1954): 259 may be referenced. For Davies HLB, *Gas/Liquid and Liquid/Liquid Interface*, *Proceedings of the International Congress of Surface Activity* (1957): 426-438 may be referenced.

Note that in the case where the object to be polished 50 is a semiconductor wafer or a nonionic alkali glass, in particular, preferably the machining fluid does not include alkali metal ions or halogen compound ions. Because of this, in this case preferably the surfactant is a nonionic surfactant or an anionic alkanolamine salt surfactant.

5 The amount of additives included in the machining fluid is preferably between 0.001 and 50% by weight, and, more preferably, between 0.5 and 30% by weight, and, even more preferably, between 1.0 and 10% by weight. If the amount of surfactant included is less than 0.5% by weight, then, depending on the type, the adhesion prevention effect would be inadequate. Additionally, if greater than 20% by weight, then the
10 machining fluid would become viscous, and there would be a risk of the occurrence of polishing irregularities.

 In the structural member for polishing 110, the adhesive agent layer 22 includes a polymer of the characteristics set forth above, and thus adequate adhesive strength is maintained even when soaked with the machining fluid, and swelling due to the machining
15 fluid is adequately suppressed. Because of this, when the structural member for polishing 110 is used, even if the polishing is performed in the presence of a machining fluid, delamination of the polishing material 24 and the adhesive agent layer 22 caused by a reduction in adhesive strength and peeling of the adhesive agent layer 22 caused by swelling of the adhesive agent layer 22 are adequately prevented, thus making it possible
20 to perform polishing operations with stability over an extended period of time.

 While preferred embodiments of the present invention have been described above, the present invention is not limited to the embodiments set forth above. For example, while in FIGS. 1-3 the structural member for polishing was illustrated as the disk-shaped, the shape of the structural member for polishing in the present invention is not limited
25 thereto. For example, the structural member for polishing maybe cylindrical, or may be a polygonal prism.

EXAMPLES

 The present invention will be explained in further detail below based on examples,
30 but the present invention is not limited to the following examples.

 First, the methods used to measure the storage elastic modulus and the glass transition temperature T_g (the dynamic adhesive characteristics) of the adhesive sheets, the method used to measure the acid value, the method used to measure the adhesive

strength, the method used to perform the saturation test, and the method used to measure the machining fluid absorbency are explained below.

Measurement of the Storage Elastic Moduli and Glass Transition Temperatures (T_g)

(Dynamic Adhesion Characteristics)

Preparation of samples: Using adhesive sheets obtained in Manufacturing Examples 1 through 11 below, disk-shaped samples were obtained by punching out, using a punching blade, 7.9 mm diameter samples from 16-layer sheets, approximately 3 mm thick, from which peeling films had been removed.

Measurements: The dynamic adhesion characteristics use the Advanced Rheometric Expansion System (ARES) manufactured by Rheometric Scientific. A 7.9 mm diameter parallel plate was used as the tool for securing the samples, where the disk-shaped samples prepared using the method set forth above were placed between the plates, and the tension was adjusted. The dynamic adhesion properties measurements were performed in atmosphere, and measurements were performed in the shearing mode with a frequency of 1.0 Hz with a rate of increase in temperature of 5°C/minute between -50 and 200°C. The temperature corresponding to the peak $\tan \delta$ value was defined as the glass transition temperature. $\tan \delta$ is the ratio of the loss elastic modulus G'' (Pa) to the storage elastic modulus G' (Pa).

Adhesive Strength Measurement

The adhesive strength between a polycarbonate film and a polishing pad was measured by a peel test. Structural members for polishing, as obtained in the examples and in the comparative example below, were cut to 25 mm x 150 mm using a cutter. The polycarbonate film and polishing pads were pulled at a peeling rate of 5 mm/minute using a pull testing machine (Ag-IS, manufactured by Shimadzu), and the maximum strength was recorded as the peeling strength of adhesive sheet.

Adhesive Strength after Soaking Measurement

Structural members for polishing as obtained in the examples and in the comparative example below, were soaked for 7 days and for 14 days in a machining fluid (10% by weight) aqueous solution of SABRELUBE 9016, manufactured by Chemettal Oakite, Romulus, Missouri, U.S.A.) at 50°C, and then rinsed with pure water. The adhesive strength was measured 30 minutes after rinsing. The adhesive strength measurement was performed using the method described above. Note that in order to

obtain adequate adhesive strength, a minimum of 20 N/25 mm is desired, both at the start and after soaking for 14 days.

Machining Fluid Absorption Measurement

5 The adhesive agent layers obtained as described below were cut to dimensions of 25 mm x 70 mm and a thickness of 250 micron, using a cutter, and the weight thereof was measured after removing one of the release liners. Soaking was performed for 10 days at 23°C in a 10% aqueous solution of SABRELUBE 9016. The sample was removed from the solution and the weight was measured 30 minutes after rinsing with pure water and
10 blowing off the moisture with compressed air. The percent absorption was then calculated from the initial and final weights as follows: $(\text{final weight} - \text{initial weight}) / (\text{initial weight}) \times 100$. In order to minimize the swelling of the adhesive agent layer, preferably the machine fluid absorption is no more than 10%, and, more preferably, less than 5%. From the results shown in Table 2, it can be seen that the machining fluid absorption varies
15 depending on the amount of acrylate and the amount of cross-linking monomer in the adhesive agent.

Manufacturing of Adhesive Agent Layer 1 with release liners

70 parts by weight of 2-ethyhexyl acrylate (Nippon Shokubai Co., Ltd.; Chiyoda
20 Ward, Tokyo), 25 parts by weight of isobornyl acrylate (Osaka Organic Chemical Industry, Ltd.; Osaka, Osaka), 5 parts by weight of acrylic acid (Toagosei Co., Ltd.; Minato Ward, Tokyo), and 0.04 parts by mass of Irgacure™ 651 (2,2-dimethoxy-2-phenylacetophenone, BASF Japan, Ltd.; Minato Ward, Tokyo) as a photopolymerization initiator were mixed well in a glass container, dissolved oxygen was substituted with nitrogen gas, a low-
25 pressure Hg lamp (Sylvania TMF20T12B: Osram Sylvania Inc., Massachusetts, U.S.) was used to irradiate the mixture with ultraviolet light for several minutes to induce partial polymerization, and a viscous liquid with a viscosity of approximately 2,500 cP was obtained. 0.06 parts by mass of HDDA (1,6-hexanediol diacrylate, light acrylate
TM1.6HX-A: Kyoeisha Chemical Co., Ltd.) as a crosslinking agent and 0.15 parts by
30 mass of additional polymerization initiator (Irgacure™ 651: BASF Japan, Ltd.; Minato Ward, Tokyo) were added and the mixture thoroughly stirred. This mixture was applied to the surface of a release liner, a 50 µm-thick peel-treated polyester film (Serapeel MIB(T): Toray Advanced Film Co., Ltd.: Minato Ward, Tokyo) so as to form a 250 µm-thick coating. A second release liner of the same polyester film was placed over the top surface

of the coating. The coating with release liners was irradiated using a low-pressure Hg lamp on both sides at 2,000 mJ/cm² to producing adhesive agent layer 1 with release liner.

Manufacturing of Adhesive Agent Layers 2-11 with release liners

5 Adhesive agent layers 2-11 were manufactured in the same manner as that of adhesive agent layer 1, with the exception of changing the compositional ratios (the ratios by weight) of the individual monomers as set forth in Table 1.

 In Table 1, "2EHA" indicates 2-ethylhexyl acrylate (AEH: Nippon Shokubai Co., Ltd.; Minato Ward, Tokyo), "IOA" indicates isooctyl acrylate (3M; Minnesota, U.S.),
10 "AA" indicates acrylic acid, "CHA" indicates cyclohexyl acrylate (Osaka Organic Chemical Industry, Ltd.; Osaka, Osaka), "IBXA" indicates isobornyl acrylate (Osaka Organic Chemical Industry, Ltd.; Osaka, Osaka), "BZA" indicates benzyl acrylate (Osaka Organic Chemical Industry, Ltd.; Osaka, Osaka), "BA" indicates butyl acrylate (Mitsubishi Chemical Corporation; Minato Ward, Tokyo), "HDDA" indicates
15 1,6-hexanediol diacrylate (Light Acrylate TM1.6HX-A: Kyoeisha Chemical Co., Ltd.; Osaka, Osaka), and "IRG651" indicates Irgacure™ 651 (2,2-dimethoxy-2-phenylacetophenone, BASF Japan, Ltd.; Minato Ward, Tokyo).

Table 1

	Component (a)		Component (b)	Component (c)		BZA	BA	HDDA	Irg 651
	2EHA	IOA	AA	CHA	IBXA				
Adhesive Agent Layer 1	60	—	5	—	35	—	—	0.06	0.15
Adhesive Agent Layer 2	70	—	5	—	25	—	—	0.06	0.15
Adhesive Agent Layer 3	61	—	6	—	33	—	—	0.04	0.15
Adhesive Agent Layer 4	60	—	5	—	25	15	—	0.06	0.15
Adhesive Agent Layer 5	68	—	2	30	—	—	—	0.04	0.15
Adhesive Agent Layer 6	80	—	5	—	15	—	—	0.06	0.15
Adhesive Agent Layer 7	70	—	5	25	—	—	—	0.06	0.15
Adhesive Agent Layer 8	90	—	10	—	—	—	—	0.06	0.15
Adhesive Agent Layer 9	50	—	5	—	—	—	45	0.06	0.15
Adhesive Agent Layer 10	—	90	10	—	—	—	—	0.08	0.15
Adhesive Agent Layer 11	—	92	8	—	—	—	—	0.06	0.15

Example 1

Adhesive agent layer 1 with release liners was cut to 1,200 x 120 mm using a cutter, one release liner was removed and the sheet was attached to a polycarbonate film (GE: Connecticut, U.S.). The remaining release liner on the transparent adhesive agent layer 1 was peeled off, and the adhesive agent layer was attached to a polishing pad cut to 1,200 mm in length from a roll (Trizact™ tile DT4MAA1HD, 250 mm x 50 mm thickness roll: Sumiyoshi 3M; Setagaya Ward, Tokyo) using a rubber roller. Lamination was subsequently performed using a laminator (ARCTIC EAGLE 1600: Japan GBC; Nakano Ward, Tokyo) at 80°C and 0.5 MPa to obtain a structural member for polishing, Example 1.

Examples 2-7

Structural members for polishing, Examples 2-7, were obtained in the same manner as for Example 1, with the exception of using the respective adhesive agent layers 2 through 7 instead of the adhesive agent layer 1.

Comparative Examples 8-11

Structural members for polishing were obtained in the same manner as in Example 1, with the exception of using the respective adhesive agent layers 8 through 11 instead of the adhesive agent layer 1.

- 5 Using the methods described above, the glass transition temperatures T_g, the adhesive strength, the adhesive strength after soaking and the machining fluid absorption for the Examples 1 through 7 and Comparative Examples 8 through 11 were measured. Results are shown in Table 2.

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Table 2

	Adhesive Sheet	T _g (°C)	Adhesive Strength (N/25 mm)	Adhesive Strength after Soaking (N/25 mm)		Machining Fluid Absorption (% weight increase)
				Seven Days	14 Days	
Example 1	Adhesive Agent Layer 1	0.2	45	21	27	3%
Example 2	Adhesive Agent Layer 2	2	47	28	28	4%
Example 3	Adhesive Agent Layer 3	-11	40	30	25	4%
Example 4	Adhesive Agent Layer 4	-18	36	33	29	4%
Example 5	Adhesive Agent Layer 5	0.5	46	20	25	4%
Example 6	Adhesive Agent Layer 6	-23	37	25	22	3%
Example 7	Adhesive Agent Layer 7	-16	43	33	30	4%
Comparative Example 8	Adhesive Agent Layer 8	-6	35	31	26	10%
Comparative Example 9	Adhesive Agent Layer 9	-22	19	8	6	24%
Comparative Example 10	Adhesive Agent Layer 10	-5	32	21	20	23%
Comparative Example 11	Adhesive Agent Layer 11	-10	25	—	18	9%

Claims

1. A structural member for polishing comprising a supporting member, a polishing material, and an adhesive agent layer bonding the support member and the polishing material; wherein the adhesive agent layer includes a polymer of monomers including from 58 to 85weight % of a first monomer, from 2 to 7 weight % of a second monomer, and from 10 to 40 weight % of a third monomer; wherein the first monomer is an alkyl (meth)acrylate having an alkyl group with carbon counts from 8 to 18 carbon atoms and provides a homopolymer with a glass transition temperature of 0°C or less; the second monomer is a polar monomer that provides a homopolymer with a glass transition temperature of 50°C or greater; and the third monomer is an alkyl (meth)acrylate having an alkyl group with carbon counts from 4 to 18 carbon atoms or an aralkyl group having carbon counts from 7 to 18 carbon atoms and provides a homopolymer with a glass transition temperature of 10°C or greater.
2. The structural member for polishing as set forth in claim 1, wherein the glass transition temperature of the polymer is between -25 and 10°C.
3. The structural member for polishing as set forth in claim 2, wherein the glass transition temperature of the polymer is between -15 and 10°C.
4. The structural member for polishing as set forth in claim 1, wherein the machine fluid absorption of the adhesive agent layer is less than 5 weight %, wherein the machine fluid absorption is measured on an adhesive agent layer having dimensions of 25 mm by 70 mm by 250 micron thickness, having release liners, after removing one of the release liners and soaking the adhesive agent layer for 10 days at 23°C in a 10% aqueous solution of SABRELUBE 9016.
5. The structural member for polishing as set forth in claim 1, wherein the polishing material comprises a base material and a polishing layer.
6. The structural member for polishing as set forth in claim 5, wherein the polishing layer comprises a plurality of solid elements.

7. The structural member for polishing as set forth in claim 6, wherein the plurality of solid elements comprises a plurality of abrasive grains and a binding agent thereof.

5 8. The structural member for polishing as set forth in any of claims 1, 3 or 7, wherein the thickness of the adhesive agent layer is between 50 and 500 μm .

9. The structural element for polishing as set forth in claim 1, further comprising a removable adhesive agent layer provided on the other face side of the supporting member.

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