[0006]

Patent Literature 3 discloses a ceria-based composite particle dispersion comprising ceria-based composite particulates, having an average particle diameter of 50 to 300 nm, each of which has a child particle having crystalline ceria as a main component bound to the surface of a mother particle having amorphous silica as a main component. According to the ceria-based composite particulate dispersion, even Si wafers and difficult-to-process materials can be polished at high speed, while a high surface accuracy (such as low scratches) can be achieved.

Citation List

Patent Literature

[0007]

Patent Literature 1: International Publication WO 99/031195

Patent Literature 2: Japanese Patent Laid-Open Publication No. 9-142840

Patent Literature 3: International Publication WO 2016/159167

Summary Technical Problem

[0008]

are easy to remain on the substrate, leading to an increase in defects and thus a decrease in yield.

If a fluorine compound or an amine compound highly reactive with silica is used to increase the chemical polishing action, the polishing speed is improved, but electrical problems due to erosion or residual contamination such as resist contamination are easy to occur.

It is also contemplated that the size of the composite particles is increased and the mechanical polishing action is thereby increased (torque for polishing by friction is increased) to improve the polishing speed. However, it leads to an increase in coarse particles and thereby an increase in defects such as scratches derived from the coarse particles.

Therefore, there is a need to improve the polishing speed by increasing the mechanical polishing action without increasing the particle size of the abrasive grain while keeping the chemical polishing effect.

[0012]

A object of the embodiments disclosed herein is to provide a polishing composition that can polish a substrate having a silica film or the like thereon at high speed by increasing the mechanical friction effect with an abrasive grain not causing defects, and that can achieve high surface accuracy such as low scratches at the same time, and that is suitable for a semiconductor substrate.

whether the friction effect could be increased without increasing the abrasive grain concentration and/or the polishing pressure.

[0014]

As a result of further intensive examination under such consideration, the present inventors have found that the use of a polishing composition comprising a particular microfibril cellulose can dramatically can improve the polishing speed for a substrate having a silica-based film formed thereon, and realizing high surface accuracy (such as low scratches) at the same time, and have thereby completed the present disclosure.

[0015]

In addition, the present inventors have found that based on this finding, both the polishing speed and a reduction in various defects which have been conventional problems to be dissolved can be achieved by using a polishing composition containing an abrasive grain and a particular microfibril cellulose for primary polishing and using a polishing composition containing an abrasive grain suitable for final polishing for secondary polishing. That is, the present inventors have found that based on the fact that the polishing composition containing an abrasive grain and a particular microfibril cellulose has a much faster polishing speed as compared to polishing with the abrasive grain alone, a substrate can be polished at high speed without causing defects

such as scratches to occur, by multistage polishing including rough polishing followed by final polishing.

[0016]

Furthermore, the present inventors have found that the inclusion of a particular acid component and a particular base component in a polishing composition can suppress a decrease in the polishing speed by stabilizing pH of the polishing composition while increasing the ionic strength of the polishing composition, so as to improve the polishing speed.

[0017]

The present inventors have speculated the mechanism of a remarkable improvement in polishing characteristics of the present disclosure as follows:

(1) An abrasive grain is trapped in a modified microfibril cellulose due to the affinity between the surface of the abrasive grain and an oxidized carboxyl group at the C6 position of the modified microfibril cellulose or the like; and in polishing a substrate having a silica-based film formed thereon, the pressing pressure from a polishing pad is thereby effectively transmitted to the abrasive grain while the contact efficiency of the abrasive grain with the substrate is increased and the friction is thereby increased, resulting in improvement in the polishing speed. In addition, the modified microfibril cellulose having the abrasive grain trapped therein is retained appropriately

grain. That is, it has the effect of enabling the occurrence of scratches or the like to be suppressed due to its dispersion effect.

[0021]

That is, the present disclosure is as follows.

[1] In an aspect, there is provided a polishing composition comprising an abrasive grain, a modified microfibril cellulose in which a cellulose unit has a carboxyl group, and a dispersion medium.

[2] The polishing composition according to [1], wherein the modified microfibril cellulose is a modified microfibril cellulose in which at least a part of the cellulose units has a hydroxyl group at the C6 position oxidized to a carboxyl group.

[3] The polishing composition according to [1] or [2], wherein each content of Na and K is 100 ppm or less relative to the solids weight.

[4] The polishing composition according to any one of [1] to [3], wherein each content of Ag, Al, Ca, Cr, Cu, Fe, Mg, Ni, Ti, Zn and Zr is 100 ppm or less relative to the solids weight.

[0022]

[5] The polishing composition according to any one of [1] to [4], wherein the modified microfibril cellulose is an ammonium-type modified microfibril cellulose in which the hydrogen atom of the carboxyl group is replaced by ammonium.

cellulose to the abrasive grain (modified microfibril cellulose/abrasive grain) is 0.002 to 20.

[0024]

[15] In another aspect, there is provided a modified microfibril cellulose in which at least a part of the cellulose units has a hydroxyl group at the C6 position oxidized to a carboxyl group, wherein each content of Na and K is 100 ppm or less.

[16] The modified microfibril cellulose according to [15], wherein each content of Ag, Al, Ca, Cr, Cu, Fe, Mg, Ni, Ti, Zn and Zr is 100 ppm or less.

[17] The modified microfibril cellulose according to [15] or [16], wherein the modified microfibril cellulose is an ammonium-type modified microfibril cellulose in which the hydrogen atom of the carboxyl group is replaced by ammonium.

[0025]

[18] In another aspect, there is provided a method of producing a polishing composition comprising an ammonium-type modified microfibril cellulose, comprising: subjecting to ion exchange using an ion exchange resin, a dispersion comprising a modified microfibril cellulose in which at least a part of the cellulose units has a hydroxyl group at the C6 position oxidized to a carboxyl group; and then adding ammonia or an amine and adding an abrasive grain.

[19] In another aspect, there is provided a method of producing a polishing composition comprising an ammonium-type modified microfibril cellulose, comprising: subjecting to ion exchange with an

ion exchange resin, a dispersion comprising a modified microfibril cellulose in which at least a part of the cellulose units has a hydroxyl group at the C6 position oxidized to a carboxyl group and an abrasive grain; and then adding ammonia or an amine.

[20] In another aspect, there is provided a method of producing an ammonium-type modified microfibril cellulose, comprising: subjecting to ion exchange with an ion exchange resin, a dispersion comprising a modified microfibril cellulose in which at least a part of the cellulose units has a hydroxyl group at the C6 position oxidized to a carboxyl group; and then adding ammonia or an amine.

[0026]

[21] In another aspect, there is provided a method for producing a polished substrate comprising:

a primary polishing step of polishing a substrate with a first polishing composition comprising the polishing composition according to any of [1] to [14]; and

a secondary polishing step of polishing the substrate with a second polishing composition comprising an abrasive grain and a dispersion medium.

[22] The method for producing a polished substrate according to [21], wherein the abrasive grain in the first polishing composition and/or the second polishing composition has an average particle diameter of 10 nm or more and 350 nm or less and a number of coarse particles

wherein the secondary polishing step is a step of feeding the second polishing composition from the second polishing composition holding means and passing it through the filtering means, and then feeding the second polishing composition from the discharging means onto the polishing pad to polish the second polishing composition.

[0028]

[26] In another aspect, there is provided a method for producing a polished substrate, comprising polishing a substrate by dropping the polishing composition according to any one of [1] to [14] onto a polishing pad.

[27] The method for producing a polished substrate according to [26], wherein an abrasive grain has an average particle diameter of 10 nm or more and 350 nm or less and a number of coarse particles of 0.51 μm or more of 100 million particles/mL or less of the abrasive grain on dry basis.

Advantageous Effect

[0029]

According to a polishing composition of the present disclosure, a substrate having a film formed thereon can be polished at high speed while a high surface accuracy such as low scratches can be achieved.

Brief Description of Drawings

[0030]