DESCRIPTION

TITLE OF INVENTION: WAFER-HOLDING RING MEMBER

TECHNICAL FIELD

[0001]

The present invention relates to a wafer-holding ring member used in a polishing apparatus such as a chemical mechanical polishing (CMP) apparatus that polishes a wafer.

Priority is claimed on Japanese Patent Application No. 2024-027157, filed February 27, 2024, and Japanese Patent Application No. 2025-019842, filed February 10, 2025 the contents of which are incorporated herein by reference.

BACKGROUND ART

[0002]

With the development of the semiconductor industry, the need for a processing method for finishing surfaces of metals, semiconductors, ceramics, and the like with high accuracy has increased, and in particular, in semiconductor wafers, surface finishing in a nanometer order is required with the improvement of the degree of integration. In order to cope with such high-accuracy surface finishing, polishing of a semiconductor wafer is generally performed by a chemical mechanical polishing (CMP) apparatus using a porous CMP pad.

[0003]

In the above-described CMP apparatus, surface polishing is performed in a state where a wafer is held by a wafer-holding ring member disposed on an outer peripheral side of the wafer. In this case, in order to ensure the polishing flatness of the outer peripheral portion of the wafer, the wafer-holding ring member disposed on the outer

peripheral side of the wafer is also configured to be polished together with the wafer.

[0004]

Here, as the above-described wafer-holding ring member, a wafer-holding ring member made of a resin material such as polyether ether ketone (PEEK) has been provided in the related art.

In addition, in Patent Document 1, a wafer-holding ring member having a structure in which a ceramic member and a resin member are laminated is proposed.

Citation List

Patent Document

[0005]

Patent Document 1: Japanese Unexamined Patent Application, First Publication No. 2002-355753

SUMMARY OF INVENTION

Technical Problem

[0006]

Meanwhile, in the wafer-holding ring member made of a resin material, since the hardness is extremely low as compared with a base plate to be polished (for example, silicon, sapphire, diamond, or the like), there is a concern that the wafer-holding ring member may be severely consumed during polishing and the flatness of the outer peripheral portion of the wafer may not be ensured.

In addition, in the wafer-holding ring member made of a resin material, since the thermal conductivity is low, the heat during polishing does not sufficiently spread, and a temperature distribution occurs. Therefore, when a wafer made of GaAs, LN, LT, GaN, InP, or the like is polished, there is a concern that the wafer may be cracked due to thermal expansion.

[0007]

Furthermore, in the wafer-holding ring member made of a resin material, the acid resistance is insufficient, and there is a concern that the wafer-holding ring member may deteriorate at an early stage in a case where an acidic slurry (an organic acid-based slurry such as a carboxylic acid, a sulfonic acid, a sulfinic acid, a phenol, a thiol, an acid imide, an oxime, or a sulfonamide) is used. In particular, in an oxidizing agent-containing slurry (potassium permanganate, nitric acid, hypochlorous acid, hydrogen peroxide, or the like), the deterioration of the resin material was remarkable. Due to such deterioration of the resin material, in the wafer-holding ring member made of a resin material, there is a concern that the flatness of the outer peripheral portion of the wafer may not be ensured.

In addition, in the wafer-holding ring member made of a resin material, the wafer-holding ring member is charged and particles are attached to the wafer-holding ring member because the wafer-holding ring member is extrusion molding at a high pressure by injection molding. In addition, the ring member is contaminated on the surface by metal impurities because the ring member comes into contact with a metal die. In a case where the insulating film used in the semiconductor device is contaminated with metal during the flattening, the metal diffuses and the insulating properties deteriorate. A component having high cleanliness without metal contamination and particle attachment is required.

[0008]

The present invention has been made in view of the above-described circumstances, and an object of the present invention is to provide a wafer-holding ring member having excellent wear resistance, thermal conductivity, acid resistance, and cleanliness, and capable of stably performing surface polishing of various wafers by

CMP.

Solution to Problem

[0009]

In order to solve the above-described problems, a wafer-holding ring member according to Aspect 1 of the present invention is a wafer-holding ring member used for a polishing apparatus, the wafer-holding ring member including a polishing surface, in which the wafer-holding ring member is made of a silicon material.

[0010]

According to the wafer-holding ring member of Aspect 1 of the present invention, since the wafer-holding ring member is made of a silicon material, the wafer-holding ring member is sufficiently hard and has excellent wear resistance as compared with a resin material. In addition, the wafer-holding ring member also has excellent thermal conductivity, and heat generated during polishing can be uniformly dispersed, and thus a temperature distribution is unlikely to occur. Furthermore, the wafer-holding ring member also has excellent acid resistance, and there is no risk of particles or metal contamination, and thus the wafer-holding ring member has high cleanliness. Therefore, the wafer can be stably subjected to surface polishing by a polishing apparatus such as a CMP apparatus.

[0011]

According to a wafer-holding ring member according to Aspect 2 of the present invention, in the wafer-holding ring member according to Aspect 1, the wafer-holding ring member is made of the silicon material having a purity of 99.9999 mass% or more.

According to the wafer-holding ring member according to Aspect 2 of the present invention, since the wafer-holding ring member is made of a high-purity silicon material having a purity of 99.9999 mass% or more, the number of impurities is small

and the characteristics are stable, and thus the wafer can be more stably subjected to surface polishing.

[0012]

According to a wafer-holding ring member according to Aspect 3 of the present invention, in the wafer-holding ring member according to Aspect 1 or 2, a contact angle of water on the polishing surface is 30° or less.

According to the wafer-holding ring member according to Aspect 3 of the present invention, since the contact angle of water on the polishing surface to be polished together with the wafer is 30° or less, the wafer-holding ring member has sufficient hydrophilicity, the slurry easily wets the surface, and the polishing can be stably performed.

[0013]

According to a wafer-holding ring member according to Aspect 4 of the present invention, in the wafer-holding ring member according to any one of Aspects 1 to 3, in which an oxide film is formed on the polishing surface.

According to the wafer-holding ring member according to Aspect 4 of the present invention, since the oxide film is formed on the polishing surface to be polished together with the wafer, the wafer-holding ring member has sufficient hydrophilicity, the slurry easily wets the surface, and the polishing can be stably performed.

[0014]

According to a wafer-holding ring member according to Aspect 5 of the present invention, in the wafer-holding ring member according to any one of Aspects 1 to 4, a hydrophilic functional group is imparted to the polishing surface.

According to the wafer-holding ring member according to Aspect 5 of the present invention, since the hydrophilic functional group is imparted to the polishing

surface to be polished together with the wafer, the wafer-holding ring member has sufficient hydrophilicity, the slurry easily wets the surface, and the polishing can be stably performed.

[0015]

According to a wafer-holding ring member according to Aspect 6 of the present invention, in the wafer-holding ring member according to any one of Aspects 1 to 5, a flatness of the polishing surface is 0.05 mm or less.

According to the wafer-holding ring member according to Aspect 6 of the present invention, since the flatness of the polishing surface to be polished together with the wafer is 0.05 mm or less, the flatness of the outer peripheral portion of the wafer can be sufficiently ensured by the surface polishing.

[0016]

According to a wafer-holding ring member according to Aspect 7 of the present invention, in the wafer-holding ring member according to any one of Aspects 1 to 6, the wafer-holding ring member is made of columnar crystal silicon.

According to the wafer-holding ring member according to Aspect 7 of the present invention, since the wafer-holding ring member is made of columnar crystal silicon, the wafer-holding ring member is very hard and has excellent wear resistance.

[0017]

According to a wafer-holding ring member according to Aspect 8 of the present invention, in the wafer-holding ring member according to any one of Aspects 1 to 7, a screw insertion hole into which a fixing screw is inserted is formed.

According to the wafer-holding ring member according to Aspect 8 of the present invention, since the screw insertion hole into which the screw is inserted is formed, the wafer-holding ring member can be fixed to the fixing member by the screw

without using an adhesive or the like, and even in a case where heat is generated during polishing, the fixing member and the wafer-holding ring member can be prevented from being peeled off, and the polishing can be stably performed.

Advantageous Effects of Invention

[0018]

According to the present invention, it is possible to provide a wafer-holding ring member that has excellent wear resistance, thermal conductivity, acid resistance, and cleanliness, and can stably perform surface polishing of various wafers by CMP.

BRIEF DESCRIPTION OF DRAWINGS

[0019]

[FIG. 1A] A top view showing an example of a wafer-holding ring member according to an embodiment of the present invention.

[FIG. 1B] A cross-sectional view showing an example of the wafer-holding ring member according to the embodiment of the present invention.

[FIG. 2] A flowchart showing an example of a method for manufacturing the wafer-holding ring member according to the embodiment of the present invention.

[FIG. 3] An explanatory view showing a measurement position of a thickness in a case of evaluating flatness of the wafer-holding ring member according to the embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0020]

Hereinafter, a wafer-holding ring member according to an embodiment of the present invention will be described with reference to the accompanying drawings.

The wafer-holding ring member 10 according to the present embodiment is used for a polishing apparatus such as a CMP apparatus. Here, the wafer-holding ring

member 10 is also referred to as a retainer ring for a polishing apparatus.

[0021]

The wafer-holding ring member 10 according to the present embodiment is used, for example, in a chemical mechanical polishing (CMP) apparatus that polishes a surface of a wafer made of silicon, SiC, diamond, sapphire, GaAs, LN, LT, GaN, InP, or the like, in a case of holding the wafer.

The wafer-holding ring member 10 according to the present embodiment is a wafer-holding ring member 10 that is disposed on an outer peripheral side of a wafer (for example, a front surface or a back surface of the wafer) in a polishing apparatus that polishes the wafer, holds the wafer, and is polished together with the wafer, in which the wafer-holding ring member 10 is made of a silicon material.

[0022]

As shown in FIGS. 1A and 1B, the wafer-holding ring member 10 according to the present embodiment has a disk shape and has an inner peripheral hole 11 into which a wafer is mounted.

The wafer-holding ring member 10 is configured to hold the outer peripheral side of the wafer and to be polished together with the wafer in a polishing apparatus such as a CMP apparatus. In this way, the wafer-holding ring member 10 located on the outer peripheral side of the wafer is polished together with the wafer, so that the polishing flatness of the outer peripheral portion of the wafer is ensured.

That is, one surface of the wafer-holding ring member 10 is a polishing surface 12 that is polished together with the wafer. A plurality of discharge grooves (groove portions) 13 for discharging a polishing slurry are formed at predetermined positions on the polishing surface 12.

[0023]

The wafer-holding ring member 10 according to the present embodiment includes the polishing surface 12 and a groove portion formed on the polishing surface 12, and is made of a silicon material. Here, as the silicon material constituting the wafer-holding ring member 10, for example, a single-crystal silicon ingot, a mono-like silicon ingot, a columnar crystal silicon ingot, or a polycrystalline silicon ingot is used. In addition, it is preferable that the wafer-holding ring member 10 contains a high-purity (99.99999 mass% or more) silicon material, and the balance consists of inevitable impurities.

In the present embodiment, it is preferable that the wafer-holding ring member 10 is made of a columnar crystal silicon ingot.

[0024]

In the present embodiment, the silicon material constituting the wafer-holding ring member 10 preferably has a purity of 99.9999 mass% or more (so-called 6N or more solar cell grade), more preferably 99.99999 mass% or more, and still more preferably 99.999999 mass% or more.

In the present embodiment, it is preferable that the wafer-holding ring member 10 is made of a silicon material having a purity of 99.999999999 mass% or more (so-called 11N or more).

Although not particularly limited, the silicon material constituting the wafer-holding ring member 10 may have a purity of 99.9999999999 mass% or less (so-called 12N or less).

[0025]

In addition, in the wafer-holding ring member 10 of the present embodiment, it is preferable that the polishing surface 12 to be polished together with the wafer is imparted with hydrophilicity, and specifically, it is preferable that the contact angle of

water on the polishing surface 12 is 30° or less.

By imparting hydrophilicity to the polishing surface 12, the polishing slurry is likely to spread in the surface direction, and the polishing can be uniformly performed.

It is still more preferable that the contact angle of water on the polishing surface 12 is 20° or less, and it is more preferable that the contact angle of water on the polishing surface 12 is 10° or less. For example, in the wafer-holding ring member 10 of the present embodiment, the polishing surface 12 is a hydrophilic surface having hydrophilicity, and the contact angle of water on the polishing surface 12 is preferably 20° or less or 10° or less.

Although not particularly limited, the contact angle of water on the polishing surface 12 may be 0° or more, 1° or more, or 5° or more.

[0026]

Here, in the wafer-holding ring member 10 of the present embodiment, an oxide film may be formed on the polishing surface 12 in order to impart hydrophilicity to the polishing surface 12.

It is preferable that the thickness of the oxide film formed on the polishing surface 12 is 1 nm or more, and it is more preferable that the thickness of the oxide film formed on the polishing surface 12 is 5 nm or more. In addition, the thickness of the oxide film formed on the polishing surface 12 is preferably 50 nm or less, and more preferably 10 nm or less.

[0027]

In addition, in the wafer-holding ring member 10 of the present embodiment, a hydrophilic functional group may be imparted to the polishing surface 12 in order to impart hydrophilicity to the polishing surface 12. Examples of the hydrophilic functional group imparted to the polishing surface 12 include OH (hydroxyl group), NH3

(amino group), COOH (carbonyl group), and CO (carboxyl group).

[0028]

In addition, in the wafer-holding ring member 10 of the present embodiment, the flatness of the polishing surface 12 is preferably 0.05 mm or less.

The flatness of the polishing surface 12 is still more preferably 0.03 mm or less, and more preferably 0.01 mm or more. The lower limit of the flatness of the polishing surface 12 is not particularly limited, and is preferably 0 mm.

[0029]

Further, in the wafer-holding ring member 10 of the present embodiment, as shown in FIGS. 1A and 1B, it is preferable that a screw insertion hole 15 through which a screw is inserted is formed.

In the wafer-holding ring member 10 of the present embodiment, the wafer-holding ring member 10 is configured to be fixed to a fixing member (not shown) disposed on a side opposite to the polishing surface 12 by a fixing screw inserted into the screw insertion hole 15. The wafer-holding ring member 10 of the present embodiment is used in a CMP apparatus in a state of being fixed to the fixing member.

The wafer-holding ring member 10 may have a structure in which a substrate is bonded to a surface (the other surface) on a side opposite to the polishing surface 12 as a support member. For example, the support member is a substrate other than a silicon material. Examples of the substrate include a metal material such as an aluminum material (a film-treated product such as an anodized aluminum material) or a SUS material, a ceramic material such as alumina or SiC, and a resin material such as PEEK or polyimide.

[0030]

Next, an example of a method for manufacturing the wafer-holding ring member

10 according to the present embodiment will be described with reference to FIG. 2.

As shown in FIG. 2, the method for manufacturing the wafer-holding ring member 10 according to the present embodiment includes a cutting step S01, a heat treatment step S02, a ring processing step S03, a shape processing step S04, a planarization step S05, a cleaning step S06, and a hydrophilization treatment step S07.

[0031]

(Cutting Step S01)

First, a silicon ingot serving as a material of the wafer-holding ring member 10 is cut to obtain a silicon disk material having a predetermined thickness.

Here, in the present embodiment, a columnar crystal silicon ingot solidified in one direction is cut in a direction orthogonal to a solidification direction, thereby obtaining a silicon disk material having a columnar crystal extending in a thickness direction.

[0032]

(Heat Treatment Step S02)

Next, the above-described silicon disk material is subjected to a heat treatment. By performing the heat treatment, strain accumulated in the silicon disk material is removed.

Here, the heat treatment conditions are, for example, preferably an atmosphere of argon, a heat treatment temperature of 200°C or higher and 800°C or lower, a holding time at the heat treatment temperature of 0.2 hours or longer and 2 hours or shorter, and a cooling rate of 100°C/min or faster and 180°C/min or slower.

[0033]

(Ring Processing Step S03)

Next, the above-described silicon disk material is mechanically processed to

obtain a silicon ring material having predetermined dimensions.

[0034]

(Shape Processing Step S04)

Next, the above-described silicon ring material is mechanically processed to form the discharge groove 13 on the polishing surface 12 and to form the screw insertion hole 15.

In a case where the silicon ring material is made of columnar crystal silicon, a grain boundary may have a groove-like shape and constitute the discharge groove 13.

In addition, since the silicon ring material (silicon material) is a brittle material, it is necessary to take care when forming the screw insertion hole 15.

[0035]

(Planarization Step S05)

Next, a planarization treatment is performed so that at least the polishing surface 12 of the silicon ring material is a flat surface.

In the planarization step S05, for example, the polishing surface 12 and the back surface are subjected to grinding processing using a machine tool (a surface grinding machine or a rotary grinding machine) to be planarized. After the grinding processing, the flatness may be further improved by additionally performing processing with a polishing apparatus.

[0036]

Here, Table 1 shows the results of measuring the flatness of the polishing surface 12 after the planarization step S05 is performed. The flatness was calculated by measuring the thickness at the locations (a total of 16 locations) shown in FIG. 3. The flatness was 0.008 mm.

Although not particularly limited, a method of measuring the thickness is, for

example, a method using a laser white light interferometer.

The locations (a total of 16 locations) at which the thickness is measured will be described in detail below.

As shown in FIG. 3, a predetermined point on the outer side (for example, a portion of 10% to 40% from the outer peripheral end of the silicon ring material toward the inner peripheral end when the length from the outer peripheral end to the inner peripheral end of the silicon ring material is set to 100%) of the surface of the silicon ring material is defined as A1. Further, a point moved by 45 degrees clockwise from A1 is defined as B1, and a point moved by 45 degrees clockwise from B1 is defined as C1. This is repeated, and eight points on the surface of the silicon ring material at equal intervals in the clockwise direction are defined as A1 to H1, respectively. Further, a point on a line connecting A1 and the center of a circle forming the outer periphery of the silicon ring material and on the inner side of the silicon ring material (for example, a portion of 60% to 90% from the outer peripheral end of the silicon ring material toward the inner peripheral end when the length from the outer peripheral end to the inner peripheral end of the silicon ring material is set to 100%) is defined as A2. Similarly, a predetermined point on a line connecting B1 and the center of a circle forming the outer periphery of the silicon ring material and on the inner side of the silicon ring material is defined as B2. This is repeated, and eight points on the inner side of the silicon ring material at A1 to H1 are defined as A2 to H2. The above-described 16 points of A1 to H1 and A2 to H2 are the points at which the thickness is measured.

[0037]

[Table 1]

Thickness (mm)	A1	A2	B1	B2	C1	C2	D1	D2
	7.052	7.051	7.052	7.050	7.051	7.050	7.054	7.048
	E1	E2	F1	F2	G1	G2	H1	H2
	7.052	7.049	7.056	7.051	7.055	7.050	7.056	7.051
Flatness (mm)	0.008							

[0038]

(Cleaning Step S06)

Next, at least the polishing surface 12 of the silicon ring material is cleaned. The cleaning is preferably performed using ultrapure water at a temperature of 20°C or higher and 80°C or lower.

[0039]

(Hydrophilization Treatment Step S07)

Next, a hydrophilization treatment is performed in order to impart hydrophilicity to the polishing surface 12 of the silicon ring material.

In a case where the hydrophilicity is imparted by forming an oxide film on the polishing surface 12, it is preferable to perform an oxidation heat treatment under conditions of an atmosphere: air, oxygen, or water vapor, a heat treatment temperature: 40°C or higher and 800°C or lower, and a holding time at the heat treatment temperature: 5 minutes or longer and 60 minutes or shorter.

In a case where the hydrophilicity is imparted by imparting a hydrophilic functional group to the polishing surface 12, it is preferable to activate the polishing surface 12 (for example, by a surfactant or plasma surface activation) and then bring a functionalization agent (for example, a silane coupling agent or an amino coupling agent) into contact with the polishing surface 12 (for example, by spraying or immersion).

[0040]

Here, the wettability of water with respect to the hydrophilization treatment step S07 was evaluated. The contact angle before and after the hydrophilization treatment was measured using pure water. Table 2 shows measurement results.

As shown in Table 2, in a case where the oxide film was formed on the polishing surface 12, the contact angle of water was 6°, and in a case where the hydrophilic functional group was imparted to the polishing surface 12, the contact angle of water was 9°. It was confirmed that the contact angle of water was sufficiently low by performing the hydrophilization treatment.

[0041]

[Table 2]

Contact Angle of Pure Water

	Oxide Film	Hydrophilic Functional Group
Before Hydrophilization Treatment	60°	62°
After Hydrophilization Treatment	6°	9°

[0042]

The wafer-holding ring member 10 according to the present embodiment is manufactured by the above-described steps.

[0043]

According to the wafer-holding ring member 10 according to the present embodiment having the above-described configuration, since the wafer-holding ring member 10 is made of a silicon material, the wafer-holding ring member 10 is sufficiently hard and has excellent wear resistance as compared with a resin material.

In addition, since the wafer-holding ring member 10 also has excellent thermal conductivity, heat generated during polishing can be uniformly dispersed, and thus a

temperature distribution is unlikely to occur, and the occurrence of cracking of a substrate during polishing can be suppressed.

Furthermore, the wafer-holding ring member 10 according to the present embodiment also has excellent acid resistance, and there is no risk of particles or metal contamination, and thus the wafer-holding ring member 10 has high cleanliness.

Therefore, the wafer can be stably subjected to surface polishing by a CMP apparatus.

[0044]

In the wafer-holding ring member 10 according to the present embodiment, in a case where the wafer-holding ring member 10 is made of a silicon material having a purity of 99.9999 mass% or more (6N or more), the number of impurities is small and the characteristics are stable, and thus the wafer can be more stably subjected to surface polishing. In particular, as in the present embodiment, in a case where the wafer-holding ring member 10 is made of a silicon material having a purity of 99.999999999 mass% or more (11N or more), the number of impurities is small and the characteristics are more stable, and thus the wafer can be more stably subjected to surface polishing.

[0045]

In the wafer-holding ring member 10 according to the present embodiment, in a case where the contact angle of water on the polishing surface 12 to be polished together with the wafer is 30° or less, the wafer-holding ring member 10 has sufficient hydrophilicity, the polishing slurry easily wets the surface, and the polishing can be stably performed.

[0046]

In the wafer-holding ring member 10 according to the present embodiment, in a case where the oxide film is formed on the polishing surface 12 to be polished together

with the wafer, sufficient hydrophilicity can be imparted to the polishing surface 12, the polishing slurry easily wets the surface, and the polishing can be stably performed.

[0047]

In the wafer-holding ring member 10 according to the present embodiment, in a case where the hydrophilic functional group is imparted to the polishing surface to be polished together with the wafer, sufficient hydrophilicity can be imparted to the polishing surface 12, the polishing slurry easily wets the surface, and the polishing can be stably performed.

[0048]

In the wafer-holding ring member 10 according to the present embodiment, in a case where the flatness of the polishing surface 12 to be polished together with the wafer is 0.05 mm or less, the flatness of the outer peripheral portion of the wafer can be sufficiently ensured by the surface polishing with the CMP apparatus.

[0049]

In the wafer-holding ring member 10 according to the present embodiment, in a case where the wafer-holding ring member is made of columnar crystal silicon, the wafer-holding ring member is very hard and has excellent wear resistance.

[0050]

In the wafer-holding ring member 10 according to the present embodiment, in a case where the screw insertion hole into which the fixing screw is inserted is formed, the wafer-holding ring member 10 can be fixed to the fixing member by the screw without using an adhesive or the like, and even in a case where heat is generated during polishing, the fixing member and the wafer-holding ring member can be prevented from being peeled off, and the polishing can be stably performed.

[0051]

Although the embodiment of the present invention has been described above, the present invention is not limited to the above description, and can be appropriately changed without departing from the technical idea of the invention.

Examples

[0052]

A description will be given below of the results of confirmation experiments conducted to confirm the effectiveness of the present invention.

First, as shown in Table 3, three types of polishing slurries, that is, an alkaline slurry containing sodium hydroxide, an acidic slurry containing oxalic acid, and an oxidizing agent slurry containing potassium permanganate were prepared. Table 3 shows the solvent, pH, abrasive grain, and concentration of the abrasive grain in the solution of each polishing slurry. The concentration of sodium hydroxide, the concentration of oxalic acid, and the concentration of potassium permanganate in each of the prepared slurries were adjusted to have the corresponding pH as shown in Table 3.

In addition, ring members (ring members having the shapes shown in FIGS. 1A and 1B) made of silicon, a polyether ether ketone (PEEK) resin, a polytetrafluoroethylene (PTFE) resin, and a polyphenylene sulfide (PPS) resin were prepared. The contact angle of water on the surface of each of the ring members was adjusted to 60° or more, 29°, and 9° by appropriately performing a hydrophilic treatment on the ring members.

[0053]

A polishing experiment was performed using AR681MSII manufactured by Machine Application Tools. Chemical mechanical polishing was performed using various slurries shown in Table 3 under conditions of a ring load pressure of 80 kPa, a ring rotation speed of 72 rpm, a polishing platen rotation speed of 80 pm, and a polishing

time of 300 minutes, and the thickness reduction amount of each of the various ring members was examined. Tables 4 to 6 show the evaluation results in which the thickness reduction amount (μm) is described.

[0054]

[Table 3]

	Alkaline Slurry	Acidic Slurry	Oxidizing Agent Slurry
Solvent	Sodium Hydroxide Aqueous Solution	Oxalic Acid Aqueous Solution	Potassium Permanganate Aqueous Solution
pH	10	4	7
Abrasive Grain	Colloidal silica	Colloidal silica	Ceria
Abrasive Grain Concentration	22mass%	18mass%	5mass%

[0055]

[Table 4]

Thickness Reduction Amount (μm)
Contact Angle on Surface of Ring Member is 60° or more

Ring Member	Polishing Slurry		
Material	Alkaline Slurry	Acidic Slurry	Oxidizing Agent Slurry
Silicon	354	395	88
PEEK	896	741	1817
PTFE	360	409	737
PPS	859	446	604

[0056]

[Table 5]

Thickness Reduction Amount (μm)
Contact Angle on Surface of Ring Member is 29°

Ring Member	Polishing Slurry		
Material	Alkaline Slurry	Acidic Slurry	Oxidizing Agent Slurry
Silicon	360	435	97
PEEK	1346	1264	2729
PTFE	613	493	1033
PPS	1462	805	970

[0057]

[Table 6]

Thickness Reduction Amount (μm)
Contact Angle on Surface of Ring Member is 9°

Ring Member	Polishing Slurry		
Material	Alkaline Slurry	Acidic Slurry	Oxidizing Agent Slurry
Silicon	425	513	105
PEEK	2062	1705	3816
PTFE	792	819	1696
PPS	1804	1115	1330

[0058]

As shown in Tables 4 to 6, it was confirmed that, in all of the alkaline slurry, the acidic slurry, and the oxidizing agent slurry, the thickness reduction amount was small and the deterioration due to the slurry was suppressed in the ring member made of the silicon material as compared with various resin materials. In any case where the contact angle of water on the surface of the ring member was 60° or more, 29°, or 9°, the ring member made of the silicon material had a small thickness reduction amount.

[0059]

In particular, in the oxidizing agent slurry containing potassium permanganate, the thickness reduction amount of various resin materials was very large, but the

thickness reduction amount was sufficiently suppressed in the ring member made of the silicon material.

In addition, when Table 4 and Tables 5 and 6 are compared, in a case where the contact angle of water on the surface of the ring member is small and the hydrophilicity is excellent, the thickness reduction amount is further reduced and the deterioration due to the slurry is suppressed.

[0060]

As a result of the above confirmation experiment, it was confirmed that, according to the present invention example, it is possible to provide a wafer-holding ring member that has excellent wear resistance, thermal conductivity, acid resistance, and cleanliness, and can stably perform surface polishing of various wafers by CMP.

INDUSTRIAL APPLICABILITY

[0061]

According to the present invention, it is possible to provide a wafer-holding ring member that has excellent wear resistance, thermal conductivity, acid resistance, and cleanliness, and can stably perform surface polishing of various wafers by CMP.

REFERENCE SIGNS LIST

[0062]

10 Wafer-holding ring member

12 Polishing surface

15 Screw insertion hole

CLAIMS

[Claim 1] A wafer-holding ring member used for a polishing apparatus, the wafer-holding ring member comprising:

a polishing surface,

wherein the wafer-holding ring member is made of a silicon material.

[Claim 2] The wafer-holding ring member according to Claim 1, wherein the wafer-holding ring member is made of the silicon material having a purity of 99.9999 mass% or more.

[Claim 3] The wafer-holding ring member according to Claim 1, wherein a contact angle of water on the polishing surface is 30° or less.

[Claim 4] The wafer-holding ring member according to Claim 1, wherein an oxide film is formed on the polishing surface.

[Claim 5] The wafer-holding ring member according to Claim 1, wherein a hydrophilic functional group is imparted to the polishing surface.

[Claim 6] The wafer-holding ring member according to Claim 1, wherein a flatness of the polishing surface is 0.05 mm or less.

[Claim 7] The wafer-holding ring member according to Claim 1, wherein the wafer-holding ring member is made of columnar crystal silicon.

[Claim 8] The wafer-holding ring member according to Claim 1, wherein a screw insertion hole into which a screw is inserted is formed.