CLAIMS

[Claim 1] A glass substrate for a magnetic recording medium, which is comprised of glass with a glass transition temperature of equal to or greater than 600°C, an average coefficient of linear expansion at 100 to 300°C of equal to or greater than 70 x 10^{-7}/°C, a Young's modulus of equal to or greater than 81 GPa, a specific modulus of elasticity of equal to or greater than 30 MNm/kg, and a fracture toughness value of equal to or greater than 0.9 MPa·$m^{1/2}$.

[Claim 2] The glass substrate for a magnetic recording medium according to claim 1, the sheet thickness of which is equal to or greater than 0.8mm.

[Claim 3] The glass substrate for a magnetic recording medium according to claim 1 or 2, which is a glass substrate for a magnetic recording medium employed in a magnetic recording apparatus in which a rotational speed is equal to or higher than 7200 rpm.

[Claim 4] The glass substrate for a magnetic recording medium according to any of claims 1 to 3, wherein a content of K_2O in the glass is less than 3 mole percent.

[Claim 5] The glass substrate for a magnetic recording medium according to any of claims 1 to 4, wherein the glass has been subjected to chemical strengthening.

[Claim 6] The glass substrate for a magnetic recording medium according to claim 5, wherein the chemical strengthening has been conducted with the use of melt of potassium nitrate and/or sodium nitrate.

[Claim 7] The glass substrate for a magnetic recording medium according to any of claims 1 to 6, which is a glass substrate for a magnetic recording medium employed in a magnetic recording apparatus equipped with a dynamic flying height head.

[Claim 8] The glass substrate for a magnetic recording medium according to any of claims 1 to 7, which is employed in a magnetic recording medium for energy-assisted magnetic recording.

[Claim 9] The glass substrate for a magnetic recording medium according to any of claims 1 to 8, wherein an arithmetic average roughness, Ra, measured by an atomic force microscope at a resolution of 512 x 256 pixels over an area of 1 μm x 1 μm on a main surface of the substrate is equal to or lower than 0.15 nm.

[Claim 10] A method of manufacturing a glass substrate for a magnetic recording medium, which comprises steps of:

polishing a glass material with a fracture toughness value of less than 1.3 MPa·$m^{1/2}$,

conducting chemical strengthening after the polishing, to manufacture the glass substrate for a magnetic recording medium according to any of claims 1 to 9.

[Claim 11] The method of manufacturing a glass substrate for a magnetic recording medium according to claim 10, which comprises a chemical strengthening step, and the chemical strengthening step is a step of rendering a ratio of a fracture toughness value K_{Ic} (after) of the glass material following chemical strengthening to a fracture strength K_{Ic} (before) of the glass material before the chemical strengthening, K_{Ic} (after)/K_{Ic} (before), being equal to or greater than 1.5.

[Claim 12] A magnetic recording medium, which comprises a magnetic recording layer on the glass substrate for a magnetic recording medium according to any of claims 1 to 9.

[Claim 13] The magnetic recording medium according to claim 12, wherein the magnetic recording layer comprises a magnetic material the main component of which is alloy of Pt with Fe and/or Co, and the magnetic recording medium is a magnetic recording medium for energy-assisted magnetic recording.

[Claim 14] A method of manufacturing a magnetic recording medium, which comprises forming a film of a magnetic material the main component of which is alloy of Pt with Fe and/or Co on a main surface of the glass substrate for a magnetic recording medium according to any of claims 1 to 9, after which conducting annealing, to form a magnetic recording layer.

[Claim 15] A magnetic recording apparatus of energy-assisted magnetic recording system, which comprises:

a heat-assisted magnetic recording head comprising a heat source heating at least a main surface of a magnetic recording medium, a recording element, and a reproduction element; and

a magnetic recording medium according to claim 12 or 13.

[Claim 16] A glass substrate blank for a magnetic recording medium, which is comprised of glass with a glass transition temperature of equal to or greater than 600°C, an average coefficient of linear expansion at 100 to 300°C of equal to or greater than 70×10^{-7}/°C, a Young's modulus of equal to or greater than 81 GPa, a specific modulus of elasticity of equal to or greater than 30 MNm/kg, and a fracture toughness value of equal to or greater than 0.9 $MPa \cdot m^{1/2}$.

CLAIMS

What is claimed is:

1. A glass substrate for a magnetic recording medium, which is comprised of glass comprising K_2O within a range of 0 to 1 mole percent and having:
a glass transition temperature of equal to or greater than 600° C.,
an average coefficient of linear expansion at 100 to 300° C. of equal to or greater than 70x10-7/° C.,
a Young's modulus of equal to or greater than 81 GPa,
a specific modulus of elasticity of equal to or greater than 30 MNm/kg, and
a fracture toughness value of equal to or greater than 0.9 MPa m1/2,
wherein the glass further comprises Li_2O and Na_2O and has a molar ratio $\{K_2O/(Li_2O+Na_2O+K_2O)\}$ of the K_2O content to the total content of the alkali metal oxides is equal to or lower than 0.13.

2. The glass substrate for a magnetic recording medium according to claim 1, the sheet thickness of which is equal to or greater than 0.8 mm.

3. The glass substrate for a magnetic recording medium according to claim 1, which is a glass substrate for a magnetic recording medium employed in a magnetic recording apparatus in which a rotational speed is equal to or higher than 7200 rpm.

4. The glass substrate for a magnetic recording medium according to claim 1, wherein the glass has been subjected to chemical strengthening.

5. The glass substrate for a magnetic recording medium according to claim 4, wherein the chemical strengthening has been conducted with the use of melt of potassium nitrate and/or sodium nitrate.

6. The glass substrate for a magnetic recording medium according to claim 1, which is a glass substrate for a magnetic recording medium employed in a magnetic recording apparatus equipped with a dynamic flying height head.

7. The glass substrate for a magnetic recording medium according to claim 1, which is employed in a magnetic recording medium for energy-assisted magnetic recording.

8. The glass substrate for a magnetic recording medium according to claim 1, wherein an arithmetic average roughness, Ra, measured by an atomic force microscope at a resolution of 512x256 pixels over an area of 1 μmx1 μm on a main surface of the substrate is equal to or lower than 0.15 nm.

9. A magnetic recording medium, which comprises a magnetic recording layer on the glass substrate for a magnetic recording medium according to claim 1.

10. The magnetic recording medium according to claim 9, wherein the magnetic recording layer comprises a magnetic material the main component of which is alloy of Pt with Fe and/or Co, and the magnetic recording medium is a magnetic recording medium for energy-assisted magnetic recording.

11. A magnetic recording apparatus of energy-assisted magnetic recording system, which comprises:
a heat-assisted magnetic recording head comprising a heat source heating at least a main surface of a magnetic recording medium, a recording element, and a reproduction element; and
a magnetic recording medium according to claim 9.

12. A glass substrate blank for a magnetic recording medium, which is comprised of glass comprising K_2O within a range of 0 to 1 mole percent and having:
a glass transition temperature of equal to or greater than 600° C.,
an average coefficient of linear expansion at 100 to 300° C. of equal to or greater than 70x10-7/° C.,
a Young's modulus of equal to or greater than 81 GPa,
a specific modulus of elasticity of equal to or greater than 30 MNm/kg, and
a fracture toughness value of equal to or greater than 0.9 MPa m1/2.

13. The glass substrate for a magnetic recording medium according to claim 1, wherein the glass substrate contains SiO_2, Al_2O_3 and one or more of alkali metal oxides R_2O, where R denotes Li, Na, or K.

14. A glass substrate for a magnetic recording medium, which is comprised of glass having:
a glass transition temperature of equal to or greater than 600° C.,

an average coefficient of linear expansion at 100 to 300° C. of equal to or greater than 70x10-7/° C.,
a Young's modulus of equal to or greater than 81 GPa,
a specific modulus of elasticity of equal to or greater than 30 MNm/kg, and
a fracture toughness value of equal to or greater than 0.9 MPa m1/2,
wherein (1) the glass substrate contains SiO_2, Al_2O_3 and one or more of alkali metal oxide R_2O where R denotes Li, Na, or K and (2) the molar ratio $\{K_2O/(Li_2O+Na_2O+K_2O)\}$ of the K_2O content to the total content of the alkali metal oxides is equal to or lower than 0.13.

15. The glass substrate for a magnetic recording medium according to claim 14, the sheet thickness of which is equal to or greater than 0.8 mm.

16. The glass substrate for a magnetic recording medium according to claim 14, which is a glass substrate for a magnetic recording medium employed in a magnetic recording apparatus in which a rotational speed is equal to or higher than 7200 rpm.

17. The glass substrate for a magnetic recording medium according to claim 14, wherein a content of K_2O in the glass is less than 3 mol percent.

18. The glass substrate for a magnetic recording medium according to claim 14, wherein the glass has been subjected to chemical strengthening.

19. The glass substrate for a magnetic recording medium according to claim 18, wherein the chemical strengthening has been conducted with the use of melt of potassium nitrate and/or sodium nitrate.

20. The glass substrate for a magnetic recording medium according to claim 14, which is a glass substrate for a magnetic recording medium employed in a magnetic recording apparatus equipped with a dynamic flying height head.

21. The glass substrate for a magnetic recording medium according to claim 14, which is employed in a magnetic recording medium for energy-assisted magnetic recording.

22. The glass substrate for a magnetic recording medium according to claim 14, wherein an arithmetic average roughness, Ra, measured by an atomic force microscope at a resolution of 512x256 pixels over an area of 1 μmx1 μm on a main surface of the substrate is equal to or lower than 0.15 nm.

23. A magnetic recording medium, which comprises a magnetic recording layer on the glass substrate for a magnetic recording medium according to claim 14.

24. The magnetic recording medium according to claim 23, wherein the magnetic recording layer comprises a magnetic material the main component of which is alloy of Pt with Fe and/or Co, and the magnetic recording medium is a magnetic recording medium for energy-assisted magnetic recording.

25. A glass substrate blank for a magnetic recording medium, comprising glass having:
a glass transition temperature of equal to or greater than 600° C.,
an average coefficient of linear expansion at 100 to 300° C. of equal to or greater than 70x10-7/° C.,
a Young's modulus of equal to or greater than 81 GPa,
a specific modulus of elasticity of equal to or greater than 30 MNm/kg, and
a fracture toughness value of equal to or greater than 0.9 MPa m1/2,
wherein (1) the glass substrate contains SiO_2, Al_2O_3 and one or more of alkali metal oxide R_2O where R denotes Li, Na, or K and (2) the molar ratio $\{K_2O/(Li_2O+Na_2O+K_2O)\}$ of the K_2O content to the total content of the alkali metal oxides is equal to or lower than 0.13.