

DESCRIPTION

DETERGENT COMPOSITION FOR HARD DISK SUBSTRATES

5 Technical Field

[0001] The present disclosure relates to a cleaning composition for a hard disk substrate, a method for cleaning a substrate, and a method for producing a hard disk substrate.

10 Background Art

[0002] In recent years, personal computers and various electronic devices have been able to handle a large volume of data such as moving images and sound, and therefore mass information recording devices have been needed. Accordingly, the demand for an information recording medium with a high recording density is increasing year by year. To meet the demand, a hard disk employing a perpendicular magnetic recording system has been put into mass production. In the perpendicular magnetic recording system, a substrate for an information recording medium (hereinafter, also referred to as a "hard disk substrate") is required to have high levels of heat resistance and surface smoothness, as compared to the existing substrate. Moreover, the surface of the hard disk substrate is required to have a high degree of cleanliness.

[0003] The materials for the hard disk substrate are, e.g., aluminum with a nickel-phosphorus plated surface and glass. Although different materials are used, recently a high degree of surface cleanliness is required also in the semiconductor substrate field, and various cleaning agents have been developed.

[0004] Patent Document 1 discloses a cleaning composition that contains an anionic surfactant having at least one group selected from $-\text{COOR}$ and $-\text{SO}_3\text{R}$ (R represents a hydrogen atom, an inorganic base, or an organic base) in its molecule, as a cleaning composition effective in cleaning pads such as a polishing pad that are contaminated by solid wastes including polishing particles in a polishing liquid, aggregates of the polishing particles, and polishing debris of an object to be polished.

[0005] Patent Document 2 discloses a cleaning composition for a semiconductor substrate or semiconductor element that contains a polycarboxylic acid compound

having a weight average molecular weight of 500 to 150000 and obtained by using at least one monomer component selected from acrylic acid, methacrylic acid, and maleic acid in an amount of 20 mol% or more with respect to the use amount of the whole monomer components, as a cleaning composition with low foaming properties effective in removing organic or inorganic fine foreign substances and oils and used in the formation of a semiconductor element on a semiconductor substrate such as a silicon wafer.

[0006] Patent Document 3 discloses a cleaning agent for semiconductor parts that contains, as a main component, a (co)polymer that is obtained by (co)polymerizing a monomer component containing at least itaconic acid (salt), as an environmentally friendly cleaning agent highly effective in cleaning chemical mechanical polishing (CMP) abrasive grains such as silica and alumina, metal impurities in CMP, and impurities such as Fe, Mn, Al, Ce, Cu, W, and Ti derived from metal wires or the like, which remain on semiconductor parts of a semiconductor substrate or the like before and after CMP.

Prior Art Documents

Patent Documents

[0007] Patent Document 1: JP 2000-309796 A

Patent Document 2: JP H11(1999)-181494 A

Patent Document 3: JP 2001-64680 A

Disclosure of Invention

Problem to be Solved by the Invention

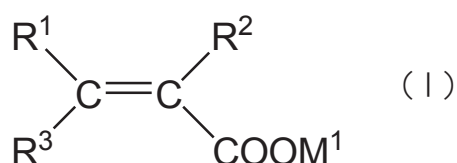
[0008] Generally, the production process of the hard disk substrate includes a polishing process using a polishing composition. If particles such as polishing debris and abrasive grains remain on the substrate surface after the polishing process, this adversely affects the performance and yield of a magnetic disk. Particularly, fine particles easily adhere to the substrate surface again even after they are once removed from the substrate. Hence, a cleaning composition is required to have high particle dispersibility.

[0009] The present disclosure provides a cleaning composition that has excellent

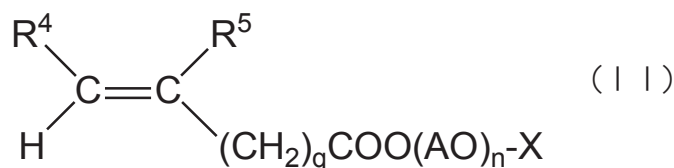
cleanability for particles remaining on a substrate surface, a method for cleaning a substrate and a method for producing a hard disk substrate using the cleaning composition.

5 Means for Solving Problem

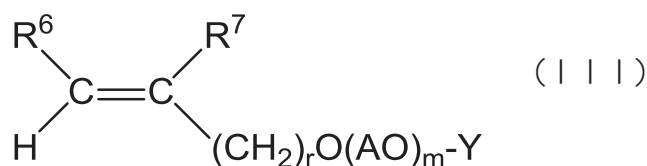
[0010] In an aspect, the present disclosure relates to a cleaning composition for a hard disk substrate that includes a polymer (component A). The polymer (component A) contains: a constituent unit (a1) derived from a monomer a1 expressed by General Formula (I) below or an anhydride thereof; and a constituent unit (a2) derived from at least one monomer a2 selected from a monomer expressed by General Formula (II) below and a monomer expressed by General Formula (III) below. The component A has a weight average molecular weight of 15000 or more and 200000 or less and a pH of 8 or higher.



15 In General Formula (I), R¹, R² and R³ independently represent a hydrogen atom, a methyl group, or -(CH₂)_pCOOM²; M¹ and M² independently represent a hydrogen atom, an alkali metal, an alkaline-earth metal (1/2 atom), an organic ammonium group, or an ammonium group; and p represents an integer of 0 to 2.



20 In General Formula (II), R⁴ and R⁵ independently represent a hydrogen atom or a methyl group; q represents an integer of 0 to 2; AO represents an alkyleneoxy group with 2 or 3 carbon atoms; n is an average number of added moles of AO and represents a number of 4 to 300; and X represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms.



In General Formula (III), R⁶ and R⁷ independently represent a hydrogen atom or a methyl group; r represents an integer of 0 to 2; AO represents an alkyleneoxy group with 2 or 3 carbon atoms; m is an average number of added moles of AO and represents a number of 4 to 300; and Y represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms.

[0011] In another aspect, the present disclosure relates to a method for cleaning a substrate. The method includes a cleaning process of cleaning a substrate to be cleaned with the cleaning composition of the present disclosure. The substrate to be cleaned is a substrate that has been polished with a polishing composition.

[0012] In another aspect, the present disclosure relates to a method for producing a hard disk substrate. The method includes a cleaning process of cleaning a substrate to be cleaned with the cleaning composition of the present disclosure. The substrate to be cleaned is a substrate that has been polished with a polishing composition.

Effects of the Invention

[0013] A cleaning composition of the present disclosure has excellent cleanability for particles remaining on a substrate surface. A cleaning method and a production method that use the cleaning composition of the present disclosure can provide a hard disk substrate with excellent surface cleanliness after cleaning. Moreover, the cleaning method and the production method that use the cleaning composition of the present disclosure can provide a hard disk recording device with a high recording density.

Description of the Invention

[0014] The present disclosure is based on the findings that when a substrate that has been polished with a polishing composition is cleaned with a cleaning composition containing a specific polymer (component A) and at a pH of 8 or higher, the removability of particles remaining on the substrate surface improves.

[0015] In other words, in an aspect, the present disclosure relates to a cleaning

composition for a hard disk substrate (hereinafter, also referred to as a "cleaning composition of the present disclosure") that includes a polymer (component A). The polymer (component A) contains: a constituent unit (a1) derived from a monomer a1 expressed by General Formula (I) above or an anhydride thereof; and a constituent
5 unit (a2) derived from at least one monomer a2 selected from a monomer expressed by General Formula (II) above and a monomer expressed by General Formula (III) above. The component A has a weight average molecular weight of 15000 or more and 200000 or less and a pH of 8 or higher.

[0016] Details of the mechanism for expressing the effects of the present disclosure
10 have not been clarified, but the following is presumed.

Since the carboxyl group of the polymer (component A) in the cleaning composition adsorbs on the substrate surface and particle surfaces, a steric barrier caused by the polyalkyleneoxy group is formed on the substrate surface and particle surfaces, and steric repulsion occurs between the substrate surface and particles, and
15 between particles. This promotes removal of particles from the substrate surface and reduces readhesion of particles to the substrate surface and aggregations of particles. Thereby, particles are efficiently removed from the substrate surface, and cleanability improves.

Moreover, since the polymer (component A) has a specific weight average
20 molecular weight, the above steric repulsion effects are produced more effectively. This reduces readhesion of particles to the substrate surface and aggregations of particles more effectively. Generally, particles derived from polishing debris have a smaller particle diameter than particles derived from abrasive grains and are difficult to be removed. By including the specific polymer (component A), the cleaning
25 composition of the present disclosure can remove such hard-to-remove particles derived from polishing debris efficiently.

The present disclosure should not be interpreted solely based on the above mechanism.

[0017] Therefore, in one or more embodiments, the cleaning composition of the
30 present disclosure is excellent in dispersibility of particles in the cleaning composition, so that particles remaining on a substrate surface are removed effectively. Moreover, in one or more embodiments, the cleaning method and the production method that use

the cleaning composition of the present disclosure can provide a hard disk substrate with excellent cleanliness. Moreover, the use of the hard disk substrate that has been cleaned with the cleaning composition of the present disclosure can provide a hard disk recording device with a high recording density.

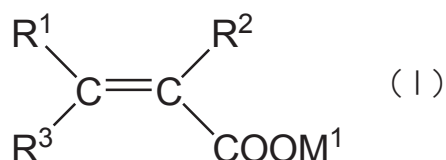
5 [0018] The term "particles" in the present disclosure refer to foreign substances remaining on or adhering to a substrate surface. Examples of the "particles" in the present disclosure include: foreign substances derived from polishing debris such as nickel oxide and silicon oxide; and foreign substances derived from polishing abrasive grains such as silicon oxide (silica), aluminium oxide (alumina), and ceric oxide (ceria).

10 [0019] Hereinafter, each component contained in the cleaning composition of the present disclosure will be described.

[0020] [Component A: polymer]

The component A contained in the cleaning composition of the present disclosure is a polymer that contains: a constituent unit (a1) derived from a monomer
15 a1 expressed by General Formula (I) below or an anhydride thereof; and a constituent unit (a2) derived from at least one monomer a2 selected from a monomer expressed by General Formula (II) below and a monomer expressed by General Formula (III) below.

[0021] (Monomer a1)



20 [0022] In General Formula (I), R¹, R² and R³ independently represent a hydrogen atom, a methyl group, or -(CH₂)_pCOOM²; M¹ and M² independently represent a hydrogen atom, an alkali metal, an alkaline-earth metal (1/2 atom), an organic ammonium group, or an ammonium group; and p represents an integer of 0 to 2.

[0023] In General Formula (I), R¹, R² and R³ are at least one selected from a
25 hydrogen atom, a methyl group, and -(CH₂)_pCOOM². It is preferred that R¹ and R³ are a hydrogen atom and R² is a hydrogen atom or a methyl group, and it is more preferred that R¹ and R³ are a hydrogen atom and R² is a methyl group, from the viewpoint of improving the cleanability.

[0024] In General Formula (I), M¹ and M² are at least one selected from a hydrogen
30 atom, an alkali metal, an alkaline-earth metal (1/2 atom), an organic ammonium

group and an ammonium group, and from the viewpoint of improving the cleanability, M¹ and M² are preferably an alkali metal, and more preferably sodium and potassium.

[0025] In General Formula (I), p is an integer of 0 to 2, and from the viewpoint of improving the cleanability, p is preferably 0 or 1, and more preferably 0.

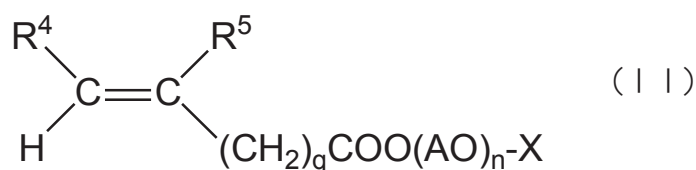
5 [0026] The monomer a1 expressed by General Formula (I) may be an anhydride.

[0027] Examples of the monomer a1 include acrylic acid, methacrylic acid, maleic acid, fumaric acid, itaconic acid, and anhydrides thereof and salts thereof. The monomer a1 is preferably at least one selected from acrylic acid, methacrylic acid, maleic acid, and maleic anhydride, more preferably at least one of acrylic acid and methacrylic acid, and further preferably methacrylic acid, from the viewpoint of improving the cleanability. Examples of the salts include alkali metal salts, alkaline-earth metal salts, ammonium salts, and organic ammonium salts. Among these, alkali metal salts are preferred, and sodium salts and potassium salts are more preferred, from the viewpoint of improving the cleanability.

15 [0028] (Monomer a2)

The monomer a2 is at least one monomer selected from a monomer expressed by General Formula (II) below (hereinafter, also referred to as a "monomer a21") and a monomer expressed by General Formula (III) below (hereinafter, also referred to as a "monomer a22").

20 [0029] <Monomer a21>



[0030] In General Formula (II), R⁴ and R⁵ independently represent a hydrogen atom or a methyl group; q represents an integer of 0 to 2; AO represents an alkyleneoxy group with 2 or 3 carbon atoms; n is an average number of added moles of AO and represents a number of 4 to 300; and X represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms.

[0031] In General Formula (II), AO represents an alkyleneoxy group with 2 or 3 carbon atoms, and the alkyleneoxy group may be either in a linear or branched form. AO may be one kind or two or more kinds. When AO is two or more kinds, the addition form of AO may be a random or block addition. Examples of AO include an

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oxyethylene (EO) group and an oxypropylene (PO) group, and from the viewpoint of improving the cleanability, an oxyethylene (EO) group is preferred.

[0032] In General Formula (II), n is a number of 4 to 300, and from the viewpoint of improving the cleanability, n is preferably 6 or more, more preferably 9 or more,
 5 further preferably 20 or more, still further preferably 40 or more, and yet further preferably 80 or more, while n is a number of preferably 200 or less, more preferably 150 or less, and further preferably 130 or less from the same viewpoint.

[0033] In General Formula (II), X represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms, and from the viewpoint of improving the cleanability, X is
 10 preferably an alkyl group with 1 to 3 carbon atoms. The alkyl group may be either in a linear or branched form. Examples of the alkyl group with 1 to 3 carbon atoms include a methyl group, an ethyl group, a n-propyl group, and an isopropyl group.

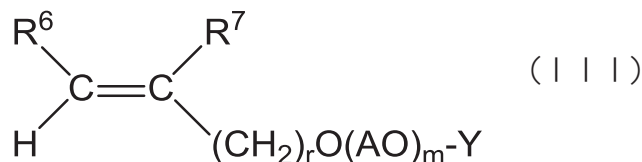
[0034] Examples of the monomer a21, when q is 0 in General Formula (II), include methoxypolyethylene glycol (meth)acrylic acid ester, ethoxypolyethylene glycol
 15 (meth)acrylic acid ester, propoxypolyethylene glycol (meta)acrylic acid ester, methoxypolypropylene glycol (meth)acrylic acid ester, ethoxypolypropylene glycol (meth)acrylic acid ester, and propoxypolypropylene glycol (meta)acrylic acid ester. Among these, the monomer a21 is preferably at least one selected from methoxypolyethylene glycol (meth)acrylic acid ester, ethoxypolyethylene glycol
 20 (meth)acrylic acid ester, and propoxypolyethylene glycol (meta)acrylic acid ester, more preferably methoxypolyethylene glycol (meth)acrylic acid ester, and further preferably methoxypolyethylene glycol methacrylic acid ester, from the viewpoint of improving the cleanability. Note here that "(meth)acrylic acid ester" means at least one kind of acrylic acid ester and methacrylic acid ester.

25 [0035] Examples of the monomer a21, when q is 1 in General Formula (II), include methoxypolyethylene glycol-3-butene acid ester, ethoxypolyethylene glycol-3-butene acid ester, propoxypolyethylene glycol-3-butene acid ester, methoxypolypropylene glycol-3-butene acid ester, ethoxypolypropylene glycol-3-butene acid ester, and propoxypolypropylene glycol-3-butene acid ester.

30 [0036] Examples of the monomer a21, when q is 2 in General Formula (II), include methoxypolyethylene glycol-4-pentenoic acid ester, ethoxypolyethylene glycol-4-pentenoic acid ester, propoxypolyethylene glycol-4-pentenoic acid ester,

methoxypolypropylene glycol-4-pentenoic acid ester, and ethoxypolypropylene glycol-4-pentenoic acid ester, and propoxypolypropylene glycol-4-pentenoic acid ester.

[0037] <Monomer a22>



- 5 [0038] In General Formula (III), R⁶ and R⁷ independently represent a hydrogen atom or a methyl group; r represents an integer of 0 to 2; AO represents an alkyleneoxy group with 2 or 3 carbon atoms; m is an average number of added moles of AO and represents a number of 4 to 300; and Y represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms.
- 10 [0039] In General Formula (III), AO represents an alkyleneoxy group with 2 or 3 carbon atoms, and the alkyleneoxy group may be either in a linear or branched form. AO may be one kind or two or more kinds. When AO is two or more kinds, the addition form of AO may be a random or block addition. Examples of AO include an oxyethylene (EO) group and an oxypropylene (PO) group, and from the viewpoint of
- 15 improving the cleanability, an oxyethylene (EO) group is preferred.
- [0040] In General Formula (III), m is a number of 4 to 300, and from the viewpoint of improving the cleanability, m is preferably 6 or more, more preferably 9 or more, further preferably 20 or more, still further preferably 40 or more, and yet further preferably 80 or more, while m is a number of preferably 200 or less, more preferably
- 20 150 or less, and further preferably 130 or less from the same viewpoint.
- [0041] In General Formula (III), Y represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms, and from the viewpoint of improving the cleanability, Y is preferably an alkyl group with 1 to 3 carbon atoms. The alkyl group may be either in a linear or branched form. Examples of the alkyl group with 1 to 3 carbon atoms
- 25 include a methyl group, an ethyl group, a n-propyl group, and an isopropyl group.
- [0042] Examples of the monomer a22, when r is 0 in General Formula (III), include polyethylene glycol vinyl ether, methoxypolyethylene glycol vinyl ether, ethoxypolyethylene glycol vinyl ether, propoxypolyethylene glycol vinyl ether, polypropylene glycol vinyl ether, methoxypolypropylene glycol vinyl ether,
- 30 ethoxypolypropylene glycol vinyl ether, propoxypolypropylene glycol vinyl ether,

polyethylene glycol isopropenyl ether, and polypropylene glycol isopropenyl ether.

[0043] Examples of the monomer a22, when r is 1 in General Formula (III), include polyethylene glycol allyl ether, methoxypolyethylene glycol allyl ether, ethoxypolyethylene glycol allyl ether, propoxypolyethylene glycol allyl ether, polypropylene glycol allyl ether, methoxypolypropylene glycol allyl ether, ethoxypolypropylene glycol allyl ether, propoxypolypropylene glycol allyl ether, polyethylene glycol-2-methylallyl ether, polypropylene glycol-2-methylallyl ether, polyethylene glycol-2-butenyl ether, and polypropylene glycol-2-butenyl ether.

[0044] Examples of the monomer a22, when r is 2 in General Formula (III), include

polyethylene glycol-3-butenyl ether, methoxypolyethylene glycol-3-butenyl ether, ethoxypolyethylene glycol-3-butenyl ether, propoxypolyethylene glycol-3-butenyl ether, polypropylene glycol-3-butenyl ether, methoxypolypropylene glycol-3-butenyl ether, ethoxypolypropylene glycol-3-butenyl ether, propoxypolypropylene glycol-3-butenyl ether, polyethylene glycol-3-methyl-3-butenyl ether, methoxypolyethylene glycol-3-methyl-3-butenyl ether, ethoxypolyethylene glycol-3-methyl-3-butenyl ether, propoxypolyethylene glycol-3-methyl-3-butenyl ether, polypropylene glycol-3-methyl-3-butenyl ether, methoxypolypropylene glycol-3-methyl-3-butenyl ether, ethoxypolypropylene glycol-3-methyl-3-butenyl ether, and propoxypolypropylene glycol-3-methyl-3-butenyl ether.

[0045] The molar ratio $a1/a2$ of the constituent unit (a1) to the constituent unit (a2) in the whole constituent units of the component A of the present disclosure is preferably 0.1 or more, more preferably 0.5 or more, further preferably 1 or more, and still further preferably 2 or more from the viewpoint of improving the cleanability, while the molar ratio $a1/a2$ is preferably 100 or less, more preferably 50 or less, further preferably 30 or less, and still further preferably 20 or less from the same viewpoint. The molar ratio $a1/a2$ in the whole constituent units of the component A is preferably 0.1 or more and 100 or less, more preferably 0.5 or more and 50 or less, further preferably 1 or more and 30 or less, and still further preferably 2 or more and 20 or less from the viewpoint of improving the cleanability.

[0046] The component A of the present disclosure may contain other constituent units in addition to the constituent unit (a1) and the constituent unit (a2). Examples of the other constituent units include constituent units derived from at least one

compound selected from (meth)acrylic acid alkyl ester, hydroxyethyl (meth)acrylate, acrylamides, vinyl acetate, styrene, olefin, vinyl alcohol, allyl alcohol, a polyalkylene oxide adduct of allyl alcohol. The content of the other constituent units in the whole constituent units of the component A of the present disclosure is preferably 10% by mass or less, more preferably 3% by mass or less, and further preferably 1% by mass or less from the viewpoint of expressing the effects of the present disclosure.

[0047] The component A of the present disclosure can be produced by a known method of, for example, polymerizing a monomer mixture containing the monomer a1 and the monomer a2 by the solution polymerization method. Examples of the solvent for use in the solution polymerization include: water; aromatic hydrocarbons such as toluene and xylene; alcohols such as ethanol and 2-propanol; ketones such as acetone and methyl ethyl ketone; and ethers such as tetrahydrofuran and diethylene glycol dimethyl ether. A polymerization initiator for use in the polymerization may be a known radical initiator, examples of which include ammonium peroxodisulfate (ammonium persulfate), hydrogen peroxide solution, and sodium peroxodisulfate. In the polymerization, a chain transfer agent can be further used, examples of which include: thiol-based chain transfer agents such as 2-mercaptoethanol and β -mercaptopropionic acid; chain transfer agents also serving as a solvent such as 1,2-propanediol. In the present disclosure, the content of each constituent unit in the whole constituent units of the component A can be regarded as a ratio of the used amount of each monomer with respect to the total amount of monomers used in the polymerization.

[0048] The array of each constituent unit constituting the component A may be a random, block, or graft array.

[0049] When the component A has a salt-forming group ($-\text{COOH}$, $-(\text{CH}_2)_p\text{COOH}$) derived from the monomer a1, the component A can be neutralized by a neutralizer. Examples of the neutralizer include sodium hydroxide, potassium hydroxide, and ammonia.

[0050] The weight average molecular weight of the component A is 15000 or more, preferably 20000 or more, more preferably 25000 or more, further preferably 30000 or more, and still further preferably 50000 or more from the viewpoint of improving the cleanability, while the weight average molecular weight of the component A is 200000

or less, preferably 150000 or less, more preferably 100000 or less, and further preferably 80000 or less from the same viewpoint. The weight average molecular weight of the component A is 15000 or more and 200000 or less, preferably 20000 or more and 150000 or less, more preferably 20000 or more and 100000 or less, further preferably 20000 or more and 80000 or less, and still further preferably 25000 or more and 80000 or less from the viewpoint of improving the cleanability. The weight average molecular weight in the present disclosure is determined by gel permeation chromatography (polyethylene glycol conversion). Specifically, the weight average molecular weight can be measured by a method described in Example.

10 [0051] The content of the component A with respect to the total mass of the components other than water in the cleaning composition of the present disclosure is preferably 1% by mass or more, more preferably 10% by mass or more, further preferably 15% by mass or more, and still further preferably 20% by mass or more from the viewpoint of improving the cleanability, while the content of the component A
15 is preferably 99.9% by mass or less, more preferably 99% by mass or less, and further preferably 98% by mass or less from the same viewpoint. Moreover, the content of the component A with respect to the total mass of the components other than water in the cleaning composition is preferably 1% by mass or more and 99.9% by mass or less, more preferably 10% by mass or more and 99.9% by mass or less, further preferably
20 15% by mass or more and 99% by mass or less, and still further preferably 20% by mass or more and 98% by mass or less from the viewpoint of improving the cleanability.

[0052] The content of the component A in the cleaning composition of the present disclosure for use in cleaning is preferably 0.001% by mass or more, more preferably
25 0.005% by mass or more, and further preferably 0.01% by mass or more from the viewpoint of improving the cleanability, while the content of the component A in the cleaning composition for use in cleaning is preferably 10% by mass or less, more preferably 5% by mass or less, further preferably 2% by mass or less, still further preferably 1% by mass or less, yet further preferably 0.5% by mass or less, and even
30 further preferably 0.2% by mass or less from the same viewpoint. Moreover, the content of the component A in the cleaning composition for use in cleaning is preferably 0.001% by mass or more and 10% by mass or less, more preferably 0.005% by mass or

more and 5% by mass or less, further preferably 0.01% by mass or more and 2% by mass or less, still further preferably 0.01% by mass or more and 1% by mass or less, yet further preferably 0.01% by mass or more and 0.5% by mass or less, and even further preferably 0.01% by mass or more and 0.2% by mass or less from the same viewpoint.

[0053] The cleaning composition of the present disclosure may be produced as a concentrate, and the concentrate may be diluted when used for cleaning, as will be described later. In one or more embodiments, the "content of each component in the cleaning composition for use in cleaning" of the present disclosure means the content of each component in the cleaning composition that is to be used in the cleaning process. Thus, in one or more embodiments, the cleaning composition for use in cleaning, i.e., the cleaning composition to be used in the cleaning process of the present disclosure, means a diluted cleaning composition.

[0054] [Component B: alkali agent]

The cleaning composition of the present disclosure may further contain an alkali agent (component B). The alkali agent may be a compound that can impart alkaline properties to the cleaning composition, a compound that can adjust the pH of the cleaning composition within a range described below, or the like. The alkali agent may be an inorganic alkali agent or an organic alkali agent. Examples of the inorganic alkali agent include ammonia, and alkali metal hydroxides such as potassium hydroxide and sodium hydroxide. Examples of the organic alkali agent include hydroxyalkylamines, and quaternary ammonium salts. Examples of the hydroxyalkylamines include monoethanolamine, diethanolamine, triethanolamine, methylethanolamine, and methyldiethanolamine, monopropanolamine, dipropanolamine, tripropanolamine, methylpropanolamine, methyldipropanolamine, and aminoethylethanolamine. Examples of the quaternary ammonium salts include tetramethylammonium hydroxide and choline. These alkali agents may be used individually or in combination of two or more.

[0055] The component B is preferably at least one selected from alkali metal hydroxides, hydroxyalkylamines, and quaternary ammonium salts from the viewpoint of improving the cleanability, more preferably alkali metal hydroxides from the viewpoint of reducing wastewater treatment load, and further preferably at least one

of potassium hydroxide and sodium hydroxide.

[0056] The content of the component B with respect to the total mass of the components other than water in the cleaning composition of the present disclosure is preferably 0.1% by mass or more, more preferably 0.3% by mass or more, and further
5 preferably 0.5% by mass or more from the viewpoint of improving the cleanability, while the content of the component B is preferably 99% by mass or less, more preferably 90% by mass or less, further preferably 80% by mass or less, and still further preferably 75% by mass or less from the same viewpoint. Moreover, the content of the component B with respect to the total mass of the components other
10 than water in the cleaning composition of the present disclosure is preferably 0.1% by mass or more and 99% by mass or less, more preferably 0.1% by mass or more and 90% by mass or less, further preferably 0.3% by mass or more and 80% by mass or less, and still further preferably 0.5% by mass or more and 75% by mass or less from the viewpoint of improving the cleanability.

15 [0057] The content of the component B in the cleaning composition of the present disclosure for use in cleaning is preferably 0.00005% by mass or more, more preferably 0.0001% by mass or more, and further preferably 0.001% by mass or more from the viewpoint of improving the cleanability, while the content of the component B in the cleaning composition for use in cleaning is preferably 2.0% by mass or less, more
20 preferably 0.3% by mass or less, further preferably 0.1% by mass or less, still further preferably 0.07% by mass or less, and yet further preferably 0.05% by mass or less from the same viewpoint. Moreover, the content of the component B in the cleaning composition for use in cleaning is preferably 0.00005% by mass or more and 2.0% by mass or less, more preferably 0.00005% by mass or more and 0.3% by mass or less,
25 further preferably 0.00005% by mass or more and 0.1% by mass or less, still further preferably 0.0001% by mass or more and 0.07% by mass or less, and yet further preferably 0.001% by mass or more and 0.05% by mass or less from the same viewpoint.

[0058] The content ratio A/B of the component A to the component B in the cleaning
30 composition of the present disclosure is preferably 0.01 or more, more preferably 0.1 or more, and further preferably 0.3 or more from the viewpoint of improving the cleanability, while the content ratio A/B is preferably 20000 or less, more preferably

1000 or less, and further preferably 100 or less from the same viewpoint. The content ratio A/B in the cleaning composition is preferably 0.01 or more and 20000 or less, more preferably 0.1 or more and 1000 or less, and further preferably 0.3 or more and 100 or less from the viewpoint of improving the cleanability.

5 [0059] [Component C: water]

The cleaning composition of the present disclosure may further contain water (component C). The water is not particularly limited, and may be any water that can serve as a solvent. Examples of the water include ultrapure water, pure water, ion exchanged water, and distilled water. Among them, ultrapure water, pure water, or
10 ion exchanged water is preferred, and ultrapure water is more preferred. The pure water and the ultrapure water can be obtained in the following manner. For example, tap water is subjected to an activated carbon treatment, an ion exchange treatment, and then distillation. The resulting water is irradiated with a predetermined ultraviolet germicidal lamp or passed through a filter as needed.

15 [0060] The content of the component C in the cleaning composition of the present disclosure for use in cleaning is preferably 90% by mass or more, more preferably 95% by mass or more, and further preferably 99% by mass or more from the viewpoint of improving the cleanability and stability of the cleaning composition, while the content of the component C in the cleaning composition for use in cleaning is preferably
20 99.99% by mass or less, more preferably 99.98% by mass or less, and further preferably 99.97% by mass or less from the same viewpoint.

[0061] [Optional component]

The cleaning composition of the present disclosure may contain an optional component other than the components A to C. Examples of the optional component
25 include a chelating agent, an anionic polymer, a nonionic surfactant, a solubilizer, an antioxidant, an antiseptic, an antifoaming agent, and an antimicrobial agent. It is preferred that the optional component is contained in the cleaning composition within a range that does not impair the effects of the present disclosure. The content of the optional component in the cleaning composition for use in cleaning is preferably 0% by
30 mass or more and 2.0% by mass or less, more preferably 0% by mass or more and 1.5% by mass or less, further preferably 0% by mass or more and 1.3% by mass or less, and still further preferably 0% by mass or more and 1.0% by mass or less.

[0062] (Chelating agent)

The cleaning composition of the present disclosure may contain a chelating agent from the viewpoint of improving the cleanability. The chelating agent may be at least one selected from the group consisting of aldonic acids such as gluconic acid
5 and glucoheptonic acid, aminocarboxylic acids such as ethylenediaminetetraacetic acid and diethylenetriaminepentaacetic acid, hydroxycarboxylic acids such as citric acid and malic acid, phosphonic acids such as 1-hydroxyethylidene-1,1-diphosphonic acid, and salts thereof.

[0063] (Anionic polymer)

10 The cleaning composition of the present disclosure may contain an anionic polymer such as a carboxylic acid polymer from the viewpoint of improving the cleanability. The carboxylic acid polymer may be, e.g., an anionic polymer including a methacrylic acid or an acrylic acid as a constituent unit such as an acrylic acid polymer, a methacrylic acid polymer, a maleic acid polymer, an acrylic acid/methacrylic acid
15 copolymer, an acrylic acid/maleic acid copolymer, or a methacrylic acid/acrylic acid methyl ester copolymer.

[0064] (Nonionic surfactant)

The cleaning composition of the present disclosure may contain a nonionic surfactant from the viewpoint of improving the cleanability. The nonionic surfactant
20 may be, e.g., polyalkylene glycol alkyl ether.

[0065] (Solubilizer)

The cleaning composition of the present disclosure may contain a solubilizer from the viewpoint of improving the preservation stability. The solubilizer may be at least one selected from p-toluenesulfonic acid, dimethylbenzenesulfonic acid,
25 2-ethylhexanoic acid, and salts thereof.

[0066] The cleaning composition of the present disclosure may further contain an aqueous solvent (e.g., alcohol such as ethanol) in addition to the water as a solvent. However, it is preferable that the solvent contained in the cleaning composition of the present disclosure is composed of only water.

30 [0067] [pH of cleaning composition]

The pH of the cleaning composition of the present disclosure for use in cleaning is 8 or more, and from the viewpoint of the cleanability, preferably 9 or more,

more preferably 9.5 or more, further preferably 10 or more, and still further preferably 10.5 or more, while the pH of the cleaning composition for use in cleaning is preferably 14 or less, more preferably 13 or less, further preferably 12.5 or less, still further preferably 12 or less, and yet further preferably 11.5 or less from the same viewpoint.

- 5 The pH of the cleaning composition of the present disclosure can be adjusted using, e.g., an acid or the alkali agent (component B) from the viewpoint of the cleanability. Examples of the acid include: inorganic acids such as nitric acid, sulfuric acid, and hydrochloric acid; organic acids such as oxycarbonic acid and amino acid; and the like. The "pH for use in cleaning" of the present disclosure means a pH of the cleaning
10 composition when it is used at 25°C (after dilution). The pH can be measured by a pH meter, and preferably is a value measured after a 3-minutes immersion of the electrode of the pH meter in the cleaning composition.

[0068] [Method for producing cleaning composition]

- The cleaning composition of the present disclosure can be produced by
15 blending the component A, and, as needed, the component B, the component C and the optional component by a known method. For example, the cleaning composition of the present disclosure may be a composition produced by blending at least the component A. Therefore, the present disclosure relates to a method for producing a cleaning composition, including a process of blending at least the component A. In the
20 present disclosure, "blending" includes mixing the component A, and, as needed, the component B, the component C and the optional component simultaneously, or in any order. In the method for producing the cleaning composition of the present disclosure, the blending amount of each component can be the same as the content of each component in the cleaning composition of the present disclosure described above.

- 25 [0069] The cleaning composition of the present disclosure may be produced as a concentrate, and the concentrate may be diluted at the time of use from the viewpoint of storage and transport. The concentrate of the cleaning composition is preferably a concentrate with a dilution ratio of 3 times or more from the viewpoint of storage and transport, and preferably a concentrate with a dilution ratio of 200 times or less from
30 the viewpoint of the storage stability. The concentrate of the cleaning composition can be used by diluting the concentrate with water so that the content of each component will be the above content (i.e., the content for use in cleaning) in use. Moreover, the

concentrate of the cleaning composition can be used by separately adding each component in use. The concentrate of the cleaning composition in the present disclosure "in use" or "for use in cleaning" refers to the concentrate of the cleaning composition in a diluted state.

5 [0070] The pH of the concentrate of the cleaning composition of the present disclosure is preferably 8 or more, more preferably 9.0 or more, further preferably 9.5 or more, and still further preferably 10.0 or more from the viewpoint of improving the cleanability after dilution, while the pH is preferably 14.0 or less, more preferably 13.0 or less, and further preferably 12.0 or less from the same viewpoint. The pH of the
10 concentrate of the cleaning composition of the present disclosure can be measured in the same manner as the pH of the cleaning composition of the present disclosure.

[0071] [Substrate to be cleaned]

In one or more embodiments, the cleaning composition of the present disclosure may be used in the cleaning of a substrate that has been polished with a
15 polishing composition, or a substrate on which particles remain or to which particles adhere.

[0072] Examples of the substrate to be cleaned include a Ni-P-plated aluminum alloy substrate and a glass substrate. The glass substrate may be a crystallized glass substrate or an amorphous glass substrate.

20 [0073] In one or more embodiments, the particles remaining on or adhering to the substrate to be cleaned may be: particles derived from polishing debris such as nickel oxide and silica; and particles derived from polishing abrasive grains such as silica, alumina, and ceria.

[0074] In one or more embodiments, the cleaning composition of the present
25 disclosure may be suitably used for cleaning substrates to which particles derived from polishing debris such as nickel oxide and silica adhere, and preferably substrates to which particles derived from polishing debris of nickel oxide adhere, from the viewpoint of the cleaning effects. Moreover, in one or more embodiments, the cleaning composition of the present disclosure may be suitably used for cleaning
30 Ni-P-plated aluminum alloy substrates, preferably Ni-P-plated aluminum alloy substrates that have been polished with a polishing composition, and more preferably Ni-P-plated aluminum alloy substrates that have been polished with a polishing

composition containing silica abrasive grains, from the viewpoint of the cleaning effects.

[0075] [Method for cleaning substrate]

In an aspect, the present disclosure relates to a method for cleaning a
5 substrate, which includes a cleaning process of cleaning a substrate to be cleaned with the cleaning composition of the present disclosure (hereinafter, also referred to as a "cleaning method of the present disclosure"), wherein the substrate to be cleaned is a substrate that has been polished with a polishing composition. The cleaning method of the present disclosure may further include a dilution process of diluting a
10 concentrate of the cleaning composition of the present disclosure. The substrate to be cleaned may be any of the above substrates. In one or more embodiments, the cleaning process may include bringing the cleaning composition of the present disclosure into contact with the substrate to be cleaned. In one or more embodiments, the cleaning process may include immersion cleaning and/or scrub cleaning. The
15 cleaning method of the present disclosure can efficiently remove particles, preferably particles derived from polishing debris such as nickel oxide and silicon oxide, and more preferably particles derived from polishing debris of nickel oxide, adhering to substrate surfaces.

[0076] (Immersion cleaning)

20 The immersion conditions of the substrate to be cleaned in the cleaning composition are not particularly limited. For example, the temperature of the cleaning composition is preferably 20°C or more and 100°C or less from the viewpoint of workability and operability. For example, the immersion time is preferably 5 seconds or more, more preferably 10 seconds or more, and further preferably 100
25 seconds or more from the viewpoint of improving the cleanability of the cleaning composition, while the immersion time is preferably 30 minutes or less, more preferably 10 minutes or less, and further preferably 5 minutes or less from the viewpoint of improving the production efficiency of the cleaned substrate. Moreover, it is preferable that ultrasonic vibrations are applied to the cleaning composition from
30 the viewpoint of improving the removal and dispersion of residues. The ultrasonic frequency is, e.g., preferably 20 kHz or more and 2000 kHz or less, more preferably 40 kHz or more and 2000 kHz or less, and further preferably 40 kHz or more and 1500

kHz or less.

[0077] (Scrub cleaning)

A scrub cleaning method preferably includes cleaning the surface of a substrate to be cleaned by injecting the cleaning composition to be in contact with the surface of the substrate while ultrasonic vibrations are being applied to the cleaning composition, or by injecting the cleaning composition to be supplied to the surface of the substrate, and scrubbing the surface of the substrate on which the cleaning composition is present with a cleaning brush, from the viewpoint of promoting the removal of residues such as polishing particles and increasing the solubility of oil.

Furthermore, the scrub cleaning method preferably includes cleaning the surface of an object to be cleaned by injecting the cleaning composition to be supplied to the surface of the object while ultrasonic vibrations are being applied to the cleaning composition, and scrubbing the surface of the object on which the cleaning composition is present with a cleaning brush, from the same viewpoint.

[0078] A means for supplying the cleaning composition to the surface of the substrate to be cleaned may be, e.g., a spray nozzle. The cleaning brush is not particularly limited, and may be, e.g., a nylon brush or a PVA (polyvinyl alcohol) sponge brush. The ultrasonic frequency may be the same as that preferably used in the immersion cleaning.

[0079] The cleaning method of the present disclosure may include at least one step using known cleaning such as swing cleaning, cleaning with the use of rotation of, e.g. a spinner, or puddle cleaning, in addition to the immersion cleaning and/or the scrub cleaning.

[0080] In the cleaning method of the present disclosure, a plurality of substrates to be cleaned may be cleaned either one by one or simultaneously. Moreover, the cleaning process may use either a single cleaning tank or a plurality of cleaning tanks.

[0081] [Method for producing hard disk substrate]

In an aspect, the present disclosure relates to a method for producing a hard disk substrate, which includes a cleaning process of cleaning a substrate to be cleaned with the cleaning composition of the present disclosure (hereinafter, also referred to as a "production method of the present disclosure"). The substrate to be cleaned may be any of the above substrates.

[0082] In general, a base material for a hard disk substrate is subjected to, e.g., a shape machining process, a rough grinding process, a fine grinding process, a rough polishing process, and a final polishing process, and thus can be formed into a hard disk substrate. In some cases, a cleaning process is performed between each of the processes. The hard disk substrate may undergo a recording portion forming process after the final cleaning process, thereby providing a magnetic hard disk.

[0083] The recording portion forming process includes forming a magnetic layer on the hard disk substrate by, e.g., sputtering. The magnetic layer has a magnetic recording area and includes a metal thin film. Examples of metal materials for the metal thin film include an alloy of cobalt and at least one selected from chromium, tantalum, and platinum, and an alloy of iron and platinum. The magnetic layer may be formed on both or one of the principal surfaces of the hard disk substrate.

[0084] The rough polishing process and the final polishing process are performed in this order, for example. A polishing composition used in the rough polishing process contains inorganic fine particles. The inorganic fine particles are, e.g., preferably cerium oxide particles or alumina particles because they allow the substrate to be polished at high speed. A polishing composition used in the final polishing process contains inorganic fine particles. In this case, the inorganic particles are preferably silica particles because they can improve the surface smoothness (surface roughness).

[0085] In one or more embodiments, after the rough polishing process, a cleaning process using the cleaning composition (the first cleaning process), a rinsing process (the first rinsing process), a drying process (the first drying process), a final polishing process, a cleaning process using the cleaning composition (the second cleaning process), a rinsing process (the second rinsing process), and a drying process (the second drying process) may be performed in this order. The cleaning method of the present disclosure can be applied to the first cleaning process and/or the second cleaning process. The cleaning method of the present disclosure is preferably used in the second cleaning process from the viewpoint of improving the cleanability.

[0086] Therefore, in an aspect, the present disclosure relates to a method for producing a hard disk substrate, which includes the following steps (1) and (2):

(1) a polishing process of polishing a substrate to be polished with a polishing composition; and

(2) a cleaning process of cleaning the substrate obtained by the step (1) (i.e., the substrate to be cleaned) with the cleaning composition of the present disclosure.

[0087] The substrate to be polished in the step (1) is generally a substrate after the fine grinding process, and preferably a substrate after the rough polishing process.

5 The substrate to be polished may be any of the above substrates used as the substrate to be cleaned. The step (1) can be performed by, e.g., supplying the polishing composition to a polishing surface of the substrate to be polished, bringing a polishing pad into contact with the polishing surface, and moving the polishing pad or the substrate while applying a predetermined pressure (load). The step (1) is preferably
10 the final polishing process using the polishing composition containing silica particles from the viewpoint of improving the quality of the final substrate. In the final polishing process, it is preferable that the polishing composition is used repeatedly.

[0088] The cleaning process in the step (2) may be performed in the same manner as the cleaning method of the present disclosure described above.

15 [0089] [Kit]

In an aspect, the present disclosure relates to a kit for producing a cleaning composition, which includes a packed component A solution in which a solution containing the component A is held in a container (hereinafter, also referred to as a "kit of the present disclosure"). The kit of the present disclosure may further include at
20 least one kind selected from the component B, the component C, and the optional component in a container different from the container of the component A solution. For example, the kit of the present disclosure may be a kit of a two-liquid type cleaning composition including a solution containing the component A (first solution) and a solution containing the component B (second solution) that are stored so as not to be
25 mixed with each other, and the first solution and the second solution are mixed at the time of use. Each of the first solution and the second solution may contain the above component C and optional component as needed. The concentration of each component in the cleaning composition can be adjusted, for example, by adjusting the use amount of the second solution at the time of mixing the first solution and the
30 second solution.

The present disclosure can provide a kit from which a cleaning composition for a hard disk substrate that is excellent in cleanability for particles remaining on a

substrate surface is obtained.

[0090] [Hard disk recording device]

In an aspect, the present disclosure relates to a hard disk recording device that uses a hard disk substrate that has been cleaned with the cleaning composition of the present disclosure (hereinafter, also referred to as a "hard disk recording device of the present disclosure"). The use of the hard disk substrate that has been cleaned with the cleaning composition of the present disclosure enables production of a hard disk recording device with a high recording density.

[0091] The present disclosure further relates to one or more of the following embodiments.

<1> A cleaning composition for a hard disk substrate including a polymer (component A),

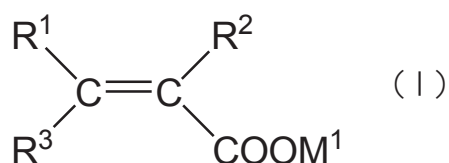
the polymer (component A) containing:

a constituent unit (a1) derived from a monomer a1 expressed by General Formula (I) below or an anhydride thereof; and

a constituent unit (a2) derived from at least one monomer a2 selected from a monomer expressed by General Formula (II) below and a monomer expressed by General Formula (III) below,

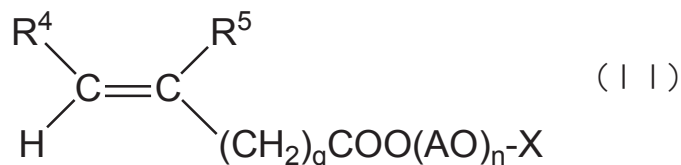
wherein the component A has a weight average molecular weight of 15000 or more and 200000 or less and a pH of 8 or higher,

wherein



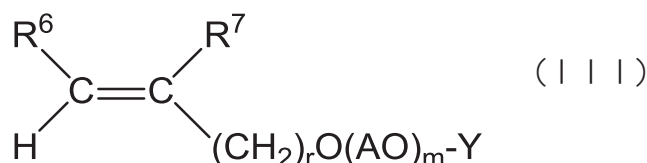
in General Formula (I), R¹, R² and R³ independently represent a hydrogen atom, a methyl group, or -(CH₂)_pCOOM²; M¹ and M² independently represent a hydrogen atom, an alkali metal, an alkaline-earth metal (1/2 atom), an organic ammonium group, or an ammonium group; and p represents an integer of 0 to 2,

wherein



in General Formula (II), R^4 and R^5 independently represent a hydrogen atom or a methyl group; q represents an integer of 0 to 2; AO represents an alkyleneoxy group with 2 or 3 carbon atoms; n is an average number of added moles of AO and represents a number of 4 to 300; and X represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms, and

wherein



in General Formula (III), R^6 and R^7 independently represent a hydrogen atom or a methyl group; r represents an integer of 0 to 2; AO represents an alkyleneoxy group with 2 or 3 carbon atoms; m is an average number of added moles of AO and represents a number of 4 to 300; and Y represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms.

[0092] <2> The cleaning composition according to <1>, wherein in General Formula (I), R^1 , R^2 and R^3 are at least one selected from a hydrogen atom, a methyl group, and $-(CH_2)_p COOM^2$, preferably R^1 and R^3 are a hydrogen atom and R^2 is a hydrogen atom or a methyl group, and more preferably R^1 and R^3 are a hydrogen atom and R^2 is a methyl group.

<3> The cleaning composition according to <1> or <2>, wherein in General Formula (I), M^1 and M^2 are at least one selected from a hydrogen atom, an alkali metal, an alkaline-earth metal (1/2 atom), an organic ammonium group and an ammonium group, preferably an alkali metal, and more preferably sodium and potassium.

<4> The cleaning composition according to any of <1> to <3>, wherein in General Formula (I), p is an integer of 0 to 2, preferably 0 or 1, and more preferably 0.

<5> The cleaning composition according to any of <1> to <4>, wherein in General Formula (II), n is 4 or more, preferably 6 or more, more preferably 9 or more, further preferably 20 or more, still further preferably 40 or more, and yet further preferably 80 or more.

<6> The cleaning composition according to any of <1> to <5>, wherein in General Formula (II), n is 300 or less, preferably 200 or less, more preferably 150 or less, and further preferably 130 or less.

<7> The cleaning composition according to any of <1> to <6>, wherein in General Formula (II), X is a hydrogen atom or an alkyl group with 1 to 3 carbon atoms, and preferably an alkyl group with 1 to 3 carbon atoms.

5 <8> The cleaning composition according to any of <1> to <7>, wherein the molar ratio a_1/a_2 of the constituent unit (a1) to the constituent unit (a2) in the whole constituent units of the component A is preferably 0.1 or more, more preferably 0.5 or more, further preferably 1 or more, and still further preferably 2 or more.

10 <9> The cleaning composition according to any of <1> to <8>, wherein the molar ratio a_1/a_2 of the constituent unit (a1) to the constituent unit (a2) in the whole constituent units of the component A is preferably 100 or less, more preferably 50 or less, further preferably 30 or less, and still further preferably 20 or less.

15 <10> The cleaning composition according to any of <1> to <9>, wherein the molar ratio a_1/a_2 of the constituent unit (a1) to the constituent unit (a2) in the whole constituent units of the component A is preferably 0.1 or more and 100 or less, more preferably 0.5 or more and 50 or less, further preferably 1 or more and 30 or less, and still further preferably 2 or more and 20 or less.

20 <11> The cleaning composition according to any of <1> to <10>, wherein the component A has a weight average molecular weight of 15000 or more, preferably 20000 or more, more preferably 25000 or more, further preferably 30000 or more, and still further preferably 50000 or more.

25 <12> The cleaning composition according to any of <1> to <11>, wherein the component A has a weight average molecular weight of 200000 or less, preferably 150000 or less, more preferably 100000 or less, and further preferably 80000 or less.

30 <13> The cleaning composition according to any of <1> to <12>, wherein the component A has a weight average molecular weight of 15000 or more and 200000 or less, preferably 20000 or more and 150000 or less, more preferably 20000 or more and 100000 or less, further preferably 20000 or more and 80000 or less, and still further preferably 25000 or more and 80000 or less.

<14> The cleaning composition according to any of <1> to <13>, wherein the content of the component A with respect to the total mass of the components other than water in the cleaning composition is preferably 1% by mass or more, more preferably 10% by mass or more, further preferably 15% by mass or more, and still
 5 further preferably 20% by mass or more.

<15> The cleaning composition according to any of <1> to <14>, wherein the content of the component A with respect to the total mass of the components other than water in the cleaning composition is preferably 99.9% by mass or less, more preferably 99% by mass or less, and further preferably 98% by mass or less.

10 <16> The cleaning composition according to any of <1> to <15>, wherein the content of the component A with respect to the total mass of the components other than water in the cleaning composition is preferably 1% by mass or more and 99.9% by mass or less, more preferably 10% by mass or more and 99.9% by mass or less, further preferably 15% by mass or more and 99% by mass or less, and still further preferably
 15 20% by mass or more and 98% by mass or less.

<17> The cleaning composition according to any of <1> to <16>, wherein the content of the component A in the cleaning composition for use in cleaning is preferably 0.001% by mass or more, more preferably 0.005% by mass or more, and further preferably 0.01% by mass or more.

20 <18> The cleaning composition according to any of <1> to <17>, wherein the content of the component A in the cleaning composition for use in cleaning is preferably 10% by mass or less, more preferably 5% by mass or less, further preferably 2% by mass or less, still further preferably 1% by mass or less, yet further preferably 0.5% by mass or less, and even further preferably 0.2% by mass or less.

25 <19> The cleaning composition according to any of <1> to <18>, wherein the content of the component A in the cleaning composition for use in cleaning is preferably 0.001% by mass or more and 10% by mass or less, more preferably 0.005% by mass or more and 5% by mass or less, further preferably 0.01% by mass or more and 2% by mass or less, still further preferably 0.01% by mass or more and 1% by mass or less,
 30 yet further preferably 0.01% by mass or more and 0.5% by mass or less, and even further preferably 0.01% by mass or more and 0.2% by mass or less.

<20> The cleaning composition according to any of <1> to <19>, further

containing an alkali agent (component B).

<21> The cleaning composition according to <20>, wherein the component B is preferably at least one selected from alkali metal hydroxides, hydroxyalkylamines, and quaternary ammonium salts, more preferably alkali metal hydroxides, and further
5 preferably at least one of potassium hydroxide and sodium hydroxide.

<22> The cleaning composition according to <20> or <21>, wherein the content of the component B with respect to the total mass of the components other than water in the cleaning composition is preferably 0.1% by mass or more, more preferably 0.3% by mass or more, and further preferably 0.5% by mass or more.

10 <23> The cleaning composition according to any of <20> to <22>, wherein the content of the component B with respect to the total mass of the components other than water in the cleaning composition is preferably 99% by mass or less, more preferably 90% by mass or less, further preferably 80% by mass or less, and still further preferably 75% by mass or less.

15 <24> The cleaning composition according to any of <20> to <23>, wherein the content of the component B with respect to the total mass of the components other than water in the cleaning composition is preferably 0.1% by mass or more and 90% by mass or less, more preferably 0.3% by mass or more and 80% by mass or less, and further preferably 0.5% by mass or more and 75% by mass or less.

20 <25> The cleaning composition according to any of <20> to <24>, wherein the content of the component B in the cleaning composition for use in cleaning is preferably 0.00005% by mass or more, more preferably 0.0001% by mass or more, and further preferably 0.001% by mass or more.

25 <26> The cleaning composition according to any of <20> to <25>, wherein the content of the component B in the cleaning composition for use in cleaning is preferably 2.0% by mass or less, more preferably 0.3% by mass or less, further preferably 0.1% by mass or less, still further preferably 0.07% by mass or less, and yet further preferably 0.05% by mass or less.

30 <27> The cleaning composition according to any of <20> to <26>, wherein the content of the component B in the cleaning composition for use in cleaning is preferably 0.00005% by mass or more and 2.0% by mass or less, more preferably 0.00005% by mass or more and 0.3% by mass or less, further preferably 0.00005% by

mass or more and 0.1% by mass or less, still further preferably 0.0001% by mass or more and 0.07% by mass or less, and yet further preferably 0.001% by mass or more and 0.05% by mass or less.

5 <28> The cleaning composition according to any of <20> to <27>, wherein the content ratio A/B of the component A to the component B in the cleaning composition is preferably 0.01 or more, more preferably 0.1 or more, and further preferably 0.3 or more.

10 <29> The cleaning composition according to any of <20> to <28>, wherein the content ratio A/B of the component A to the component B in the cleaning composition is preferably 20000 or less, more preferably 1000 or less, and further preferably 100 or less.

15 <30> The cleaning composition according to any of <20> to <29>, wherein the content ratio A/B of the component A to the component B in the cleaning composition is preferably 0.01 or more and 20000 or less, more preferably 0.1 or more and 1000 or less, and further preferably 0.3 or more and 100 or less.

 <31> The cleaning composition according to any of <1> to <30>, further containing water (component C).

20 <32> The cleaning composition according to <31>, wherein the content of the component C in the cleaning composition for use in cleaning is preferably 90% by mass or more, more preferably 95% by mass or more, and further preferably 99% by mass or more.

25 <33> The cleaning composition according to <31> or <32>, wherein the content of the component C in the cleaning composition for use in cleaning is preferably 99.99% by mass or less, more preferably 99.98% by mass or less, and further preferably 99.97% by mass or less.

 <34> The cleaning composition according to any of <1> to <33>, further containing an optional component that is at least one selected from a chelating agent, an anionic polymer, a nonionic surfactant, a solubilizer, an antioxidant, an antiseptic, an antifoaming agent, and an antimicrobial agent.

30 <35> The cleaning composition according to <34>, wherein the content of the optional component in the cleaning composition for use in cleaning is preferably 0% by mass or more and 2.0% by mass or less, more preferably 0% by mass or more and 1.5%

by mass or less, further preferably 0% by mass or more and 1.3% by mass or less, and still further preferably 0% by mass or more and 1.0% by mass or less.

<36> The cleaning composition according to any of <1> to <35>, wherein the pH of the cleaning composition for use in cleaning is 8 or more, preferably 9 or more,
5 more preferably 9.5 or more, further preferably 10 or more, and still further preferably 10.5 or more.

<37> The cleaning composition according to any of <1> to <36>, wherein the pH of the cleaning composition for use in cleaning is preferably 14 or less, more preferably 13 or less, further preferably 12.5 or less, still further preferably 12 or less,
10 and yet further preferably 11.5 or less.

<38> Use of the cleaning composition according to any of <1> to <37> for cleaning a substrate that has been polished with a polishing composition, or a substrate on which particles remain or to which particles adhere.

<39> A method for cleaning a substrate, including a cleaning process of
15 cleaning a substrate to be cleaned with the cleaning composition according to any of <1> to <37>, wherein the substrate to be cleaned is a substrate that has been polished with a polishing composition.

<40> The method for cleaning a substrate according to <39>, wherein the substrate is a Ni-P-plated aluminum alloy substrate.

<41> The method for cleaning a substrate according to <39> or <40>, wherein
20 the polishing composition is a polishing composition containing silica abrasive grains.

<42> A method for producing a hard disk substrate, including a cleaning process of cleaning a substrate to be cleaned with the cleaning composition according to any of <1> to <37>, wherein the substrate to be cleaned is a substrate that has been
25 polished with a polishing composition.

<43> A kit for producing the cleaning composition according to any of <1> to <37>, including a packed component A solution in which a solution containing the component A is held in a container.

<44> A hard disk recording device using a hard disk substrate that has been
30 cleaned with the cleaning composition according to any of <1> to <37>.

<45> Use of the cleaning composition according to any of <1> to <37> for cleaning of a hard disk substrate.

Examples

[0093] Hereinafter, the present disclosure will be described specifically based on the following examples. However, the present disclosure is not limited by these examples.

5 [0094] 1. Preparation of polymer (component A)

The following materials were used to prepare polymers A1 to A16 shown in Table 1.

[0095] <Monomer a1>

10 (1) MAA: methacrylic acid (manufactured by Tokyo Chemical Industry Co., Ltd.)

(2) AA: acrylic acid (manufactured by FUJIFILM Wako Pure Chemical Corporation)

(3) MA: maleic anhydride (manufactured by Mitsubishi Chemical Corporation)

15 [0096] <Monomer a2>

(1) Monomer a2-1

20 1000 parts by mass of polyethylene glycol monomethyl ether (weight average molecular weight: 5344) (the number of added moles of ethylene oxide: 120) molten at 80°C was charged into a glass reaction container equipped with a thermometer, a stirrer, a dropping funnel, a nitrogen introduction pipe, and a cooling condenser. Subsequently, 3 parts by mass of hydroquinone and 32 parts by mass of p-toluenesulfonic acid were added thereto. 483 parts by mass of methacrylic acid (30 mol times the amount of the polyethylene glycol monomethyl ether) was added therein, while air was introduced into the reaction liquid at a flow rate of 6 ml/min per 1 kg of the total mass of the polyethylene glycol monomethyl ether and the methacrylic acid, and further, nitrogen was introduced into a gas phase part of the reaction container at a flow rate of 12 ml/min, followed by heating and pressure reduction inside the reaction container. The pressure was controlled at 26.7 kPa. A time at which the temperature of the reaction liquid reached 105°C was determined as a reaction start time. The reaction container was continuously heated to maintain the temperature of the reaction liquid at 110°C, and the reaction was performed while distilling out the reaction water and methacrylic acid. The pressure was reduced to 12 to 13.3 kPa

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after one hour from the start of the reaction, and maintained. After six hours from the start of the reaction, the pressure was returned to normal pressure, and a 48% sodium hydroxide aqueous solution was added in an amount 1.05 times the amount of the p-toluenesulfonic acid for neutralization so as to stop the reaction. Then, the temperature of the reaction liquid was maintained at 130°C or lower, and unreacted methacrylic acid was collected by a vacuum distillation method, whereby an esterification reactant was obtained. After the esterification reactant was cooled to 100°C, 200 parts by mass of saturated brine and 1000 parts by mass of toluene were added, and the temperature was adjusted to 50°C. Extraction of a separated lower layer, addition of 200 parts by mass of saturated brine and liquid separating operation were repeated five times, and then toluene was distilled away, whereby a purified monomer a2-1, methoxypolyethylene glycol methacrylic acid ester (the average number of added moles of EO: 120), was obtained.

(2) Monomer a2-2

Methoxypolyethylene glycol methacrylic acid ester (the average number of added moles of EO: 23), M-230G (manufactured by Shin-Nakamura Chemical Co., Ltd.)

(3) Monomer a2-3

Methoxypolyethylene glycol methacrylic acid ester (the average number of added moles of EO: 9), M-90G (manufactured by Shin-Nakamura Chemical Co., Ltd.)

(4) Monomer a2-4

A purified monomer a2-4, methoxypolyethylene glycol methacrylic acid ester (the average number of added moles of EO: 41), was produced in the same manner as in the production of the monomer a2-1 except that the number of added moles of ethylene oxide of polyethylene glycol monomethyl ether was 41 (weight average molecular weight: 1838), and the amount of the methacrylic acid added was changed to 1405 parts by mass.

(5) EG: ethylene glycol

(6) Monomer a2-5

Methoxypolyethylene glycol allyl ether (average molecular weight: 1500, the average number of added moles of EO: 32), UNIOX (registered trademark) PKA-5010 (manufactured by NOF Corporation)

(7) Monomer a2-6

Polyethylene glycol-3-methyl-3-butenyl ether (the average number of added moles of EO: 50)

(8) Monomer a2-7

5 Polyethylene glycol allyl ether (the average number of added moles of EO: 25)

(9) Monomer a2-8

Polyethylene glycol acrylic acid ester (the average number of added moles of EO: 5)

[0097] <Polymerization chain transfer agent>

10 • 2-Mercaptoethanol (manufactured by Tokyo Chemical Industry Co., Ltd.)
• β-Mercaptopropionic acid (manufactured by Tokyo Chemical Industry Co., Ltd.)

<Polymerization chain transfer agent also serving as a solvent>

15 • 1,2-Propanediol (manufactured by FUJIFILM Wako Pure Chemical Corporation)

<Polymerization initiator>

• Ammonium peroxodisulfate (ammonium persulfate) (manufactured by Nacalai Tesque, Inc.)

20 • Hydrogen peroxide solution (30-35.5 mass% aqueous solution, manufactured by Nacalai Tesque, Inc.)

• Sodium peroxodisulfate (manufactured by Nacalai Tesque, Inc.)

<Neutralizer>

• Sodium hydroxide (48 mass% NaOH, manufactured by AGC, Inc.)

[0098] <Production example of polymer A1>

25 282 g (15.7 mol) of water was charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature was increased to 75°C in the nitrogen atmosphere. Subsequently, a mixture in which 20.7 g (0.24 mol) of MAA and 323 g (0.06 mol) of the monomer a2-1 (the mass ratio = 6/94, the molar ratio = 80/20) were dissolved in 239 g (13.3 mol) of water, 34.7 g of a 10 mass% ammonium persulfate aqueous solution, and 1.8 g of 2-mercaptoethanol were simultaneously added to the reaction system dropwise for two hours. Next, 13.9 g of a 10 mass% ammonium persulfate aqueous solution was added thereto dropwise for 30

minutes, followed by aging at the same temperature (75°C) for one hour. After completion of the aging, 23.9 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A1 (37 mass% aqueous solution) was obtained.

5 [0099] <Production example of polymer A2>

367 g (20.4 mol) of water was charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature was increased to 80°C in the nitrogen atmosphere. Subsequently, a mixture in which 62.9 g (0.73 mol) of MAA and 300 g (0.27 mol) of the monomer a2-2 (the mass ratio =
10 17.3/82.7, the molar ratio = 73/27) were dissolved in 173 g (9.6 mol) of water, 34.1 g of a 10 mass% ammonium persulfate aqueous solution, and 2.9 g of 2-mercaptoethanol were simultaneously added to the reaction system dropwise for two hours. Next, 11.4 g of a 10 mass% ammonium persulfate aqueous solution was added thereto dropwise for 30 minutes, followed by aging at the same temperature (75°C) for one hour. After
15 completion of the aging, 61 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A2 (36 mass% aqueous solution) was obtained.

[0100] <Production example of polymer A3>

317 g (17.6 mol) of water was charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature
20 was increased to 75°C in the nitrogen atmosphere. Subsequently, a mixture in which 46.5 g (0.54 mol) of MAA and 323 g (0.06 mol) of the monomer a2-1 (the mass ratio = 12.6/87.4, the molar ratio = 90/10) were dissolved in 239 g (13.3 mol) of water, 41.7 g of a 10 mass% ammonium persulfate aqueous solution, and 1.9 g of 2-mercaptoethanol were simultaneously added to the reaction system dropwise for two hours. Next, 13.9
25 g of a 10 mass% ammonium persulfate aqueous solution was added thereto dropwise for 30 minutes, followed by aging at the same temperature (75°C) for one hour. After completion of the aging, 49.3 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A3 (36 mass% aqueous solution) was obtained.

30 [0101] <Production example of polymer A4>

275 g (15.3 mol) of water was charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature

was increased to 75°C in the nitrogen atmosphere. Subsequently, a mixture in which 9.5 g (0.11 mol) of MAA and 323 g (0.06 mol) of the monomer a2-1 (the mass ratio = 2.9/97.1, the molar ratio $a_1/a_2 = 65/35$) were dissolved in 239 g (13.3 mol) of water, 3.8 g of a 10 mass% ammonium persulfate aqueous solution, and 1.2 g of

5 2-mercaptoethanol were simultaneously added to the reaction system dropwise for two hours. Next, 11.9 g of a 10 mass% ammonium persulfate aqueous solution was added thereto dropwise for 30 minutes, followed by aging at the same temperature (75°C) for one hour. After completion of the aging, 13.1 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A4 (38 mass% aqueous
10 solution) was obtained.

[0102] <Production example of polymer A5>

449 g (24.9 mol) of water was charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature was increased to 80°C in the nitrogen atmosphere. Subsequently, a mixture in which
15 55.9 g (0.65 mol) of MAA and 390 g (0.35 mol) of the monomer a2-2 (the mass ratio = 12.5/87.5, the molar ratio = 65/35) were dissolved in 220 g (12.2 mol) of water, 31.0 g of a 10 mass% ammonium persulfate aqueous solution, and 4.2 g of 2-mercaptoethanol were simultaneously added to the reaction system dropwise for two hours. Next, 10.5 g of a 10 mass% ammonium persulfate aqueous solution was added thereto dropwise
20 for 30 minutes, followed by aging at the same temperature (75°C) for one hour. After completion of the aging, 54.2 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A5 (37 mass% aqueous solution) was obtained.

[0103] <Production example of polymer A6>

25 292 g (16.2 mol) of water was charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature was increased to 75°C in the nitrogen atmosphere. Subsequently, a mixture in which 102 g (1.19 mol) of MAA and 339 g (0.063 mol) of the monomer a2-1 (the mass ratio = 23.1/76.9, the molar ratio = 95/5) were dissolved in 252 g (14.0 mol) of water, 71.5 g of a
30 10 mass% ammonium persulfate aqueous solution, and 10.3 g of 2-mercaptoethanol were simultaneously added to the reaction system dropwise for two hours. Next, 57.2 g of a 10 mass% ammonium persulfate aqueous solution was added thereto dropwise

for 30 minutes, followed by aging at the same temperature (75°C) for one hour. After completion of the aging, 103.3 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A6 (36 mass% aqueous solution) was obtained.

5 [0104] <Production example of polymer A7>

303 g (16.8 mol) of water was charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature was increased to 75°C in the nitrogen atmosphere. Subsequently, a mixture in which 40.4 g (0.47 mol) of MAA and 257 g (0.53 mol) of the monomer a2-3 (the mass ratio =
10 13.3/86.7, the molar ratio = 47/53) were dissolved in 152 g (8.42 mol) of water, 15.5 g of a 10 mass% ammonium persulfate aqueous solution, and 2.1 g of 2-mercaptoethanol were simultaneously added to the reaction system dropwise for two hours. Next, 5.2 g of a 10 mass% ammonium persulfate aqueous solution was added thereto dropwise for 30 minutes, followed by aging at the same temperature (75°C) for one hour. After
15 completion of the aging, 39.2 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A7 (37 mass% aqueous solution) was obtained.

[0105] <Production example of polymer A8>

22.6 g (1.26 mol) of water was charged in a reaction container with a stirrer,
20 and after the atmosphere was replaced with nitrogen under stirring, the temperature was increased to 85°C in the nitrogen atmosphere. Subsequently, a mixture in which 8.7 g (0.12 mol) of AA and 89.6 g (0.047 mol) of the monomer a2-4 (the mass ratio = 8.8/91.2, the molar ratio = 72/28) were dissolved in 92.3 g (5.13 mol) of water, 15.0 g of a 5 mass% ammonium persulfate aqueous solution, and 15.0 g of a 6 mass%
25 β-mercaptopropionic acid aqueous solution were simultaneously added to the reaction system dropwise for 1.5 hours. Next, 5.0 g of a 22 mass% ammonium persulfate aqueous solution was added thereto dropwise for 5 minutes, followed by aging at the same temperature (85°C) for 0.5 hours. After completion of the aging, 10.1 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a
30 polymer A8 (38 mass% aqueous solution) was obtained.

[0106] [Polymer A9]

•Sodium polyacrylate "ARON (registered trademark) A-210" (43 mass%

aqueous solution, weight average molecular weight: 3000, manufactured by Toagosei Co., Ltd.)

[Polymer A10]

- Sodium polyacrylate (35 mass% aqueous solution, weight average molecular weight: 60000, manufactured by Polysciences, Inc.)

[Polymer A11]

• Polyethylene glycol methyl ether (number average molecular weight: 5000, manufactured by Sigma-Aldrich Co., LLC.)

[Polymer A12]

- Sodium dodecylbenzenesulfonate "NEOPELEX G-25" (25 mass% aqueous solution, manufactured by Kao Corporation)

[0107] <Production example of polymer A13>

90.5 g (5.0 mol) of water was charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature was increased to 75°C in the nitrogen atmosphere. Subsequently, a mixture in which 63.7 g (0.65 mol) of MA and 525 g (0.35 mol) of the monomer a2-5 (the mass ratio = 11/89, the molar ratio = 65/35) were dissolved in 161 g (8.9 mol) of water, and 37.0 g of a 10 mass% ammonium persulfate aqueous solution were simultaneously added to the reaction system dropwise for two hours. Next, 14.8 g of a 10 mass% ammonium persulfate aqueous solution was added thereto dropwise for 30 minutes, followed by aging at the same temperature (75°C) for three hours. After completion of the aging, 108 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A13 (60 mass% aqueous solution) was obtained.

[0108] <Production example of polymer A14>

234 g (13.0 mol) of water and 546 g (0.24 mol) of the monomer a2-6 were charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature was increased to 65°C in the nitrogen atmosphere. 8.6 g of hydrogen peroxide solution was added thereto dropwise. Subsequently, a mixture in which 54.4 g (0.76 mol) of AA was dissolved in 45.6 g (2.5 mol) of water, and a mixture in which 8.0 g of β -mercaptopropionic acid and 3.3 g of L-ascorbic acid were dissolved in 38.8 g of water were simultaneously added to the reaction system dropwise for two hours, followed by aging at the same temperature

(65°C) for one hour. After completion of the aging, 62.9 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A14 (60 mass% aqueous solution) was obtained (the mass ratio AA/ monomer a2-6 = 9/91, the molar ratio = 76/24).

5 [0109] <Production example of polymer A15>

193 g (10.7 mol) of water, 295 g (3.9 mol) of 1,2-propanediol, 5.0 g (0.069 mol) of AA and 150 g (0.13 mol) of the monomer a2-7 were charged in a reaction container with a stirrer, and after the atmosphere was replaced with nitrogen under stirring, the temperature was increased to 85°C in the nitrogen atmosphere. Subsequently, a
 10 mixture in which 49.7 g (0.69 mol) of AA and 150 g (0.13 mol) of the monomer a2-7 were dissolved in 50.3 g (2.8 mol) of water, and a mixture in which 5.3 g of sodium peroxodisulfate was dissolved in 21.2 g of water were simultaneously added to the reaction system dropwise for 75 minutes. Next, a mixture in which 45.1 g (0.63 mol) of AA and 4.8 g of sodium peroxodisulfate were dissolved in 30.3 g of water was added
 15 to the reaction system dropwise for 135 minutes, followed by aging at the same temperature (85°C) for 3 hours. After completion of the aging, 52.2 g of a 48 mass% NaOH aqueous solution was added thereto for neutralization, whereby a polymer A15 (40 mass% solution) was obtained (the mass ratio AA/ monomer a2-7 = 25/75, the molar ratio = 84/16).

20 [0110] [Polymer A16]

A sodium salt (weight average molecular weight: 10000, compound E described in JP 2000-309796 A) of an acrylic acid/ polyethylene glycol acrylic acid ester (the average number of added moles of EO: 5) copolymer was used as a polymer A16. In Table 1, the acrylic acid serving as the constituent unit (a1) of the polymer A16 is
 25 indicated by AA, and the polyethylene glycol acrylic acid ester (the average number of added moles of EO: 5) serving as the constituent unit (a2) of the polymer A16 is indicated by monomer a2-8.

[0111] [Measurement of weight average molecular weight]

The weight average molecular weights of the polymers A1 to A11 and A13 to
 30 A16 were measured by gel permeation chromatography (hereinafter, also referred to as "GPC") under the conditions below. Table 1 shows the measurement results.

The weight average molecular weight (348.5) of the polymer A12 in Table 1 is

a value described in International Chemical Safety Cards.

[GPC conditions]

Columns: G4000PWXL and G2500PWXL (manufactured by TOSOH CORPORATION)

5 Eluent: 0.2M phosphate buffer/ CH₃CN = 9/1 (volume ratio)

Flow rate: 1.0 mL/min

Column temperature: 40°C

Detector: RI

Sample size: 0.5 mg/mL

10 Reference material: polyethylene glycol conversion

[0112] [Table 1]

(Table 1)

	Abbreviation	Monomer a1	Monomer a2	Molar ratio a1/a2	Weight average molecular weight
Component A	A1* ¹	MAA	a2-1	80/20	53000
	A2* ¹	MAA	a2-2	73/27	50000
	A3* ¹	MAA	a2-1	90/10	39000
	A4* ¹	MAA	a2-1	65/35	60000
	A5* ¹	MAA	a2-2	65/35	50000
	A6* ¹	MAA	a2-1	95/5	25000
	A7* ¹	MAA	a2-3	47/53	70000
	A8* ¹	AA	a2-4	72/28	30000
	A13* ¹	MA	a2-5	65/35	31000
	A14* ¹	AA	a2-6	76/24	50000
	A15* ¹	AA	a2-7	84/16	29000
Non-Component A	A16* ¹	AA	a2-8		10000
	A9* ¹	AA	—	100/0	3000
	A10* ¹	AA	—	100/0	60000
	A11	—	EG	0/100	5000
	A12	Sodium dodecylbenzenesulfonate			348.5

MAA: methacrylic acid

AA: acrylic acid

15 MA: maleic anhydride

EG: ethylene glycol

*1: sodium salt

[0113] 2. Preparation of cleaning compositions (Examples 1 to 22 and Comparative Examples 1 to 8)

20 The components in Table 2 were blended in the proportions (mass%, active components) as shown in Table 2 and mixed to prepare the cleaning compositions of

Examples 1 to 22 and Comparative Examples 1 to 8. The pH is a pH of each of the cleaning compositions at 25°C, and measured by a pH meter (HM-30G, manufactured by DKK-TOA CORPORATION) after a 3-minutes immersion of the electrode of the pH meter in the cleaning composition. The pH was adjusted by potassium hydroxide and sulfuric acid. The component B and the component C used were as follows .

<Component B: alkali agent>

KOH: potassium hydroxide (with a solid content of 48 mass%, guaranteed reagent, manufactured by KANTO CHEMICAL CO., INC.)

MEA: monoethanolamine (manufactured by NIPPON SHOKUBAI CO., LTD.)

MDA: N-methyldiethanolamine (Amino alcohol MDA manufactured by NIPPON NYUKAZAI CO., LTD.)

EA: N-(β-aminoethyl)ethanolamine (Amino alcohol EA, manufactured by NIPPON NYUKAZAI CO., LTD.)

<Component C: water>

Water: ultrapure water produced by a continuous water purifying apparatus (Pureconti PC-2000VRL) and a subsystem (Makuace KC-05H), both of which are manufactured by Kurita Water Industries Ltd.

<Other component>

Sulfuric acid: reagent special grade, purity: 95.0 mass%, manufactured by FUJIFILM Wako Pure Chemical Corporation

[0114] 3. Evaluation method

[Dispersibility test method]

30.0 g of each cleaning composition was placed in a 50 mL polypropylene bottle, to which 0.15 g of nickel oxide particles (average particle diameter: less than 50 nm) were added, followed by stirring with an ultrasonic cleaner UT-105HS (manufactured by Sharp Manufacturing Systems Corporation) (100 W, 35 kHz, 30 minutes). An absorbance directly after stirring and an absorbance of the supernatant after a lapse of one hour of still standing were measured by an ultraviolet and visible spectrophotometer UV-2700 (manufactured by Shimadzu Corporation, measurement wavelength: 660 nm). Dispersibility shown in Table 2 is a relative value when the absorbance directly after stirring is defined as 100. The larger the value is, the more

excellent the dispersibility is.

[0115] [Cleanability test method]

Contaminated substrates to be cleaned, i.e., substrates to be cleaned to which particles adhered, were prepared by immersing Ni-P-plated aluminum alloy
 5 substrates (outer diameter: 95 mm ϕ , inner diameter: 25 mm ϕ , thickness: 1.75 mm) in a dispersion (concentration: 0.0025 mass%) containing nickel oxide particles (average particle diameter: less than 50 nm) (corresponding to polishing debris) for two minutes. The substrates to be cleaned were cleaned with the cleaning compositions to evaluate the cleanability of the respective cleaning compositions. Cleaning was performed in
 10 the following manner.

[0116] (Cleaning)

Five substrates to be cleaned were cleaned by a cleaning apparatus under the following conditions. Two sets of rinsing tanks were prepared.

(1) Cleaning-1: 4000 g of the cleaning composition for use in cleaning was
 15 prepared. The cleaning composition thus prepared was placed in a cleaning tank (a), and the temperature of the liquid in the cleaning tank (a) was set to 25°C. Then, the substrate to be cleaned was immersed in the cleaning composition in the cleaning tank (a), and cleaned for 120 seconds while ultrasonic waves (200 kHz) were being applied.

(2) Rinsing-1: Ultrapure water was placed in a rinsing tank (b), and the
 20 temperature of the liquid in the rinsing tank (b) was set to 25°C. Then, the substrate to be cleaned in the cleaning tank (a) was transferred to the rinsing tank (b), immersed in the ultrapure water in the rinsing tank (b), and rinsed for 120 seconds while ultrasonic waves (600 kHz) was being applied.

(3) Using a rinsing tank (c) containing ultrapure water that was prepared
 25 under the same conditions as the rinsing tank (b), the step (2) was repeated again.

(4) Cleaning-2: The substrate to be cleaned in the rinsing tank (c) was transferred to a scrub cleaning unit (A) in which cleaning brushes were mounted. Then, a cleaning composition of 25°C was injected into each of the cleaning brushes, and the cleaning brushes were pressed against both surfaces of the substrate in the
 30 presence of the cleaning composition while rotating the cleaning brushes at 400 rpm so that the substrate was cleaned at 25°C for 5 seconds. The cleaning composition had the same composition as that of the cleaning composition used in the "(1) Cleaning-1".

(5) Rinsing-2: The substrate to be cleaned was transferred to a scrub cleaning unit (B) that was prepared under the same conditions as the scrub cleaning unit (A). Then, ultrapure water of 25°C was injected, and the cleaning brushes were pressed against both surfaces of the substrate while rotating the cleaning brushes at 400 rpm in the same manner as the step (4) so that the substrate was rinsed at 25°C for 5 seconds.

(6) A scrub cleaning unit (C) was prepared under the same conditions as the scrub cleaning unit (A), and a scrub cleaning unit (D) was prepared under the same conditions as the scrub cleaning unit (B). Using the scrub cleaning units (C) and (D), the steps (4) and (5) were repeated again.

(7) Rinsing-3: Ultrapure water was placed in a rinsing tank (e), and the temperature of the liquid in the rinsing tank (e) was set to 25°C. Then, the substrate to be cleaned was transferred to the rinsing tank (e), immersed in the ultrapure water in the rinsing tank (e), and rinsed for 600 seconds while ultrasonic waves (170 kHz) was being applied.

(8) Drying: The substrate to be cleaned was transferred to a spin dryer and spun at 700 rpm for 60 seconds to completely dry the surface of the substrate.

[0117] [Cleanability evaluation method]

The cleaned substrate was rotated at 10000 rpm and irradiated with a laser using MODE Q-Scatter of an optical microdefect inspection apparatus (Candela 7100, manufactured by KLA-Tencor Corporation) to measure the number of defects (i.e., the number of foreign substances on the substrate). This measurement was performed on 10 substrates for each of the cleaning compositions, and the average of the measured values was calculated. Table 2 shows the relative values when the value of Comparative Example 1 is defined as 100. It can be evaluated that the cleanability is better as the relative value is smaller, since the number of defects is reduced.

[0118] [Table 2]

(Table 2)				Examples																						
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Cleaning composition (for use in cleaning)	Polymer	Component A (mass%)	A1	0.020	-	-	-	-	-	-	-	0.010	0.040	0.070	0.100	0.200	0.020	0.020	0.020	0.020	0.020	0.020	-	-	-	
			A2	-	0.020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			A3	-	-	0.020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			A4	-	-	-	0.020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			A5	-	-	-	-	0.020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			A6	-	-	-	-	-	0.020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			A7	-	-	-	-	-	-	0.020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			A8	-	-	-	-	-	-	-	-	0.020	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			A13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.020	-	-
			A14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.020	-
	A15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.020		
	Alkali agent	Component B (mass%)	KOH (solid)	0.0056	0.0056	0.0056	0.0056	0.0056	0.0056	0.0056	0.0056	0.0056	0.0056	0.0056	0.0056	0.0056	0.0001	0.0009	0.0559	-	-	-	0.0056	0.0056	0.0056	
			MEA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1000	-	-	-	-	-	
			MDA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9500	-	-	-	-	
			EA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3000	-	-	-	
Water	Component C (mass%)	Water	99.9744	99.9744	99.9744	99.9744	99.9744	99.9744	99.9744	99.9744	99.9844	99.9544	99.9244	99.8944	99.7944	99.9799	99.9791	99.9241	99.8800	98.0300	99.6800	99.9744	99.9744	99.9744		
Other component (mass%)		Sulfuric acid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
pH			11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	8.0	10.0	12.0	11.0	11.0	11.0	11.0	11.0	11.0		
Dispersibility	Absorbance retention rate (%)			79	74	72	67	61	60	61	73	74	73	79	78	76	63	67	72	70	68	75	71	77	75	
Cleanability	The number of defects (%)			10.5	12.7	16.4	21.7	30.5	31.7	28.5	17.8	16.2	16.5	11.2	13.4	11.4	28.5	22.8	14.3	18.2	20.4	13.9	8.0	11.1	17.5	

(Table 2)				Comparative Examples							
				1	2	3	4	5	6	7	8
Cleaning composition (for use in cleaning)	Polymer	Component A (mass%)	A1	-	-	-	-	-	0.0200	0.0200	-
		Non-Component A (mass%)	A16	-	-	-	-	-	-	-	0.020
			A9	-	0.020	-	-	-	-	-	-
			A10	-	-	-	0.002	-	-	-	-
			A11	-	-	0.020	0.019	-	-	-	-
			A12	-	-	-	-	0.020	-	-	-
	Alkali agent	Component B (mass%)	KOH (solid)	0.0056	0.0056	0.0057	0.0058	0.0056	-	-	0.0056
	Water	Component C (mass%)	Water	99.9944	99.9744	99.9743	99.9732	99.9744	99.9314	99.9800	99.9744
	Other component (mass%)		Sulfuric acid	-	-	-	-	-	0.0486	-	-
	pH			11.0	11.0	11.0	11.0	11.0	2.0	7.0	11.0
Dispersibility	Absorbance retention rate (%)			2	54	1	46	2	1	52	56
Cleanability	The number of defects (%)			100	39.6	100	55.7	100	100	49.6	35.3

[0119] As shown in Table 2, the cleaning compositions of Examples 1 to 22 exhibited higher dispersibility than the cleaning compositions of Comparative Examples 1 to 8. Moreover, the cleaning compositions of Examples 1 to 22 exhibited higher cleanability than the cleaning compositions of Comparative Examples 1 to 8.

CLAIMS

1. A cleaning composition for a hard disk substrate comprising a polymer (component A),

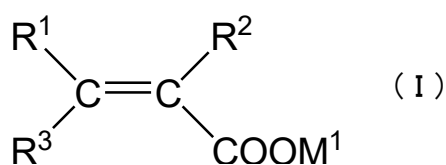
the polymer (component A) comprising:

5 a constituent unit (a1) derived from a monomer a1 expressed by General Formula (I) below or an anhydride thereof: and

a constituent unit (a2) derived from at least one monomer a2 selected from a monomer expressed by General Formula (II) below and a monomer expressed by General Formula (III) below,

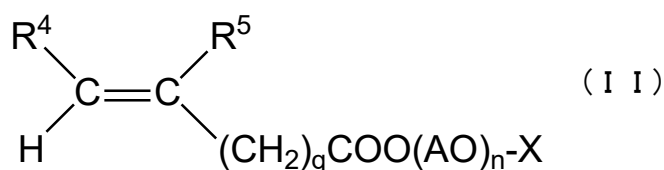
10 wherein the component A has a weight average molecular weight of 15000 or more and 200000 or less and a pH of 8 or higher,

wherein



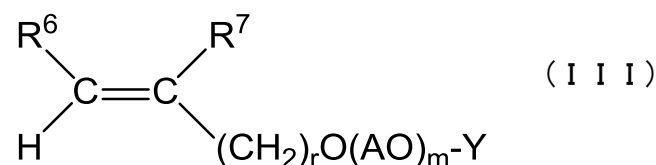
15 in General Formula (I), R¹, R² and R³ independently represent a hydrogen atom, a methyl group, or -(CH₂)_pCOOM²; M¹ and M² independently represent a hydrogen atom, an alkali metal, an alkaline-earth metal (1/2 atom), an organic ammonium group, or an ammonium group; and p represents an integer of 0 to 2,

wherein



20 in General Formula (II), R⁴ and R⁵ independently represent a hydrogen atom or a methyl group; q represents an integer of 0 to 2; AO represents an alkyleneoxy group with 2 or 3 carbon atoms; n is an average number of added moles of AO and represents a number of 4 to 300; and X represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms, and

25 wherein



in General Formula (III), R⁶ and R⁷ independently represent a hydrogen atom or a methyl group; r represents an integer of 0 to 2; AO represents an alkyleneoxy group with 2 or 3 carbon atoms; m is an average number of added moles of AO and represents a number of 4 to 300; and Y represents a hydrogen atom or an alkyl group with 1 to 3 carbon atoms.

2. The cleaning composition according to claim 1, wherein the component A has a weight average molecular weight of 20000 or more and 80000 or less.
- 10 3. The cleaning composition according to claim 1 or 2, further comprising an alkali agent (component B).
4. The cleaning composition according to claim 3, wherein the component B is at least one selected from alkali metal hydroxides, hydroxyalkylamines, and quaternary ammonium salts.
- 15 5. The cleaning composition according to any of claims 1 to 4, wherein a content of the component A in the cleaning composition for use in cleaning is 0.001% by mass or more and 10% by mass or less.
- 20 6. A method for cleaning a substrate, comprising a cleaning process of cleaning a substrate to be cleaned with the cleaning composition according to any of claims 1 to 5, wherein the substrate to be cleaned is a substrate that has been polished with a polishing composition.
- 25 7. The method for cleaning a substrate according to claim 6, wherein the substrate is a Ni-P-plated aluminum alloy substrate.
8. The method for cleaning a substrate according to claim 6 or 7, wherein the polishing composition is a polishing composition containing silica abrasive grains.
- 30 9. A method for producing a hard disk substrate, comprising a cleaning process

of cleaning a substrate to be cleaned with the cleaning composition according to any of claims 1 to 5,

wherein the substrate to be cleaned is a substrate that has been polished with a polishing composition.