DESCRIPTION

TITLE OF INVENTION:

MICROPROCESSING TREATMENT AGENT AND MICROPROCESSING TREATMENT METHOD USING SAME

TECHNICAL FIELD

[0001]

The present invention relates to a microprocessing treatment agent for use in etching, cleaning, or other processes in the manufacture of semiconductor devices, liquid crystal display devices, micromachines (micro electro mechanical systems (MEMS)) devices, etc., and to a microprocessing treatment method using such an agent. More specifically, the invention relates to a microprocessing treatment agent and a microprocessing treatment method for use in etching, cleaning, or other processing of a structure including a laminate of a silicon nitride film and a silicon oxide film.

BACKGROUND ART

[0002]

Among semiconductor device manufacturing processes, one of the most important processes is patterning and etching of a silicon oxide film, a silicon nitride film, a polysilicon film, a metal film, or any other film formed on

the surface of a wafer into the desired shape. Wet etching, one of such etching techniques, has required a fine processing technique capable of selectively etching only an etching target film.

[0003]

When a silicon oxide film is the target of etching, examples of such a fine processing technique include techniques using buffered hydrofluoric acid or hydrofluoric acid. Unfortunately, when such buffered hydrofluoric acid or hydrofluoric acid is used as a microprocessing treatment agent in the processing of a laminated film composed of a silicon oxide film and a silicon nitride film, the silicon nitride film is also etched at the same time. As a result, patterning into the desired shape becomes difficult.

[0004]

For example, a microprocessing treatment method using an agent containing hydrofluoric acid and an anionic surfactant such as ammonium lauryl sulfate can solve such a problem and selectively etch only a silicon oxide film (see Patent Document 1 listed below). Unfortunately, such a microprocessing treatment agent has very high foaming ability and therefore is not suitable for use in semiconductor device manufacturing processes.

[0005]

For example, dynamic random access memory (DRAM) is a

semiconductor device that is produced through wet etching with a microprocessing treatment agent. A DRAM cell includes one transistor and one capacitor. DRAM integration has increased about four times in the last three years. DRAM integration is generally achieved by integration of capacitors. Therefore, while the area occupied by a capacitor is reduced, an increase in capacitor area, a reduction in capacitor insulating film thickness, and incorporation of a high dielectric constant film are made so that the capacitance required for stable storage operation can be ensured.

[0006]

A silicon oxide film has been used as the capacitor insulating film, and a reduction in the film thickness has been made. However, the reduction in the thickness of a silicon oxide film as a capacitor insulating film has reached a limit for 1 Mbit DRAM. In a 4 Mbit DRAM, therefore, a silicon nitride film is used as an insulating film. As integration has proceeded, a tantalum oxide film has also begun to be used.

[0007]

A 64 Mbit generation DRAM has a cylindrical capacitor structure. The problem described below occurs when a conventional etchant is used in a process that includes forming cylindrical capacitor lower electrodes and then

removing the formed silicon oxide film by wet etching to form a capacitor.

[0008]

Specifically, after the capacitor lower electrodes are formed, the formed silicon oxide film is removed by wet etching, and rinsing with ultrapure water and drying are further performed. The drying process has the problem that due to the surface tension of water present between the capacitor lower electrodes, a "leaning" phenomenon, in which the lower electrodes lean and come into contact with each other, frequently occurs to induce 2-bit failure. Thus, Patent Document 2 listed below discloses a technique for forming a silicon nitride support film between capacitor lower electrodes. Patent Document 3 listed below also discloses a technique for forming a silicon nitride film as an insulating film for improving insulating properties from bit lines, and Patent Document 4 listed below also discloses a technique for forming a silicon nitride film as an etching stopper film for the subsequent process of etching a silicon oxide film.

[0009]

In these semiconductor device manufacturing processes, the use of a conventional etchant has the problem that the silicon nitride support film disclosed in Patent Document 2, the silicon nitride film disclosed in Patent Document 3, or

the silicon nitride film disclosed as an etching stopper film in Patent Document 4 is also etched together with the etching target.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0010]

Patent Document 1: Japanese Patent Application Laid-Open (JP-A) No. 2005-328067

Patent Document 2: JP-A No. 2003-297952

Patent Document 3: JP-A No. 10-98155

Patent Document 4: JP-A No. 2000-22112

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0011]

The invention has been made in view of the above problems, and an object of the invention is to provide a microprocessing treatment agent that allows selective fine processing of a silicon oxide film when a laminated film composed of at least a silicon oxide film and a silicon nitride film is subjected to fine processing, and to provide a microprocessing treatment method using such an agent.

MEANS FOR SOLVING THE PROBLEMS

[0012]

To solve the conventional problems, the inventors have made studies on microprocessing treatment agents and microprocessing treatment methods using them. As a result, the invention has been completed based on the finding that a microprocessing treatment agent prepared by adding a certain concentration of an acid to an aqueous solution containing hydrogen fluoride or at least one of ammonium fluoride or quaternary ammonium fluoride makes it possible to perform selective fine processing of a silicon oxide film in the processing of a laminated film composed of the silicon oxide film and a silicon nitride film.

[0013]

Thus, to solve the above problems, the invention is directed to a microprocessing treatment agent for use in fine processing of an object having a silicon nitride film and a silicon oxide film, which includes: at least one of a component (A) or a component (B); a component (C); and a component (D), wherein

the component (A) is 0.01% by weight to 20% by weight of hydrogen fluoride,

the component (B) is 0.1% by weight to 20% by weight of at least one of ammonium fluoride or quaternary ammonium fluoride,

the component (C) is 1% by weight to 80% by weight of at least one acid selected from the group consisting of hydrochloric acid, nitric acid, sulfuric acid, and phosphoric acid,

the component (D) is water, and

the total content of at least one of the component (A) or the component (B) and the component (C) is 90% by weight or less, based on the total amount of the microprocessing treatment agent.

[0014]

According to the feature, the composition containing a combination of at least one of the component (A) or the component (B) and the component (C) can have high etching selectivity of a silicon oxide film to a silicon nitride film (silicon oxide film/silicon nitride film). Therefore, when the microprocessing treatment agent of the invention is used in fine processing of an object including a silicon oxide film and a silicon nitride film stacked sequentially, selective fine processing of the silicon oxide film to the silicon nitride film can be achieved. This can improve the yield ratio in a semiconductor device manufacturing process.

[0015]

In the composition, the content of the acid as the component (C) is in the range of 1 to 80% by weight. When the lower limit is set at 1% by weight, the addition of the

acid is effective in making possible selective etching of a silicon oxide film. On the other hand, when the upper limit is set at 80% by weight, the reaction product produced by fine processing of a silicon oxide film can be smoothly dissolved in the microprocessing treatment agent, so that fine processing of the silicon oxide film can be facilitated. In this case, the increase in the viscosity of the microprocessing treatment agent can also be suppressed, so that the ability of a rinse agent such as ultrapure water to remove the microprocessing treatment agent can be kept high. As used herein, the term "fine processing" is intended to include etching of a processing target film and cleaning of the surface of a processing target film.

[0016]

The silicon oxide film is preferably any one of a native oxide film, a thermal silicon oxide film, a non-doped silicate glass film, a phosphorus-doped silicate glass film, a boron-doped silicate glass film, a boron-and-phosphorus-doped silicate glass film, a TEOS film, or a fluorine-containing silicon oxide film.

[0017]

To solve the above problems, the invention is also directed to a microprocessing treatment method, which includes performing selective fine processing of a silicon

oxide film using the microprocessing treatment agent described above.

EFFECTS OF THE INVENTION

[0018]

The invention produces the advantageous effects as described below by the means described above.

Specifically, when a laminated film composed of at least a silicon oxide film and a silicon nitride film is subjected to fine processing, the invention makes possible selective fine processing of only the silicon oxide film, so that successful fine processing can be achieved, for example, in the manufacture of semiconductor devices, liquid crystal display devices, micromachine devices, etc.

EMBODIMENTS OF THE INVENTION

[0019]

An embodiment of the invention is described below.

A microprocessing treatment agent according to an embodiment of the invention contains at least one of the component (A) or (B) below and contains the components (C) and (D) below.

Component (A): 0.01% by weight to 20% by weight of hydrogen fluoride

Component (B): 0.1% by weight to 20% by weight of at

least one of ammonium fluoride or quaternary ammonium fluoride

Component (C): 1% by weight to 80% by weight of at least one acid selected from the group consisting of hydrochloric acid, nitric acid, sulfuric acid, and phosphoric acid

Component (D): water

[0020]

The content of hydrogen fluoride as the component (A) is in the range of 0.01 to 20% by weight, preferably in the range of 0.1 to 10% by weight, based on the total amount of the microprocessing treatment agent. If the hydrogen fluoride content is less than 0.01% by weight, the hydrogen fluoride concentration will be difficult to control so that there may be significant variations in the etch rate for a silicon oxide film. If the hydrogen fluoride content is more than 20% by weight, the etch rate for a silicon oxide film will be too high so that the etching controllability may be low. In addition, hydrogen fluoride gas may vaporize significantly so that the microprocessing treatment agent may be difficult to handle.

[0021]

The component (B) only has to include at least one of ammonium fluoride or quaternary ammonium fluoride. Examples of the quaternary ammonium fluoride include, but

are not limited to, tetramethylammonium fluoride, tetraethylammonium fluoride, triethylmethylammonium fluoride, and choline fluoride.

[0022]

The content of the component (B) is in the range of 0.1 to 20% by weight, preferably in the range of 0.5 to 10% by weight, based on the total amount of the microprocessing treatment agent. If the content of the component (B) is less than 0.1% by weight, the concentration of the component (B) in the fine processing agent will be difficult to control so that there may be significant variations in the etch rate for a silicon oxide film. If the content of the component (B) is more than 20% by weight, it will be close to the saturation solubility of the component (B) so that crystals may precipitate out of the microprocessing treatment agent depending on the liquid temperature.

[0023]

The component (C) is at least one acid selected from the group consisting of hydrochloric acid, nitric acid, sulfuric acid, and phosphoric acid. Among these acids, sulfuric acid is preferred from the viewpoint of the selectivity of a silicon oxide film to a silicon nitride film.

[0024]

The content of the component (C) is in the range of 1 to 80% by weight, preferably in the range of 40 to 70% by weight, based on the total amount of the microprocessing treatment agent. If the content of the component (C) is less than 1% by weight, the addition of the acid may fail to be effective, so that selective etching of a silicon oxide film or the like may be difficult to achieve. If the content of the component (C) is more than 80% by weight, the reaction product produced by the etching of a silicon oxide film may be inhibited from dissolving in the microprocessing treatment agent, so that the etching of the silicon oxide film may be inhibited. In addition, the viscosity of the microprocessing treatment agent may increase, which may reduce the ability of a rinse agent such as ultrapure water to rinse and remove the microprocessing treatment agent.

[0025]

The total content of at least one of the component (A) or the component (B) and the component (C) is 90% by weight or less, preferably 70% by weight or less, based on the total amount of the microprocessing treatment agent. When the total content of at least one of the component (A) or the component (B) and the component (C) is 90% by weight or less, the reaction product produced by the etching of a silicon oxide film can be smoothly dissolved in the

microprocessing treatment agent, so that variations in the etch rate for a silicon oxide film can be reduced. In addition, the increase in the viscosity of the microprocessing treatment agent can be suppressed, which can increase the ability of a rinse agent such as ultrapure water to remove the microprocessing treatment agent.

[0026]

The microprocessing treatment agent according to an embodiment of the invention may also contain a third component. For example, the third component may be a surfactant. For example, when the microprocessing treatment agent has a pH of less than 2, the surfactant is preferably, but not limited to, a nonionic surfactant such as polyethylene glycol alkyl ether, polyethylene glycol alkyl phenyl ether, or polyethylene glycol fatty acid ester. When the microprocessing treatment agent has a pH of 2 or more, the surfactant is preferably at least one selected from the group consisting of an aliphatic alcohol, an aliphatic carboxylic acid, a hydrofluoroalkyl alcohol, a hydrofluoroalkylcarboxylic acid, a hydrofluoroalkylcarboxylic acid salt, an aliphatic amine salt, and an aliphatic sulfonic acid. When the microprocessing treatment agent has a pH of 2 or more, the microprocessing treatment agent may be solid or liquid.

[0027]

The content of the surfactant is preferably in the range of 0.001 to 0.1% by weight, more preferably in the range of 0.003 to 0.05% by weight. The added surfactant can inhibit roughening of the surface of a silicon nitride film, a semiconductor substrate, or any other material during an etching process. In ultra large scale integration, conventional microprocessing treatment agents are more likely to remain locally on a finely patterned surface of a semiconductor substrate, so that uniform etching becomes more difficult when the resist spacing is set at about 0.5 μm or less. In contrast, when the surfactant-containing microprocessing treatment agent according to the invention is used as an etchant, the etchant has improved wettability to the surface of a semiconductor substrate, so that the in-plane uniformity of etching across the substrate is improved. If the content is less than 0.001% by weight, the surface tension of the microprocessing treatment agent may be reduced insufficiently, so that the effect of improving wettability may be insufficient. If the content is more than 0.1% by weight, not only the resulting effect may fail to be proportional to the content, but also defoaming ability may be degraded so that foam may adhere to the etched surface to cause uneven etching or that foam may enter fine spaces to cause etching failure.

[0028]

In an embodiment of the invention, the microprocessing treatment agent may further contain a non-surfactant additive as long as the effects are not inhibited. Examples of such an additive include hydrogen peroxide and a chelating agent.

[0029]

The microprocessing treatment agent according to an embodiment of the invention may be produced by mixing the components (A), (B), (C), and (D) in any order. When a hydroxide is used as a raw material for the component (B), the component (B) can be obtained by properly adding hydrofluoric acid to the hydroxide so that a fluoride can be formed by neutralization. Alternatively, a hydroxide as a raw material may be added to a solution containing at least hydrogen fluoride as the component (A) without neutralization with hydrofluoric acid, so that a solution containing the component (B) can be formed as a result of partial neutralization of the hydrogen fluoride. In such a process, for example, the hydroxide as a raw material for the component (B) may be ammonium hydroxide, tetramethylammonium hydroxide, tetraethylammonium hydroxide, triethylmethylammonium hydroxide, or a hydroxide of an ammonium such as choline.

[0030]

Next, a description is given of a microprocessing treatment method using the microprocessing treatment agent according to an embodiment of the invention, in which wet etching is used as an example.

[0031]

For example, the microprocessing treatment agent according to an embodiment of the invention is used to process an object including a substrate and a silicon nitride film and a silicon oxide film, which are formed on the substrate. More specifically, such an object includes a substrate and a silicon nitride film and a silicon oxide film, which are provided on the same surface of the substrate, a substrate and a laminated film which includes a silicon nitride film and a silicon oxide film stacked in this order on the substrate, or a substrate and a laminated film which includes a silicon oxide film and a silicon nitride film stacked in this order on the substrate. The silicon oxide film may be a native oxide film, a thermal silicon oxide film, a non-doped silicate glass film, a phosphorus-doped silicate glass film, a boron-doped silicate glass film, a boron-and-phosphorus-doped silicate glass film, a TEOS film, or a fluorine-containing silicon oxide film.

[0032]

In an embodiment of the invention, the

microprocessing treatment agent may be used in various wet etching methods. Etching methods include immersion methods, spraying methods, etc., and the microprocessing treatment agent of the invention may be used in any of these methods. Immersion methods are preferred, because vaporization-induced changes in the composition of the microprocessing treatment agent are small in the etching process.

[0033]

When the microprocessing treatment agent is used as an etchant, the etching temperature (the temperature of the microprocessing treatment agent) is preferably in the range of 5 to 50°C, more preferably in the range of 15 to 35°C, even more preferably in the range of 20 to 30°C. Within the above range, vaporization of the microprocessing treatment agent can be suppressed so that changes in composition can be prevented. At high temperature, the etch rate becomes difficult to control due to the evaporation of the microprocessing treatment agent, and at low temperature, some components of the microprocessing treatment agent are more likely to crystallize so that the etch rate can disadvantageously decrease or particles in the liquid can disadvantageously increase. When the etching temperature is in the above range, these disadvantages can also be avoided. Depending on the etching temperature, the etch rate varies from one film to

another, and therefore, the difference between the etch rate for a silicon oxide film and the etch rate for a silicon nitride film may be influenced in some cases.

[0034]

In an embodiment of the invention, the microprocessing treatment agent preferably has an etch rate in the range of 1 to 10,000 nm/minute, more preferably in the range of 15 to 3,000 nm/minute, for a silicon oxide film at 25°C. If the etch rate is less than 1 nm/minute, fine processing such as etching may take a long time so that production efficiency may be deteriorated. If it is more than 10,000 nm/minute, a reduction in film thickness controllability after the etching or roughening of the substrate surface (the opposite surface from the surface on which a silicon oxide film or the like is formed) may be significant, so that the yield may be lowered.

EXAMPLES

[0035]

Hereinafter, preferred examples of the invention are illustratively described in detail. It will be understood that the materials, the amounts, and so on described in the examples are illustrative only and are not intended to limit the scope of the invention, unless otherwise specified.

[0036]

(Etch Rates for Silicon Oxide Film and Silicon Nitride Film)

An optical film thickness meter (Nanospec 6100 manufactured by Nanometrics Japan LTD) was used to measure the thicknesses of a silicon oxide film and a silicon nitride film before and after etching, and to determine changes in film thickness caused by the etching. The measurement was repeatedly performed for three different etching times when the etch rates were calculated. Substrates on which a silicon nitride film and a silicon oxide film were formed, respectively, were used as the objects to be processed.

[0037]

(Example 1)

Eighty-three parts by weight of sulfuric acid (96% by weight in concentration, manufactured by Mitsubishi Chemical Corporation) was added to a solution of a mixture of 10 parts by weight of hydrogen fluoride (high-purity grade for semiconductor applications, 50% by weight in concentration, manufactured by Stella Chemifa Corporation) and 7 parts by weight ultrapure water, and mixed by stirring. Subsequently, the mixture solution was controlled to a temperature of 25°C and allowed to stand for 3 hours. Thus, an etchant (microprocessing treatment

agent) was prepared which contained 5% by weight of hydrogen fluoride and 80% by weight of sulfuric acid.

[0038]

Subsequently, the substrates on which the silicon nitride film and the silicon oxide film were formed, respectively, were immersed in the etchant, and etch rates were measured for a BPSG film as the silicon oxide film and for the silicon nitride film. In addition, etch rate selectivity (silicon oxide film/silicon nitride film) was also evaluated. In the measurement, the temperature of the etchant was set at 25°C. The results are shown in Table 1 below.

[0039]

(Examples 2 to 9)

The etchants of Examples 2 to 9 were prepared as in Example 1, except that the content of the component (A) (hydrogen fluoride), the content and type of the component (B), and the content and type of the component (C) were changed as shown in Table 1. Using the etchant obtained in each example, etch rates for the BPSG film and the silicon nitride film, and etch rate selectivity (silicon oxide film/silicon nitride film) were also evaluated. The results are shown in Table 1 below.

[0040]

(Comparative Examples 1 and 2)

The etchant of Comparative Example 1 was prepared as in Example 1, except that an acid as the component (C) was not added as shown in Table 1. The etchant of Comparative Example 2 was prepared as in Example 7, except that an acid as the component (C) was not added as shown in Table 1. Using the etchant obtained in each comparative example, etch rates for the BPSG film and the silicon nitride film, and etch rate selectivity (silicon oxide film/silicon nitride film) were also evaluated as in Example 1. The results are shown in Table 1 below.

[0041]

(Results)

As is also evident from Table 1 below, when the etchant according each of Comparative Examples 1 and 2 not containing an acid as the component (C) was used, selective etching of the BPSG film was suppressed so that it was not possible to increase the etch rate selectivity of the silicon oxide film to the silicon nitride film (silicon oxide film/silicon nitride film).

[0042]

In contrast, it was demonstrated that when the etchant used contained at least one of the component (A) or the component (B) and the component (C) according to each of Examples 1 to 9, the etch rate for the silicon oxide film was able to be selectively increased, so that the etch

rate selectivity of the silicon oxide film to the silicon nitride film (silicon oxide film/silicon nitride film) was successfully increased.

[0043]

[Table 1]

	Component (a)	Component (b)		Component (c)		Etch rate (at 25°C)		Etch rate selectivity (silicon oxide film/silicon nitride film)
	Hydrogen fluoride	Type	Concentration	Type	Concentration	Silicon nitride film	BPSG film (silicon oxide film)	
	[wt%]		[wt%]		[wt%]	[Å/minute]	[Å/minute]	-
Example 1	5	-	-	Sulfuric acid	80	15	26088	1739
Example 2	5	-	-	Hydrochloric acid	20	21	13357	630
Example 3	5	-	-	Phosphoric acid	60	39	20544	529
Example 4	20	-	-	Nitric acid	5	71	29040	409
Example 5	0.1	-	-	Sulfuric acid	40	0.86	323	376
Example 6	-	Ammonium fluoride	10	Sulfuric acid	50	25	22080	883
Example 7	1	Ammonium fluoride	5	Sulfuric acid	40	22	13854	639
Example 8	3	Tetraethylammonium fluoride	5	Hydrochloric acid	10	14	4316	319
Example 9	3	Tetraethylammonium fluoride	5	Sulfuric acid	40	23	16519	705
Comparative Example 1	5	-	-	—	-	23	3759	166
Comparative Example 2	1	Ammonium fluoride	5	-	-	4.6	824	179

[0044]

(Examples 10 to 14)

The etchants of Examples 10 to 14 were prepared as in Example 1, except that the content of the component (A) (hydrogen fluoride), the content and type of the component (B), and the content and type of the component (C) were changed as shown in Table 2. Using the etchant obtained in each example, etch rates for a non-doped silicate glass film as the silicon oxide film and for the silicon nitride film, and etch rate selectivity (silicon oxide film/silicon nitride film) were also evaluated as in Example 1. The results are shown in Table 2 below.

[0045]

(Comparative Examples 3 and 4)

The etchant of Comparative Example 3 was prepared as in Example 10, except that the component (C) was not added as shown in Table 2. The etchant of Comparative Example 4 was prepared as in Example 11, except that the component (B) was not added as shown in Table 2. Using the etchant obtained in each comparative example, etch rates for the non-doped silicate glass film and the silicon nitride film, and etch rate selectivity (silicon oxide film/silicon nitride film) were also evaluated as in Example 1. The results are shown in Table 2 below.

[0046]

(Results)

As is also evident from Table 2 below, when the etchant according each of Comparative Examples 3 and 4 not containing an acid as the component (C) was used, selective etching of the non-doped silicate glass film was suppressed so that it was not possible to increase the etch rate selectivity of the silicon oxide film to the silicon nitride film (silicon oxide film/silicon nitride film).

[0047]

In contrast, it was demonstrated that when the etchant used contained at least one of the component (A) or the component (B) and the component (C) according to each of Examples 10 to 14, the etch rate for the silicon oxide film was able to be selectively increased, so that the etch rate selectivity of the silicon oxide film to the silicon nitride film (silicon oxide film/silicon nitride film) was successfully increased.

[0048]

[Table 2]

	Component (a)	Component (b)		Component (c)		Etch rate (at 25°C)		Etch rate selectivity (silicon oxide film/silicon nitride film)
	Hydrogen fluoride	Type	Concentration	Type	Concentration	Silicon nitride film	Non-doped silicate glass film (silicon oxide film)	
	[wt%]		[wt%]		[wt%]	[Å/minute]	[Å/minute]	-
Example 10	20	-	-	Nitric acid	40	253.0	49845	197
Example 11	5	-	-	Sulfuric acid	60	34	9561	279
Example 12	-	Ammonium fluoride	10	Sulfuric acid	50	25	5098	204
Example 13	10	-	-	Sulfuric acid	40	45	14320	318
Example 14	1	Ammonium fluoride	20	Sulfuric acid	30	43	8160	190
Comparative Example 3	1	Ammonium fluoride	5	-	-	6.0	942	157
Comparative Example 4	5	-	-	-	-	23	1193	53

CLAIMS

1. A microprocessing treatment agent for use in fine processing of an object having a silicon nitride film and a silicon oxide film, comprising:

at least one of a component (A) or a component (B); a component (C); and a component (D), wherein

the component (A) is 0.01% by weight to 20% by weight of hydrogen fluoride,

the component (B) is 0.1% by weight to 20% by weight of at least one of ammonium fluoride or quaternary ammonium fluoride,

the component (C) is 1% by weight to 80% by weight of at least one acid selected from the group consisting of hydrochloric acid, nitric acid, sulfuric acid, and phosphoric acid,

the component (D) is water, and

the total content of at least one of the component (A) or the component (B) and the component (C) is 90% by weight or less, based on the total amount of the microprocessing treatment agent.

2. The microprocessing treatment agent according to claim 1, wherein the silicon oxide film is any one of a native oxide film, a thermal silicon oxide film, a non-

doped silicate glass film, a phosphorus-doped silicate glass film, a boron-doped silicate glass film, a boron-and-phosphorus-doped silicate glass film, a TEOS film, or a fluorine-containing silicon oxide film.

3. A microprocessing treatment method, comprising performing selective fine processing of a silicon oxide film using the microprocessing treatment agent according to claim 1 or 2.