DESCRIPTION

GLASS FOR INFORMATION RECORDING MEDIA SUBSTRATE

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

The present invention relates to a glass substrate for information recording media such as a glass substrate for magnetic disks and a glass for an information recording media substrate suitable for the glass substrate for information recording media.

DISCUSSION OF BACKGROUND

Glass substrates are widely used as substrates for information recording media, particularly as substrates for magnetic disks (hard disks). As a glass substrate for magnetic disks, chemically strengthened one and chemically not strengthened one are available.

As the glass substrate for a chemically not strengthened magnetic disk, one made of an SiO_2-Al_2O_3-Li_2O-Na_2O-K_2O-TiO_2 type glass has been proposed (Patent Document 1).

Patent Document 1: JP-A-2004-161597 (Tables 1 to 12)

DISCLOSURE OF THE INVENTION

PROBLEMS THAT THE INVENTION IS TO SOLVE

In the case of the glass in Patent Document 1, the

glass transition temperature (Tg) is 567°C even at the maximum, and in a case where such a glass was used for a glass substrate for a magnetic disk, it was impossible to increase the temperature at the time of forming a magnetic layer onto the glass substrate, and as a result, it was difficult to increase the magnetic coercive force of the magnetic layer.

It is an object of the present invention to provide a glass for an information recording media substrate and a glass substrate for information recording media using it, which can solve such a problem.

MEANS OF SOLVING THE PROBLEMS

The present invention provides a glass for an information recording media substrate, which comprises, as represented by mol% based on oxide, from 55 to 75% of SiO_2, from 1 to 12% of Al_2O_3, from 2 to 15% of MgO, from 0 to 1.5% of CaO, from 1 to 20% of Na_2O and/or K_2O, and from 0 to 8% of TiO_2, wherein in a case where BaO is contained, its content is at most 2%, in a case where Li_2O is contained, its content is at most 1%, and in a case where ZrO_2 is contained, its content is at most 0.5%.

Further, the present invention provides a glass substrate for information recording media, which is made of the glass for an information recording media substrate.

EFFECT OF THE INVENTION

According to the present invention, it is possible to obtain a glass for an information recording media substrate, which has Tg of at least 600°C.

Further, it is possible to obtain a high-strength, low-density or float-processable glass for an information recording media substrate or a glass substrate for information recording media.

Further, it is possible to obtain a glass substrate for information recording media having high weather resistance, and therefore a film such as a base film, a magnetic film or a protective film, which is formed on the substrate, can be prevented from peeling due to remarkable change of a surface condition of a glass substrate during storage.

Further, without carrying out a chemical strengthening treatment, a glass substrate for an information recording media can be produced, whereby a process step can be reduced, and the problem of stain on the substrate surface after the chemical strengthening treatment can be solved.

BEST MODE FOR CARRYING OUT THE INVENTION

Tg of the glass for an information recording media substrate of the present invention (hereinafter referred to as the glass of the present invention) is preferably at least 600°C. If Tg is lower than 600°C, the temperature for the heat treatment for forming a magnetic

layer cannot be made sufficiently high, and it may be difficult to increase the magnetic coercive force of the magnetic layer. Tg is more preferably at least 610°C, particularly preferably at least 620°C.

The glass of the present invention preferably has an average linear expansion coefficient (α) of at least 70×10^{-7}/°C in a temperature range of from 50 to 350°C. If α is lower than 70×10^{-7}/°C, the difference from the thermal expansion coefficient of a metal of a hub (typically, 70×10^{-7}/°C to 100×10^{-7}/°C) to be mounted on a substrate becomes large, and the substrate tends to fracture. α is more preferably at least 75×10^{-7}/°C, particularly preferably 80×10^{-7}/°C. Further, typically, α is at most 95×10^{-7}/°C.

In the glass of the present invention, $(T_L - T_4)$ is preferably less than 50°C, where T_L is the liquidus temperature, and T_4 is the temperature at which the viscosity becomes 10^4 P (poise). If $(T_L - T_4)$ is 50°C or more, it may be difficult to manufacture the glass by a float process. $(T_L - T_4)$ is more preferably less than 40°C, particularly preferably less than 30°C.

The temperature T_2 at which the viscosity of the glass of the present invention becomes 10^2 P, is preferably at most 1700°C. If T_2 exceeds 1700°C, melting or refining of the glass tends to be difficult.

The glass substrate for a magnetic disk is widely used for a 2.5 inch substrate (outside diameter of a

glass substrate: 65 mm) to be used for laptop computers, etc. or a 1.8 inch substrate (outside diameter of a glass substrate: 48 mm) to be used for portable MP3 players, etc., and its market is expanding year by year, while it is demanded to supply the glass substrate at low price. The glass to be used for such a glass substrate is preferably one which is suitable for mass production.

Mass production of such a plate glass is widely carried out by a continuous forming method such as a float process, a fusion method or a down draw method. Since the glass of the present invention is glass which can be formed by e.g. a float process as mentioned above, the glass of the present invention is suitable for mass production.

The density of the glass of the present invention is preferably at most 2.50 g/cm^3, more preferably at most 2.48 g/cm^3, particularly preferably at most 2.47 g/cm^3.

The glass substrate for information recording media of the present invention (hereinafter, referred to as the glass substrate of the present invention) is usually a circular glass plate made of the glass of the present invention. Further, as an information recording medium, a magnetic disk is exemplified.

When the glass substrate of the present invention is held under a steam atmosphere at 120°C under 2 atm for 20 hours, it is preferred that the number N_L of deposits having a size of at least 10 μm present on its surface,

is at most 1 pieces/cm^2, or the number N_S of deposits having a size of at least 1 μm and less than 10 μm, is at most 10^5 pieces/cm^2. If N_L exceeds 1 pieces/cm^2 or if N_S exceeds 10^5 pieces/cm^2, deposits (whitening) will form on the surface of the glass substrate during the storage of the glass substrate, whereby a film such as an undercoating film, a magnetic film or a protective film formed on the glass substrate, is likely to be peeled. Such deposits are considered to be a reaction product formed and deposited on the glass substrate due to the influence of moisture or carbon dioxide gas in air, and cannot be removed even by wiping. N_L is more preferably at most 0.8 pieces/cm^2, particularly preferably at most 0.5 pieces/cm^2. N_S is more preferably at most 0.8×10^5 pieces/cm^2, particularly preferably at most 0.6×10^5 pieces/cm^2.

The crack formation ratio of the glass of the present invention is preferably at most 70%. If it exceeds 70%, the glass strength is likely to be insufficient. The crack formation ratio is more preferably at most 60%, particularly preferably at most 50%.

The above crack formation ratio can be obtained as follows. Namely, in a room controlled at 23°C and a relative humidity of 70%, a Vickers indenter is indented with a load of 500 g into a surface of a mirror-polished glass plate having a thickness of from 1 to 2 mm and a

size of 4 cm × 4 cm, and the number of cracks formed from its four vertexes is measured. This measurement is repeated 10 times, and 100 × (the total number of formed cracks)/40 is taken as a crack formation ratio.

When the crack formation ratio is low, the glass surface is not likely to be scratched, whereby stress concentration tends to hardly occur, and brittle fracture by weak stress tends to reduce or hardly occur.

The methods for producing the glass and the glass substrate of the present invention are not particularly restricted, and various methods may be used. For example, raw materials for the respective components which are commonly used may be mixed to have a desired composition, and such a composition is heated and melted by a glass melting furnace. The glass is homogenized by bubbling, stirring, addition of a refining agent, etc., and formed into a plate glass having a predetermined thickness by a well-known method such as a float process, a press-process, a fusion process or a down-draw process and the plate glass is annealed, and then, if necessary, subjected to processing such as grinding or polishing, followed by cutting into a glass substrate having a predetermined size and shape. As the forming method, a float process suitable for mass production, is particularly preferred. Further, a continuous forming method other than a float process, namely a fusion process or a down-draw process is also preferred.

Now, the composition of the glass of the present invention will be described by employing mol% representation.

SiO_2 is a component for forming the glass structure and an essential component. If the content of SiO_2 is less than 55%, the glass tends to be brittle, or T_L increases whereby the glass becomes unstable. The content of SiO_2 is preferably at least 58%, more preferably at least 60%, particularly preferably at least 62%, typical at least 64%, more typically at least 65%. If it exceeds 75%, its working temperature increases, whereby the glass is hardly melted. It is preferably at most 72%, more preferably at most 71%.

Al_2O_3 has effects to increase Tg and improve weather resistance, and is an essential component. If the content of Al_2O_3 is less than 1%, the above effects will be small. The content of Al_2O_3 is preferably at least 1.5%, more preferably at least 2%, particularly preferably a least 2.5%. If it exceeds 12%, its working temperature increases and the glass is hardly melted, and further T_L becomes too high. It is preferably at most 10%, more preferably at most 8%, particularly preferably at most 7%, typically at most 6.5%.

MgO has an effect to increase α, prevent the glass from being brittle or improve the melting property of glass, while maintaining weather resistance, and is an essential component. If it is less than 2%, the above

effect will be small. It is preferably at least 5%, more preferably at least 7%, most preferably at least 8%. If it exceeds 15%, T_L becomes too high. It is preferably at most 14%, more preferably at most 13%.

Although CaO is not essential, in order to increase α or improve the melting property of the glass while maintaining weather resistance, at most 1.5% of CaO may be contained therein. If it exceeds 1.5%, the glass is likely to be brittle. It is preferably at most 1%, more preferably less than 0.5%, typically at most 0.3%.

Na_2O and K_2O are components having an effect to increase α or improve the melting property of the glass, and at least either of them is necessarily incorporated therein. If the total content of Na_2O and K_2O is less than 1%, the above effect will be small. It is preferably more than 2%, more preferably at least 5%, particularly preferably at least 7%, and typically at least 10%. If it exceeds 20%, the weather resistance will be deteriorated, and the glass transition temperature will be lowered. It is preferably at most 17%, more preferably at most 15%, particularly preferably at most 14%, and typically at most 13.5%. Typically, Na_2O is from 2 to 8%, and K_2O is from 3 to 10%.

It is preferred that SiO_2 exceeds 60%, Al_2O_3 is at most 10%, and Na_2O+K_2O is more than 2% and at most 17%.

Although TiO_2 is not an essential component, it has an effect to increase Tg, increase weather resistance, or

improve the melting property of the glass, and at most 8% of TiO_2 may be contained therein. If it exceeds 8%, T_L is likely to be too high, or a phase separation phenomenon tends to occur. The content of TiO_2 is preferably at most 7%, more preferably at most 6%, particularly preferably at most 5%. Further, in a case where TiO_2 is contained, its content is preferably at least 1%, more preferably at least 1.5%, particularly preferably at least 2%, most preferably at least 3%.

The total content of MgO and TiO_2, i.e. $MgO+TiO_2$ is preferably at least 10%. If it is less than 10%, the glass is likely to be brittle, or its working temperature increases and the glass is hardly melted. $MgO+TiO_2$ is typically at least 13%.

Typically, SiO_2 is from 62 to 72%, Al_2O_3 is from 2 to 8%, MgO is from 7 to 14%, Na_2O+K_2O is from 10 to 14%, and TiO_2 is from 0 to 6%.

The glass of the present invention basically comprises the above components, however, other components may be contained so long as the object of the present invention is not impaired. In such a case, the total content of other components is preferably at most 10%, more preferably at most 5%, typically at most 2%.

For example, a refining agent such as SO_3, Cl, As_2O_3, Sb_2O_3 or SnO_2 may be contained up to 2% in total, but it is preferred that As_2O_3, Sb_2O_3 and SnO_2 are not contained.

Further, in order to improve the melting property or

stability of the glass, B_2O_3 may be contained up to 3% in total.

However, it is preferred to contain substantially no B_2O_3 from the following viewpoint. Namely, if B_2O_3 coexists with an alkali metal oxide component, an alkali borate compound having a low vapor pressure is readily formed, and the alkali borate component highly and readily volatilizes and diffuses from glass melt. Due to such a phenomenon, non-homogeneity such as striae occurs, and the quality of glass deteriorates. At the same time, there are problems that volatilized materials are condensed on refractories used for the glass melting furnace, and refractory strength is thereby substantially lowered, and enormous cost is required to collect volatilized substances, and in order to suppress occurrence of such problems, it is preferred to contain substantially no B_2O_3.

There is a case where SrO or BaO may be contained in a range of at most 4% in total in order to increase α or improve the melting property of the glass, while maintaining weather resistance. If it exceeds 4%, the glass will be readily brittle. It is preferably at most 2%. Provided that when BaO is contained therein, its content is required to be at most 2 mol%.

Further, for example, in order to prevent the glass from being brittle, it is preferred to contain no SrO, and even if SrO is contained therein, such a content is

preferably less than 0.1%. Further, in such a case, it is preferred to contain no BaO, and even when BaO is contained therein, such a content is less than 0.1%.

In order to increase α or improve the melting property of the glass, Li_2O may be contained up to 1%. If it exceeds 1%, Tg tends to be low, the weather resistance tends to be deteriorated, or the glass tends to be brittle. Typically, such a content is at most 0.6%, but in many cases, it is preferred to contain substantially no Li_2O.

In order to increase Tg, ZrO_2 may be contained up to 0.5%. If it exceeds 0.5%, the glass tends to be brittle.

In the case of containing CaO, SrO or BaO, the molar ratio of the MgO content to (the total content of MgO, CaO, SrO and BaO): (MgO)/(MgO+CaO+SrO+BaO) is preferably at least 0.6. If it is less than 0.6, the glass tends to be brittle.

When the total content of Li_2O, Na_2O and K_2O is represented by R'_2O and the total content of alkaline earth metal oxides is represented by RO, the molar ratio of R'_2O to (R'_2O+RO), namely, (R'_2O)/(R'_2O+RO) is preferably from 0.25 to 0.75. If it is outside of this range, the weather resistance tends to be deteriorated, α tends to be low, or the glass is likely to be brittle. Such a ratio is more preferably from 0.3 to 0.7.

When K_2O is contained, the molar ratio of the K_2O content to the total content of Li_2O, Na_2O and K_2O,

namely, $K_2O/(Li_2O+Na_2O+K_2O)$ is preferably at least 0.2. If it is less than 0.2, Tg tends to be low or the weather resistance tends to be deteriorated. It is more preferably at least 0.3, particularly preferably at least 0.4.

An oxide of an atom (such as V) having a larger atomic number than Ti is likely to make the glass brittle, and therefore in a case where such an oxide is contained, the total content thereof is preferably at most 0.5%. It is more preferably at most 0.3%, particularly preferably at most 0.2%, most preferably at most 0.1%.

EXAMPLES

Raw materials for the respective components were mixed to have a composition shown by mol percentage in the rows for from SiO_2 to ZrO_2 in Tables, and melted in a platinum crucible at a temperature of from 1,550 to 1,600°C for 3 to 5 hours. At the time of melting, a platinum stirrer was inserted in molten glass, and the molten glass was stirred for 2 hours to homogenize glass. Then, the molten glass was cast out, formed into a plate, and annealed. Further, in Tables, RO represents the total content (unit: mol%) of MgO, CaO, SrO and BaO, and R'_2O represents the total content (unit: mol%) of Li_2O, Na_2O and K_2O.

Glasses of Examples 1 to 11 are Examples of the

present invention, and glasses of Examples 12 to 25 are Comparative Examples.

With respect to the glass plates thus obtained, crack formtion ratio (unit: %), glass transition temperature Tg (unit: °C), thermal expansion coefficient α (unit: $\times 10^{-7}$/°C), liquidus temperature T_L (unit: °C), temperature T_4 (unit: °C) at which the viscosity becomes 10^4P, temperature T_2 (unit: °C) at which the viscosity becomes 10^2P, the above N_L (unit: piece/cm^2), the above N_S (unit: 10^5 pieces/cm^2) and density (unit: g/cm^3) were measured. The results are shown in Tables, and the methods of measuring Tg, α, T_L, T_4, T_2, N_L and N_S are respectively shown below. Here, the symbol "-" in Tables means "not measured".

Tg: Using a differential thermal dilatometer, the elongation of glass when quartz glass as a reference specimen was heated at a rate of 5°C/min from room temperature was measured up to the temperature at which elongation was no longer observed even when glass was softened, namely the yield point, and a temperature at a bending point on the obtained thermal expansion curve was taken as the glass transition temperature.

α: Using a differential thermal dilatometer, the elongation of glass when quartz glass as a reference specimen was heated at a rate of 5°C/min from room temperature was measured up to the yield point, and an average linear expansion coefficient in a temperature

range of from 50 to 350°C was calculated from the obtained thermal expansion curve.

T_L: The glass was pulverized into glass particles of about 2 mm by a mortar, and such glass particles were placed on a platinum boat and heat-treated for 24 hours in a furnace having temperature gradient. The maximum value of the temperature of the glass particles where crystals were precipitated, was taken as the liquid phase temperature.

T_4 and T_2: T_4 and T_2 were measured by a rotation viscometer.

N_L, N_S: Both sides of a glass plate having a thickness of from 1 to 2 mm and a size of 4 cm × 4 cm were mirror-polished and cleaned with calcium carbonate and a neutral detergent, and then the glass plate was put in a super accelerated life tester (an unsaturated type pressure cooker TPC-410, manufactured by Tabai Espec) and left to stand in a steam atmosphere at 120°C under 2 atm for 20 hours. The area of a 200 μm square on the surface of the glass plate taken out, was observed by a differential interference microscope, whereby the number of deposits having a size of at least 10 μm, and the number of deposits having a size of at least 1 μm and less than 10 μm, were counted.

TABLE 1

Examples	1	2	3	4	5	6	7	8	9
SiO_2	67.7	66.7	65.5	67.7	67.7	65.7	65.5	67.2	70.6
Al_2O_3	4.9	5.1	6.0	4.9	4.9	6.9	6.0	5.4	2.2
MgO	10.9	11.8	12.0	8.9	10.9	10.9	12.0	10.9	9.0
CaO	0	0	0	0	0	0	0	0	1.0
BaO	0	0	0	0	0	0	0	0	0
Li_2O	0	0	0	0	0	0	0	0	0
Na_2O	4.9	5.1	6.0	4.9	6.9	4.9	6.0	3.9	6.4
K_2O	7.6	7.3	7.0	7.6	5.6	7.6	6.5	8.6	6.3
TiO_2	4.0	4.0	3.5	6.0	4.0	4.0	4.0	4.0	4.5
ZrO_2	0	0	0	0	0	0	0	0	0
RO	10.9	11.8	12.0	8.9	10.9	10.9	12.0	10.9	10.0
R'_2O	12.5	12.4	13.0	12.5	12.5	12.5	12.5	12.5	12.7
MgO/RO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90
$R'_2O/(RO+R'_2O)$	0.53	0.51	0.52	0.58	0.53	0.53	0.51	0.53	0.56
K_2O/R'_2O	0.61	0.59	0.54	0.61	0.45	0.61	0.52	0.69	0.50
Crack formation ratio	5	15	5	25	0	10	10	10	20
Tg	635	636	634	625	625	647	638	645	600
α	82	81	87	83	82	84	84	85	83
T_L	1190	1210	—	—	—	—	—	1190	—
T_4	1220	1210	—	—	—	—	—	1240	—
T_2	1670	1650	—	—	—	—	—	1680	—
N_L	0	0	0	0	0	0	0	0	0
N_S	0.5	0.7	0.7	0.3	0.8	0.5	0.7	0.6	0.8
Density	2.461	2.465	2.475	2.474	2.468	2.467	2.479	2.460	2.467

TABLE 2

Examples	10	11	12	13	14	15	16	17	18
SiO_2	69.7	71.7	67.7	65.5	65.3	68.4	64.5	64.0	65.7
Al_2O_3	4.9	4.9	4.9	6.0	8.6	3.0	6.0	6.0	4.9
MgO	10.9	10.9	8.9	11.0	0	8.0	11.0	11.0	10.9
CaO	0	0	2.0	0	0	6.1	0	0	0
BaO	0	0	0	0	0	0	0	3.0	0
Li_2O	0	0	0	1.2	12.5	0	1.2	0	0
Na_2O	4.9	4.9	4.9	4.9	10.1	3.3	4.9	5.0	4.9
K_2O	7.6	7.6	7.6	6.9	0	7.2	6.9	6.5	7.6
TiO_2	2.0	0	4.0	4.5	0	4.0	4.5	4.5	4.0
ZrO_2	0	0	0	0	3.5	0	1.0	0	2.0
RO	10.9	10.9	10.9	11.0	0	14.1	11.0	14.0	10.9
R'_2O	12.5	12.5	12.5	13.0	22.6	10.5	13.0	11.5	12.5
MgO/RO	1.00	1.00	0.82	1.00	—	0.57	1.00	0.79	1.00
$R'_2O/(RO+R'_2O)$	0.53	0.53	0.53	0.54	1.00	0.43	0.54	0.45	0.53
K_2O/R'_2O	0.61	0.61	0.61	0.53	0.00	0.69	0.53	0.57	0.61
Crack formation ratio	0	0	70	70	80	100	95	95	100
Tg	626	618	624	605	500	637	617	636	656
α	81	80	84	85	90	80	81	83	80
T_L	—	—	—	—	—	—	—	1170	—
T_4	—	—	—	—	—	—	—	1190	—
T_2	—	—	—	—	—	—	—	1640	—
N_L	—	—	0	0	20000	—	—	—	—
N_S	—	—	0.5	0.8	4	—	—	—	—
Density	2.433	2.403	2.477	2.485	2.52	2.502	2.516	2.605	2.525

TABLE 3

Examples	19	20	21	22	23	24	25
SiO_2	65.7	67.7	67.7	72.7	67.7	67.7	67.7
Al_2O_3	3.9	4.9	4.9	4.9	9.9	4.9	4.9
MgO	10.9	5.5	9.5	5.9	5.9	5.9	5.9
CaO	0	5.4	5.4	0	0	0	0
BaO	0	0	0	0	0	0	0
Li_2O	0	0	0	0	0	0	0
Na_2O	4.9	4.9	4.9	4.9	4.9	9.9	4.9
K_2O	7.6	7.6	7.6	7.6	7.6	7.6	12.6
TiO_2	4.0	4.0	0	4.0	4.0	4.0	4.0
ZrO_2	3.0	0	0	0	0	0	0
RO	10.9	10.9	14.9	5.9	5.9	5.9	5.9
R'_2O	12.5	12.5	12.5	12.5	12.5	17.5	17.5
MgO/RO	1.00	0.50	0.64	1.00	1.00	1.00	1.00
$R'_2O/(RO+R'_2O)$	0.53	0.53	0.46	0.68	0.68	0.75	0.75
K_2O/R'_2O	0.61	0.61	0.61	0.61	0.61	0.43	0.72
Crack formation ratio	93	100	100	5	10	15	10
Tg	661	633	611	638	670	600	610
α	78	87	87	80	80	98	102
T_L	1180	—	—	—	—	—	—
T_4	1220	—	—	1280	1325	—	—
T_2	1630	—	—	1780	1815	—	—
N_L	—	—	—	0	0	0	0
N_S	—	—	—	0.6	0.3	5	8
Density	2.554	2.486	2.467	2.412	2.428	2.450	2.429

INDUSTRIAL APPLICABILITY

The glass of the present invention can be used as information recording media substrates such as magnetic disk substrates or for producing information recording media such as magnetic disks.

The entire disclosure of Japanese Patent Application No. 2006-315122 filed on November 22, 2006 including specification, claims, drawings and summary is incorporated herein by reference in its entirety.

CLAIMS:

1. A glass for an information recording media substrate, which comprises, as represented by mol% based on oxide, from 55 to 75% of SiO_2, from 1 to 8% of Al_2O_3, from 2 to 15% of MgO, from less than 0.5% of CaO, from 1 to 20% of Na_2O and/or K_2O, and from 0 to 8% of TiO_2, wherein in a case where BaO is contained, its content is at most 2%, in a case where Li_2O is contained, its content is at most 1%, and in a case where ZrO_2 is contained, its content is at most 0.5%, and wherein a total amount of MgO and TiO_2 is at least 10%.

2. The glass for an information recording media substrate according to Claim 1, wherein SiO_2 is more than 60% and at most 75%, Al_2O_3 is at most 10%, Na_2O+K_2O is more than 2% and at most 17%.

3. The glass for an information recording media substrate according to Claim 1, wherein SiO_2 is from 62 to 72%, Al_2O_3 is from 2 to 8%, MgO is from 7 to 14%, Na_2O+K_2O is from 10 to 14%, and TiO is from 0 to 6%.

4. The glass for an information recording media substrate according to any one of Claims 1 to 3, which contains CaO, SrO and/or BaO, wherein the MgO content to the total content of MgO, CaO, SrO and BaO is at least 0.6 by molar ratio.

5. The glass for an information recording media substrate according to any one of Claims 1 to 4, wherein when the total content of Li_2O, Na_2O and K_2O is represented as R'_2O and the total content of alkaline earth metal oxides is represented as RO, $R'_2O/(R'_2O+RO)$

is from 0.25 to 0.75 by molar ratio.

6. The glass for an information recording media substrate according to any one of Claims 1 to 5, which contains K_2O, wherein the molar ratio of the K_2O content to the total content of Li_2O, Na_2O and K_2O is at least 0.2.

7. The glass for an information recording media substrate according to any one of Claims 1 to 6, which contains substantially no B_2O_3.

8. The glass for an information recording media substrate according to any one of Claims 1 to 7, which has a glass transition temperature of at least 600°C.

9. The glass for an information recording media substrate according to any one of Claims 1 to 8, which has an average linear expansion coefficient of at least 70×10^{-7}/°C and at most 95×10^{-7}/°C in a temperature range of from 50 to 350°C.

10. The glass for an information recording media substrate according to any one of Claims 1 to 9, wherein $(T_L - T_4) < 50$°C, where T_L is the liquidus temperature, and T_4 is the temperature at which the viscosity becomes 10^4 P.

11. The glass for an information recording media substrate according to any one of Claims 1 to 10, which has a density of at most 2.50 g/cm^3.

12. A glass substrate for information recording media, which is made of the glass for an information recording media substrate as defined in any one of Claims 1 to 11.