Claims

[1]

A glass for a magnetic recording medium substrate, comprised of an oxide glass, characterized:

by comprising, denoted as mass percentages:

Si	20 to 40 percent,
Al	0.1 to 10 percent,
Li	0.1 to 5 percent,
Na	0.1 to 10 percent,
K	0 to 5 percent

(where the total content of Li, Na, and K is 15 percent or less),

Sn	0.005 to 0.6 percent, and
Ce	0 to 1.2 percent;

in that the Sb content is 0 to 0.1 percent; and

by not comprising As or F, and wherein the ratio of the Ce content to the Sn content, Ce/Sn, falls within a range of 0.02 to 2.1.

[2]

The glass for a magnetic recording medium substrate according to Claim 1, further characterized in that the ratio of the Ce content to the Sn content, Ce/Sn, falls within a range of 0.02 to 1.3.

[3]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 2, further characterized by not comprising Sb.

[4]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 3, comprising, denoted as mass percentages:

Mg	0 to 5 percent,
Ca	0 to 5 percent,
Sr	0 to 2 percent, and
Ba	0 to 2 percent.

[5]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 4, further characterized by comprising 0.1 to 10 mass percent of Zr, Ti, La, Nb, Ta, and Hf in total.

[6]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 5, characterized by a total content of Mg, Ca, Sr, and Ba of 0 to 10 percent.

[7]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 6, comprising, denoted as mass percentages:

Si 28 to 34 percent,
Al 6 to 10 percent
(where the total content of Si and Al is 37 percent or greater),
Li 0.1 to 3 percent,
Na 5 to 10 percent,
K 0.1 to 1 percent
(where the total content of Li, Na, and K is 7 to 13 percent),
Mg 0.1 to 2 percent,
Ca 0.1 to 2 percent,
Sr and Ba in total 0 to 1 percent,
Zr 1 to 5 percent,
B 0 to 1 percent, and
Zn 0 to 1 percent.

[8]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 6, comprising, denoted as mass percentages:

Si 28 to 34 percent,
Al 6 to 10 percent
(where the total content of Si and Al is 37 percent or greater),
Li 1 to 5 percent,
Na 1 to 10 percent,
K 0.1 to 3 percent
(where the total content of Li, Na, and K is 5 to 11 percent),
Mg 0 to 2 percent,
Ca 0 to 2 percent,
Sr 0 to 1 percent,
Ba 0 to 1 percent,
Zr, Ti, La, Nb, Ta, and Hf in total 1 to 10 percent,
B 0 to 1 percent,
Zn 0 to 1 percent, and
P 0 to 1 percent.

[9]

A method for manufacturing a glass for a magnetic recording medium substrate comprised of an oxide glass, characterized by:

preparing a glass starting material to which Sn, and optionally Ce, are added, comprising, denoted as mass percentages:

Si 20 to 40 percent,
Al 0.1 to 10 percent,
Li 0.1 to 5 percent,
Na 0.1 to 10 percent,
K 0 to 5 percent
(wherein the total content of Li, Na, and K is 15 percent or lower),
Sn 0.005 to 0.6 percent,
Ce 0 to 1.2 percent, and

so as to permit obtaining a glass comprising 0 to 0.1 percent of Sb and no As or F;

melting the glass starting material;

clarifying the resulting glass melt; and

then molding the resulting glass melt.

[10]

The method for manufacturing a glass for a magnetic recording medium substrate according to Claim 9, characterized by:

preparing a glass starting material comprising a ratio of Ce content to Sn content, Ce/Sn, falling within a range of 0.02 to 1.3;

maintaining the resulting glass melt at 1,400 to 1,600°C;

decreasing the temperature;

maintaining the temperature at 1,200 to 1,400°C; and

conducting molding.

[11]

The method for manufacturing a glass for a magnetic recording medium substrate according to Claim 9 or 10, wherein the viscosity of the glass melt at 1,400°C is 10^3 dPa·s or lower.

[12]

The method for manufacturing a glass for a magnetic recording medium substrate according to any one of Claims 9 to 11, wherein the quantities of Sn and Ce added are established so as to achieve a density of residual bubbles in the glass of 100 bubbles/kg or lower.

[13]

A glass for a magnetic recording medium substrate comprised of oxide glass, characterized:

by comprising, as converted based on the oxide, denoted as molar percentages:

SiO_2 60 to 75 percent,

Al_2O_3 1 to 15 percent,

Li_2O 0.1 to 20 percent,

Na_2O 0.1 to 15 percent, and

K_2O 0 to 5 percent

(where the total content of Li_2O, Na_2O, and K_2O is 25 percent or lower);

in that, based on the total amount of the glass components, 0.01 to 0.7 mass percent of Sn oxide and 0 to 1.4 mass percent of Ce oxide are added;

in that the content of Sb oxide is 0 to 0.1 mass percent; and

by not comprising As or F.

[14]

The glass for a magnetic recording medium substrate according to Claim 13, characterized in that the ratio of the content of Ce oxide to the content of Sn oxide (Ce oxide/Sn oxide) as denoted by mass percentages falls within a range of 0 to 2.0.

[15]

The glass for a magnetic recording medium substrate according to Claim 13, characterized in that the ratio of the content of Ce oxide to the content of Sn oxide (Ce oxide/Sn oxide) as denoted by mass percentages falls within a range of 0.02 to 1.2.

[16]

The glass for a magnetic recording medium substrate according to any one of Claims 13 to 15, characterized by not comprising Sb.

[17]

The glass for a magnetic recording medium substrate according to any one of Claims 13 to 16, comprising, denoted as molar percentages:

MgO 0 to 10 percent,

CaO 0 to 10 percent,

SrO 0 to 5 percent, and

BaO 0 to 5 percent.

[18]

The glass for a magnetic recording medium substrate according to any one of Claims 13 to 17, characterized by comprising 0.1 to 5 molar percent of ZrO_2, TiO_2, La_2O_3, Nb_2O_5, Ta_2O_5, and HfO_2 in total.

[19]

The glass for a magnetic recording medium substrate according to any one of Claims 13 to 18, characterized by comprising a total content of 0.1 to 10 molar percent of MgO, CaO, SrO, and BaO.

[20]

The glass for a magnetic recording medium substrate according to any one of Claims 13 to 19, characterized in that the total content of SiO_2 and Al_2O_3 is 65 molar percent or greater, and by having a viscous property such that the viscosity at 1,400°C is 10^3 dPa·s or lower.

[21]

The glass for a magnetic recording medium substrate according to any one of Claims 13 to 20, comprising, denoted as mass percentages:

SiO_2 66 to 70 percent,

Al_2O_3 7 to 12 percent

(where the total content of SiO_2 and Al_2O_3 is 75 percent or greater),

Li_2O 5 to 10 percent,

Na_2O 8 to 13 percent,

K_2O 0.1 to 2 percent

(wherein the total content of Li_2O, Na_2O, and K_2O is 15 to 22 percent),

MgO 0.1 to 5 percent,

CaO 0.1 to 5 percent,

SrO and BaO in total 0 to 1 percent,

ZrO_2 0.1 to 2 percent,

B_2O_3 0 to 1 percent, and

ZnO 0 to 1 percent.

[22]

The glass for a magnetic recording medium substrate according to any one of Claims 13 to 20, comprising, denoted as mass percentages:

SiO_2 66 to 70 percent,

Al_2O_3 5 to 12 percent,

Li_2O 5 to 20 percent,

Na_2O 1 to 13 percent,

K_2O 0.1 to 2 percent

(wherein the total content of Li_2O, Na_2O, and K_2O is 18 to 22 percent),

MgO and CaO in total 0 to 5 percent,

SrO and BaO in total 0 to 5 percent,

ZrO_2, TiO_2, La_2O_3, Nb_2O_5, Ta_2O_5, and HfO_2 in total 0.1 to 5 percent,

B_2O_3 0 to 3 percent,

ZnO 0 to 1 percent, and

P_2O_5 0 to 0.5 percent.

[23]

The glass for a magnetic recording medium substrate according to any one of Claims 13 to 22, characterized by exhibiting an acid resistant property such that the etching rate when immersed in a 0.5 volume percent hydrogenfluosilicic acid aqueous solution maintained at 50°C is 3.0 nm/minute or less and an alkali resistant property such that the etching rate when immersed in a 1 mass percent potassium hydroxide aqueous solution maintained at 50°C is 0.1 nm/minute or less.

[24]

A method for manufacturing a glass for a magnetic recording medium substrate comprised of an oxide glass, characterized by:

preparing a glass starting material to which Sn, and optionally Ce, are added, comprising, as converted based on the oxides, denoted as molar percentages:

SiO_2 60 to 75 percent,

Al_2O_3 1 to 15 percent,

Li_2O 0.1 to 20 percent,

Na_2O 0.1 to 15 percent, and

K_2O 0 to 5 percent

(wherein the total content of Li_2O, Na_2O, and K_2O is 25 percent or lower);

so as to permit obtaining a glass comprising 0 to 0.1 percent of Sb, no As or F, and, based on the total amount of the glass components, 0.01 to 0.7 mass percent of Sn oxide and 0 to 1.4 mass percent of Ce oxide;

melting the glass starting material;

clarifying the resulting glass melt; and

molding the resulting glass melt.

[25]

The method for manufacturing a glass for a magnetic recording medium substrate according to Claim 24, comprising:

mixing the glass starting material so that the ratio of the content of Ce oxide to the content of Sn oxide (Ce oxide/Sn oxide) denoted as a mass percentage falls within a range of 0.02 to 1.2,

melting the starting material,

maintaining the resulting glass melt at 1,400 to 1,600°C,

reducing the temperature,

maintaining the temperature at 1,200 to 1,400°C, and

molding the glass melt.

[26]

The method for manufacturing a glass for a magnetic recording medium substrate according to Claim 24 or 25, wherein the viscosity of the glass melt at 1,400°C is 10^3 dPa·s or lower.

[27]

The method for manufacturing a glass for a magnetic recording medium substrate according to any one of Claim 24 to 26, wherein the quantities of Sn and Ce added are established to achieve a density of residual bubbles in the glass of 100 bubbles/kg or lower.

[28]

The method for manufacturing a glass for a magnetic recording medium substrate according to any one of Claims 9 to 12 and 24 to 27, wherein the glass melt is made to flow out to obtain glass melt gobs, and the glass gobs are press molded.

[29]

The method for manufacturing a glass for a magnetic recording medium substrate according to any one of Claims 9 to 12 and 24 to 27, wherein the glass melt is molded into a sheet of glass by the float method.

[30]

The method for manufacturing a glass for a magnetic recording medium substrate according to any one of Claims 9 to 12 and 24 to 27, wherein the glass melt is molded into a sheet of glass by overflow down draw molding.

[31]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 8 and 13 to 23 that has been subjected to a chemical strengthening treatment.

[32]

A magnetic recording medium substrate comprised of the glass described in any one of Claims 1 to 8, 13 to 23, and 31.

[33]

The magnetic recording medium substrate according to Claim 32, wherein roughness Ra of the main surface is less than 0.25 nm.

[34]

The magnetic recording medium substrate according to Claim 32 or 33, characterized by a bending strength of 10 kg or greater.

[35]

The magnetic recording medium substrate of any one of Claims 32 to 34, having a disklike shape and a thickness of 1 mm or less.

[36]

A method for manufacturing a magnetic recording medium substrate, comprising the steps of:

mirror-surface polishing the glass described in any one of Claims 1 to 8, 13 to 23, and 31, and

following mirror-surface polishing, subjecting the glass to a cleaning step in which the glass is cleaned with an acid and cleaned with an alkali.

[37]

The method for manufacturing a magnetic recording medium substrate according to Claim 36, comprising a step of subjecting the glass to a chemical strengthening treatment between the mirror-surface polishing step and the cleaning step.

[38]

A method for manufacturing a magnetic recording medium substrate, comprising the steps of:

manufacturing a glass by the method described in any one of Claims 9 to 12 and 24 to 30,

mirror-surface polishing the glass, and

following mirror surface polishing, subjecting the glass to a cleaning step in which the glass is cleaned with an acid and cleaned with an alkali.

[39]

The method for manufacturing a magnetic recording medium substrate of Claims 38, comprising a step of subjecting the glass to a chemical strengthening treatment between the mirror-surface polishing step and the cleaning step.

[40]

A magnetic recording medium having an information recording layer on the magnetic recording medium substrate described in any one of Claims 32 to 35.

[41]

The magnetic recording medium according to Claim 40, suited to a vertical magnetic recording method.

[42]

A method for manufacturing a magnetic recording medium, comprising:

preparing a magnetic recording medium substrate by the method described in any one of Claims 36 to 39 and

forming an information recording layer on the substrate.

[43]

A glass for a magnetic recording medium substrate comprised of oxide glass, characterized:

by comprising, converted based on the oxide, denoted as molar percentages:

SiO_2 60 to 75 percent,

Al_2O_3 1 to 15 percent,

Li_2O 0.1 to 20 percent,

Na_2O 0.1 to 15 percent,

K_2O 0 to 5 percent

(where the total content of Li_2O, Na_2O, and K_2O is 25 percent or less);

by comprising a 0.1 to 3.5 mass percent of total content of Sn oxide and Ce oxide, based on the total amount of the glass components;

in that the ratio of the Sn oxide content to the total content of Sn oxide and Ce oxide (Sn oxide content/(Sn oxide content + Ce oxide content)) is 0.01 to 0.99;

in that the Sb oxide content is 0 to 0.1 percent; and

by comprising no As or F.

[44]

The glass for a magnetic recording medium substrate according to Claim 43, characterized in that the ratio of the Sn oxide content to the total content of Sn oxide and Ce oxide (Sn oxide content/(Sn oxide content + Ce oxide content)) is 1/3 or greater.

[45]

The glass for a magnetic recording medium substrate according to Claim 43, characterized in that the ratio of the Sn oxide content to the total content of Sn oxide and Ce oxide (Sn oxide content/(Sn oxide content + Ce oxide content)) falls within a range of 0.45 to 0.98.

[46]

The glass for a magnetic recording medium substrate according to any one of Claims 43 to 45, characterized by not containing Sb.

[47]

The glass for a magnetic recording medium substrate according to any one of Claims 43 to 46, comprising, denoted as molar percentages:

MgO 0 to 10 percent,

CaO 0 to 10 percent,

SrO 0 to 5 percent,

BaO 0 to 5 percent,

B_2O_3 0 to 3 percent,

P_2O_5 0 to 1 percent, and

ZnO 0 to 3 percent.

[48]

The glass for a magnetic recording medium substrate according to any one of Claims 43 to 47, characterized by comprising a total content of ZrO_2, TiO_2, La_2O_3, Nb_2O_5, Ta_2O_5, and HfO_2 of 0.1 to 5 molar percent.

[49]

The glass for a magnetic recording medium substrate according to any one of Claims 43 to 48, characterized by comprising a total content of MgO, CaO, SrO, and BaO of 0.1 to 10 molar percent.

[50]

The glass for a magnetic recording medium substrate of any one of Claims 43 to 49, characterized in that the total content of SiO_2 and Al_2O_3 is 65 molar percent or greater and by having a viscous property such that the viscosity at 1,400°C is 10^3 dPa·s or lower.

[51]

The glass for a magnetic recording medium substrate of any one of Claims 43 to 50, comprising, denoted as mass percentages:

SiO_2 66 to 70 percent,

Al_2O_3 7 to 12 percent

(where the total content of SiO_2 and Al_2O_3 is 75 percent or greater),

Li_2O 5 to 10 percent,

Na_2O 8 to 13 percent,

K_2O 0.1 to 2 percent

(wherein the total content of Li_2O, Na_2O, and K_2O is 15 to 22 percent),

MgO 0.1 to 5 percent,

CaO 0.1 to 5 percent,

SrO and BaO in total 0 to 1 percent,

ZrO_2 0.1 to 2 percent,

B_2O_3 0 to 1 percent, and

ZnO 0 to 1 percent.

[52]

The glass for a magnetic recording medium substrate of any one of Claims 43 to 50, comprising, denoted as mass percentages:

SiO_2 66 to 70 percent,

Al_2O_3 5 to 12 percent,

Li_2O 5 to 20 percent,

Na_2O 1 to 13 percent,

K_2O 0.1 to 2 percent

(wherein the total content of Li_2O, Na_2O, and K_2O is 18 to 22 percent),

MgO and CaO in total 0 to 5 percent,

SrO and BaO in total 0 to 5 percent,

ZrO_2, TiO_2, La_2O_3, Nb_2O_5, Ta_2O_5, and HfO_2 in total 0.1 to 5 percent,

B_2O_3 0 to 3 percent,

ZnO 0 to 1 percent, and

P_2O_5 0 to 0.5 percent.

[53]

The glass for a magnetic recording medium substrate according to any one of Claims 43 to 52, characterized by exhibiting an acid resistant property such that the etching rate when immersed in a 0.5 volume percent hydrogenfluosilicic acid aqueous solution maintained at 50°C is 3.0 nm/minute or less and an alkali resistant property such that the etching rate when immersed in a 1 mass percent potassium hydroxide aqueous solution maintained at 50°C is 0.1 nm/minute or less.

[54]

A method for manufacturing a glass for a magnetic recording medium substrate comprised of an oxide glass, characterized by:

preparing a glass starting material to which Sn and Ce are added, comprising, as converted based on the oxide, denoted as molar percentages:

SiO_2 60 to 75 percent,

Al_2O_3 1 to 15 percent,

Li_2O 0.1 to 20 percent,

Na_2O 0.1 to 15 percent, and

K_2O 0 to 5 percent

(wherein the total content of Li_2O, Na_2O, and K_2O is 25 percent or lower); and, so as to permit obtaining a glass containing a total quantity of Sn oxide and Ce oxide of 0.1 to 3.5 mass percent based on the total amount of the glass components, wherein the ratio of the content of Sn oxide to the total content Sn oxide and Ce oxide (content of Sn oxide/(content of Sn oxide + content of Ce oxide)) is 0.01 to 0.99, having an Sb oxide content of 0 to 0.1 percent, and comprising no As or F;

melting the glass starting material;

clarifying the resulting glass melt; and

molding the resulting glass melt.

[55]

The method for manufacturing a glass for a magnetic recording medium substrate according to Claim 54, wherein the glass melt obtained by preparing and melting the glass starting material is maintained at 1,400 to 1,600°C, the temperature is

decreased, the glass melt is maintained at 1,200 to 1,400°C, and the glass melt is molded.

[56]

The method for manufacturing a glass for a magnetic recording medium substrate according to Claim 54 or 55, wherein the viscosity of the glass melt at 1,400°C is 10^3 dPa·s or lower.

[57]

The method for manufacturing a glass for a magnetic recording medium substrate of any one of Claims 54 to 57, wherein the quantities of Sn and Ce added are established so as to achieve a density of residual bubbles in the glass of 60 bubbles/kg or less.

[58]

The method for manufacturing a glass for a magnetic recording medium substrate according to any one of Claims 54 to 57, wherein the glass melt is made to flow out to obtain glass melt gobs and the glass gobs are press molded.

[59]

The method for manufacturing a glass for a magnetic recording medium substrate according to any one of Claims 54 to 57, wherein the glass melt is molded into a sheet of glass by the float method.

[60]

The method for manufacturing a glass for a magnetic recording medium substrate according to any one of Claims 54 to 57, wherein the glass melt is molded into a sheet of glass by overflow down draw molding.

[61]

The glass for a magnetic recording medium substrate of any one of Claims 43 to 53 that has been subjected to a chemical strengthening treatment.

[62]

A magnetic recording medium substrate being composed of the glass described in any one of Claims 43 to 53 and 59.

[63]

The magnetic recording medium substrate according to Claim 62, wherein roughness Ra of the main surface is less than 0.25 nm.

[64]

The magnetic recording medium substrate according to Claim 62 or 63, characterized by exhibiting a bending strength of 10 kg or greater.

[65]

The magnetic recording medium substrate described in any one of Claims 62 to 64, having a disklike shape and a thickness of 1 mm or less.

[66]

A method for manufacturing a magnetic recording medium substrate, comprising:

a step of mirror-surface polishing the glass described in any one of Claims 43 to 53 and 59; and

following mirror-surface polishing, a cleaning step of cleaning with an acid and cleaning with an alkali.

[67]

A method for manufacturing the magnetic recording medium substrate according to Claim 66, comprising a step of subjecting the glass to a chemical strengthening treatment between the mirror-surface polishing step and the cleaning step.

[68]

A method for manufacturing a magnetic recording medium substrate, comprising:

a step of preparing a glass by the method described in any one of Claims 54 to 60,

a step of mirror-surface polishing the glass, and

following mirror-surface polishing, a cleaning step of cleaning with an acid and cleaning with an alkali.

[69]

The method for manufacturing a magnetic recording medium substrate according to Claim 68, comprising a step of subjecting the glass to a chemical strengthening treatment between the mirror-surface polishing step and the washing step.

[70]

A magnetic recording medium comprising an information recording layer on the magnetic recording medium substrate described in any one of Claims 62 to 65.

[71]

The magnetic recording medium according to Claim 70, suited to a vertical recording method.

[72]

A method for manufacturing a magnetic recording medium, comprising:

preparing a magnetic recording medium substrate according to the method described in any one of Claims 66 to 69; and

forming an information recording layer on the substrate.

[73]

A glass for a magnetic recording medium substrate comprised of oxide glass, characterized:

by comprising, denoted as mass percentages:

Si 20 to 40 percent,

Al 0.1 to 10 percent,

Li 0.1 to 5 percent,

Na 0.1 to 10 percent,

K 0 to 5 percent

(where the total content of Li, Na, and K is 15 percent or less),

Sn 0.005 to 0.6 percent, and

Ce 0 to 1.2 percent;

in that the Sb content is 0 to 0.1 percent;

by not comprising As or F; and

by having a λ(*lambda*)80 of 320 nm or greater.

[74]

A glass for a magnetic recording medium substrate comprised of oxide glass, characterized:

by comprising, as converted based on the oxides, denoted as molar percentages:

SiO_2 60 to 75 percent,

Al_2O_3 1 to 15 percent,

Li_2O 0.1 to 20 percent,

Na_2O 0.1 to 15 percent, and

K_2O 0 to 5 percent

(where the total content of Li_2O, Na_2O, and K_2O is 25 percent or lower);

in that, based on the total amount of the glass components, 0.01 to 0.7 mass percent of Sn oxide and 0 to 1.4 mass percent of Ce oxide are added;

in that the content of Sb oxide is 0 to 0.1 mass percent;

by not comprising As or F; and

by having a λ(*lambda*)80 of 320 nm or greater.

[75]

A glass for a magnetic recording medium substrate comprised of oxide glass, characterized:

by comprising, converted based on the oxide, denoted as molar percentages:

SiO_2 60 to 75 percent,

Al_2O_3 1 to 15 percent,

Li_2O 0.1 to 20 percent,

Na_2O 0.1 to 15 percent, and

K_2O 0 to 5 percent

(where the total content of Li_2O, Na_2O, and K_2O is 25 percent or less);

by comprising a 0.1 to 3.5 mass percent of the total content of Sn oxide and Ce oxide, based on the total amount of the glass components;

in that the ratio of the Sn oxide content to the total content of Sn oxide and Ce oxide (Sn oxide content/(Sn oxide content + Ce oxide content)) is 0.01 to 0.99;

in that the Sb oxide content is 0 to 0.1 percent;

by comprising no As or F; and

by having a λ(*lambda*)80 of 320 nm or greater.

Claims

[1]

A glass for a magnetic recording medium substrate, comprised of an oxide glass, characterized:

by comprising, denoted as mass percentages:

Si 20 to 40 percent,

Al 0.1 to 10 percent,

Li 0.1 to 5 percent,

Na 0.1 to 10 percent,

K 0 to 5 percent

(where the total content of Li, Na, and K is 15 percent or less),

Sn 0.005 to 0.6 percent, and

Ce 0 to 1.2 percent;

in that the Sb content is 0 to 0.1 percent; and

by not comprising As or F, and wherein the ratio of the Ce content to the Sn content, Ce/Sn, falls within a range of 0.02 to 2.1.

[2]

The glass for a magnetic recording medium substrate according to Claim 1, further characterized in that the ratio of the Ce content to the Sn content, Ce/Sn, falls within a range of 0.02 to 1.3.

[3]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 2, further characterized by not comprising Sb.

[4]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 3, comprising, denoted as mass percentages:

Mg 0 to 5 percent,

Ca 0 to 5 percent,

Sr 0 to 2 percent, and

Ba 0 to 2 percent.

[5]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 4, further characterized by comprising 0.1 to 10 mass percent of Zr, Ti, La, Nb, Ta, and Hf in total.

[6]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 5, characterized by a total content of Mg, Ca, Sr, and Ba of 0 to 10 percent.

[7]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 6, comprising, denoted as mass percentages:

Si 28 to 34 percent,
Al 6 to 10 percent
(where the total content of Si and Al is 37 percent or greater),
Li 0.1 to 3 percent,
Na 5 to 10 percent,
K 0.1 to 1 percent
(where the total content of Li, Na, and K is 7 to 13 percent),
Mg 0.1 to 2 percent,
Ca 0.1 to 2 percent,
Sr and Ba in total 0 to 1 percent,
Zr 1 to 5 percent,
B 0 to 1 percent, and
Zn 0 to 1 percent.

[8]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 6, comprising, denoted as mass percentages:

Si 28 to 34 percent,
Al 6 to 10 percent
(where the total content of Si and Al is 37 percent or greater),
Li 1 to 5 percent,
Na 1 to 10 percent,
K 0.1 to 3 percent
(where the total content of Li, Na, and K is 5 to 11 percent),
Mg 0 to 2 percent,
Ca 0 to 2 percent,
Sr 0 to 1 percent,
Ba 0 to 1 percent,
Zr, Ti, La, Nb, Ta, and Hf in total 1 to 10 percent,
B 0 to 1 percent,
Zn 0 to 1 percent, and
P 0 to 1 percent.

[9]

The glass for a magnetic recording medium substrate according to any one of Claims 1 to 8 that has been subjected to a chemical strengthening treatment.

[10]

A magnetic recording medium substrate comprised of the glass described in any one of Claims 1 to 9.

[11]

The magnetic recording medium substrate according to Claim 10, wherein roughness Ra of the main surface is less than 0.25 nm.

[12]

The magnetic recording medium substrate according to Claim 10 or 11, characterized by a bending strength of 10 kg or greater.

[13]

The magnetic recording medium substrate of any one of Claims 10 to 12, having a disklike shape and a thickness of 1 mm or less.

[14]

A magnetic recording medium having an information recording layer on the magnetic recording medium substrate described in any one of Claims 10 to 13.

[15]

The magnetic recording medium according to Claim 14, suited to a vertical magnetic recording method.