

DESCRIPTION

POLISHING COMPOSITION

5 CROSS-REFERENCE TO RELATED APPLICATION

[0001]

This application claims priority to Japanese Patent Application No. 2017-250013, the disclosure of which is incorporated herein by reference in its entirety.

10

FIELD

[0002]

The present invention relates to a polishing composition.

15 BACKGROUND

[0003]

In recent years, miniaturization and high integration of printed circuit boards, module boards, package boards or the like have progressed the development of minuter and higher-density wiring. Wires are overlaid into a number of layers to form an irregular profile, which needs to be removed by polishing into a flat profile.

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[0004]

Conventionally, in a printed circuit board or the like, wires formed of copper or a copper alloy are layered on an insulating substrate formed of a resin to form a conductive layer. Known as a polishing composition for polishing copper or the copper alloy is, for example, a polishing composition including abrasive grains such as colloidal silica, a copper complexing agent, alkylbenzenesulfonic acid triethanolamine, and water (Patent Literature 1).

25

30 CITATION LIST

Patent Literature

[0005]

Patent Literature 1 JP 2015-090922 A

SUMMARY

5 Technical Problem

[0006]

Recently, there has been a demand for polishing the resin constituting the insulating substrate at the same time as polishing the copper or the copper alloy. In particular, it has been demanded to polish the resin at a high selectivity ratio relative to the copper or the copper alloy. However, no consideration has been previously given on a polishing composition for simultaneously polishing the copper or the copper alloy and the resin.

[0007]

15 The present invention has been conceived in view of such circumstances, and it is therefore an object of the present invention to provide a polishing composition capable of decreasing the polishing speed for copper or a copper alloy relative to the polishing speed for a resin and reducing the surface roughness of the copper or the copper alloy after being polished.

Solution to Problem

[0008]

25 The present inventors have found that a polishing composition including alumina abrasive grains, glycine, an anionic surfactant, and water can be used to simultaneously polish copper or a copper alloy and a resin to be thereby capable of decreasing the polishing speed for the copper or the copper alloy relative to the polishing speed for the resin and reducing the surface roughness of the copper and the copper alloy after being polished.

30 The summary of the present invention is provided below.

[0009]

The polishing composition according to the present invention is a polishing composition for polishing copper or a copper alloy and a resin, and includes alumina abrasive grains, glycine, an anionic surfactant, and water.
[0010]

5 In the polishing composition according to the present invention, the content of the glycine is preferably 0.3 mass % or more.
[0011]

 In the polishing composition according to the present invention, the anionic surfactant is preferably an alkylbenzenesulfonic acid.
10 [0012]

 The polishing composition according to the present invention preferably has a pH of 7.0 or more and 11.0 or less.

BRIEF DESCRIPTION OF THE DRAWINGS

15 [0013]

 Fig. 1 is a graph showing the polishing speed for polyimide and copper when polished using a polishing composition of each of Examples and Comparative Examples, and the surface roughness of copper after being polished.

20

DESCRIPTION OF EMBODIMENTS

[0014]

 Hereinafter, a polishing composition according to an embodiment of the present invention will be described.

25 [0015]

<Polishing composition>

 The polishing composition according to the embodiment of the present invention includes alumina abrasive grains, glycine, an anionic surfactant, and water.

30 [0016]

(Alumina abrasive grains)

The polishing composition according to this embodiment includes alumina abrasive grains. The alumina abrasive grains are not particularly limited, and may be appropriately selected from various known kinds of alumina particles for use. Examples of such known kinds of alumina particles include α -alumina, γ -alumina, δ -alumina, θ -alumina, η -alumina, κ -alumina, and χ -alumina. The examples of the known kinds of alumina particles further include alumina called fumed alumina (typically alumina fine particles produced when alumina salt is calcined at a high temperature), and alumina called colloidal alumina or alumina sol (for example an alumina hydrate such as boehmite), based on classification according to production methods. These kinds of alumina particles may be individually used, or two or more of them may be used in combination.

[0017]

The content of the alumina abrasive grains in the polishing composition is preferably 0.3 mass % or more, and preferably 5.0 mass % or less. When the content of the alumina abrasive grains falls within the above range, it is possible to suppress a decrease in storage stability while maintaining a high polishing capability. The content of the alumina abrasive grains is more preferably 1.0 mass % or more, and more preferably 3.0 mass % or less. In the case where two or more kinds of the alumina abrasive grains are included, the content of the alumina abrasive grains shall be the total content of the two or more kinds of the alumina abrasive grains.

[0018]

In the polishing composition according to this embodiment, in which the abrasive grains are the alumina abrasive grains, the anionic surfactant to be described later is absorbed on surfaces of the alumina abrasive grains to form clusters. As a result, dispersibility of the alumina abrasive grains can be improved to prevent the alumina abrasive grains from precipitating, thus allowing the polishing composition to be uniformly supplied on a polishing pad. In the polishing composition according to this embodiment,

in which the abrasive grains are the alumina abrasive grains, the particle size of the clusters formed is larger than the particle size of the alumina abrasive grains. This configuration enables an increased polishing speed for a resin.

5 [0019]
(Glycine)

The polishing composition according to this embodiment includes glycine. The polishing composition including the glycine can reduce the surface roughness of copper or a copper alloy after being polished.

10 [0020]

The content of the glycine in the polishing composition is preferably 0.3 mass % or more, and preferably 15.0 mass % or less. When the content of the glycine falls within the above range, the surface roughness of the copper or the copper alloy after being polished can be further reduced. The
15 content of the glycine is more preferably 0.4 mass % or more, and more preferably 5.0 mass % or less.

[0021]
(Anionic surfactant)

The polishing composition according to this embodiment includes an
20 anionic surfactant. Examples of the anionic surfactant include a polyacrylic acid, an alkylbenzenesulfonic acid, an alkanesulfonic acid, and an α -olefinsulfonic acid, and salts thereof. Among these, the alkylbenzenesulfonic acid or the salt thereof is preferable. These anionic surfactants may be individually used, or two or more kinds of them may be
25 used in combination.

[0022]

Examples of the alkylbenzenesulfonic acid include alkylbenzenesulfonic acids from C6 to C20, specifically a decylbenzenesulfonic acid, a undecylbenzenesulfonic acid, a
30 dodecylbenzenesulfonic acid, a tridecylbenzenesulfonic acid, and a tetradecylbenzenesulfonic acid. Among these, the dodecylbenzenesulfonic

acid is preferable in terms of the absorption speed on the surface of copper or a copper alloy and in terms of the ease of polishing. Further, examples of alkylbenzenesulfonate include sodium alkylbenzenesulfonate and alkylbenzenesulfonic acid triethanolamine.

5 [0023]

The polishing composition according to this embodiment includes an anionic surfactant. Thus, the anionic surfactant is absorbed on the surface of copper or a copper alloy at the time of polishing to protect the copper or the copper alloy. As a result, the polishing speed for the copper or the copper alloy can be decreased relative to the polishing speed for the resin. Further, in the polishing composition, the anionic surfactant forms clusters by being absorbed on the surfaces of the abovementioned alumina abrasive grains, to thereby improve dispersibility of the alumina abrasive grains. This can prevent the alumina abrasive grains from precipitating, and thus allows the polishing composition to be uniformly supplied on a polishing pad. The particle size of the clusters formed is larger than the particle size of the alumina abrasive grains. This configuration enables an increased polishing speed for the resin.

[0024]

20 In the polishing composition, the content of the anionic surfactant is preferably 0.3 mass % or more, and preferably 3.0 mass % or less. When the content of the anionic surfactant falls within the above range, the polishing speed for copper or a copper alloy can be further decreased relative to the polishing speed for a resin. The content of the anionic surfactant is more preferably 0.5 mass % or more, and more preferably 1.5 mass % or less. In the case where two or more kinds of the anionic surfactants are included, the content of the anionic surfactants shall be the total content of the two or more kinds of the anionic surfactants.

[0025]

30 (Water)

In the polishing composition according to this embodiment, the

alumina abrasive grains, the glycine and the anionic surfactant are dissolved or suspended in water. It is preferable that the water including few impurities, such as ion exchange water, be used so as not to inhibit various actions of the alumina abrasive grains, the glycine and the anionic
5 surfactant.

[0026]

(Defoamer)

The polishing composition according to this embodiment may include a defoamer as required. This configuration allows foaming of the polishing
10 composition to be suppressed and allows copper or a copper alloy and a resin to be more uniformly polished. Examples of the defoamer include a silicone emulsion and a nonionic surfactant. In the polishing composition, the content of the defoamer is preferably 0.05 mass % or more, and preferably 0.3 mass % or less.

15 [0027]

(pH adjuster)

It is preferable that the polishing composition according to this embodiment have a pH of 7.0 or more and 11.0 or less. This configuration can improve the mechanical polishing power for a resin and increase the
20 polishing speed for the resin. With regard to copper or a copper alloy, on the other hand, this configuration allows the anionic surfactant to be absorbed on the surface of the copper or the copper alloy to thereby enable a decrease in the polishing speed for the copper or the copper alloy. In order to adjust the pH within the above range, the polishing composition according to this
25 embodiment may include a pH adjuster as required. Examples of the pH adjuster include: an acid such as an organic acid or an inorganic acid; an inorganic base such as ammonia or KOH; and an organic base such as tetramethylammonium hydroxide (TMAH).

[0028]

30 The polishing composition according to the present invention is not limited to the abovementioned embodiment. Further, the polishing

composition according to the present invention is not limited to the abovementioned operational effects, either. Various modifications can be made to the polishing composition according to the present invention without departing from the gist of the present invention.

5 [0029]

<Polishing object>

The polishing composition according to this embodiment is for polishing copper or a copper alloy and a resin. Examples of the copper or the copper alloy include copper, a tin-copper alloy, and a nickel-copper alloy.

10 Examples of the resin include an epoxy resin, a phenol resin, and a polyimide resin.

[0030]

Examples of the polishing object to be polished with the polishing composition according to this embodiment include a printed circuit board, a module board, and a package board, which include the copper or the copper alloy and the resin.

Examples

[0031]

20 Hereinafter, examples of the present invention will be described. However, the present invention is not limited to the following examples.

[0032]

<Preparation of polishing composition>

25 The polishing compositions of Examples and Comparative Examples having the respective compositions shown in Table 1 were prepared.

Details of each component are shown below:

Alumina abrasive grains: A9225 (manufactured by Saint-Gobain K.K.)

Glycine: manufactured by FUSO CHEMICAL CO., LTD.

30 LAS: Triethanolamine dodecylbenzenesulfonate (manufactured by TOHO Chemical Industry Co., Ltd.)

Silicone-based defoamer : Silicone emulsion (manufactured by SENKA corporation)

KOH: manufactured by TOAGOSEI CO., LTD.

Water: ion-exchanged water

5 [0033]

<Measurement of pH>

The pH of the polishing composition of each of Examples and Comparative Examples was measured using a pH meter.

[0034]

10 <Measurement of polishing speed>

Using the polishing composition of each of Examples and Comparative Examples, a polishing object was polished under the following conditions to obtain the polishing speed. The results are shown in Table 1 and Fig. 1.

15 Polishing object: Polyimide (deposited on silicon wafers), copper (plated on silicon wafers)

Polisher: FREX (manufactured by EBARA CORPORATION)

Polishing pressure: 3 psi

Slurry flow rate: 300 mL/min

20 Platen rotation speed / carrier rotation speed: 103 rpm / 97 rpm

Polishing time: 1 minute

Polishing pad: IC1000 (Nitta Haas Incorporated)

[0035]

<Measurement of surface roughness>

25 Copper was polished using the polishing composition of each of Examples and Comparative Examples, and thereafter the surface roughness Ra of the copper was measured using a contactless surface roughness measuring instrument (Wyko NT9300 manufactured by Veeco). The measurement results are shown in Table 1 and Fig. 1.

30 [0036]

<Evaluation of dispersion stability>

100 ml of the polishing composition of each of Examples and Comparative Examples was put in a plastic container having a transparent or translucent side wall and was sufficiently stirred therein, followed by being allowed to stand at room temperature for 10 minutes to obtain a slurry of each polishing composition. Then, the slurry was visually observed to evaluate its dispersion stability. The evaluation criteria are as follows. The evaluated results are shown in Table 1.

○: It is not observed that the abrasive grains are precipitated in the lower part of the container.

×: It is observed that the abrasive grains are being precipitated in the lower part of the container.

[0037]

Table 1

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	C. Ex. 1	C. Ex. 2	C. Ex. 3
Composition (mass %)	Alumina abrasive grains	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
	Glycine	0.1	0.2	0.3	0.4	0.5	0.3	—	0.3	0.3
	Anionic surfactant	0.5	0.5	0.5	0.5	0.5	1.0	—	—	—
	Defoamer	0.1	0.1	0.1	0.1	0.1	0.1	—	—	0.1
	pH adjuster	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Water	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance
	pH	9.8	9.3	9.2	9.0	8.9	9.2	12.5	9.7	9.7
	Polishing speed of polyimide (nm/min)	527	493	523	500	506	502	370	329	297
	Polishing speed of copper (nm/min)	58	57	53	57	56	54	58	166	156
	Copper surface roughness Ra (nm)	26.8	19.5	2.3	1.6	1.9	3.2	43.5	2.8	2.5
Dispersion stability		○	○	○	○	○	○	○	×	×

As shown in Table 1, the polishing compositions of Examples 1 to 7 that meet all the requirements of the present invention can decrease the polishing speed for the copper relative to the polishing speed for the polyimide resin, and reduce the surface roughness of the copper after being polished. The polishing compositions of Examples 1 to 7 can improve dispersibility of the alumina abrasive grains.

[0039]

In addition, the polishing compositions of Examples 3 to 7, in which the content of the glycine is 0.3 mass % or more, can further reduce the surface roughness of the copper after being polished.

[0040]

On the other hand, the polishing compositions of Comparative Examples 1 to 3, which do not include the anionic surfactant, cannot sufficiently decrease the polishing speed for the copper relative to the polishing speed for the polyimide resin. Further, the polishing composition of Comparative Example 1, which does not include the glycine, cannot sufficiently reduce the surface roughness of the copper after being polished.

CLAIMS

1. A polishing composition for polishing copper or a copper alloy and a resin, comprising:
 - 5 alumina abrasive grains;
 - glycine;
 - an anionic surfactant; and
 - water.
- 10 2. The polishing composition according to claim 1, wherein the content of the glycine is 0.3 mass % or more.
3. The polishing composition according to claim 1 or 2, wherein the anionic surfactant is an alkylbenzenesulfonic acid.
- 15 4. The polishing composition according to claim 1 or 2, having a pH of 7.0 or more and 11.0 or less.
5. The polishing composition according to claim 3, having a pH of 7.0 or
20 more and 11.0 or less.