aluminosilicate glass that preferably contains, in mass%, SiO_2 in an amount of 57 to 75%, Al_2O_3 in an amount of 5 to 20% (it should be noted that the total amount of SiO_2 and Al_2O_3 is 74% or more), ZrO_2, HfO_2, Nb_2O_5, Ta_2O_5, La_2O_3, Y_2O_3 and TiO_2 in a total amount of more than 0% to 6% or less, Li_2O in an amount of more than 1% to 9% or less, Na_2O in an amount of 5 to 18% (it should be noted that a mass ratio Li_2O/Na_2O is 0.5 or less), K_2O in an amount of 0 to 6%, MgO in an amount of 0 to 4%, CaO in an amount of more than 0% to 5% or less (it should be noted that the total amount of MgO and CaO is 5% or less and the content of CaO is larger than that of MgO), and SrO+BaO in an amount of 0 to 3%.

[0027] Also, the glass substrate of this embodiment may contain, in terms of oxide amount in mass%,

SiO_2: 45.60 to 60%,

Al_2O_3: 7 to 20%,

B_2O_3: 1.00 or more to less than 8%,

P_2O_5: 0.50 to 7%,

TiO_2: 1 to 15%, and

the total amount of RO (it should be noted that R represents Zn and Mg): 5 to 35%.

In this case, it is also preferable to use glass containing CaO in an amount of 3.00% or less, BaO in an amount of 4% or less, no PbO, no As_2O_3, no Sb_2O_3, no Cl^- component, no NO^- component, no SO_3^- component, and no F^- component (second glass composition). By performing crystallization processing on such glass, crystallized glass can be obtained that contains one or more selected from RAl_2O_4 and R_2TiO_4 (it should be noted that R represents one or more selected from Zn and Mg) as a main crystal phase and in which the particle size of crystals in the main crystal phase is within a range of 0.5 nm to 20 nm, the degree of crystallization is 15% or less, and the specific gravity is 2.95 or less.

That is, crystallized glass may be used that contains SiO_2 in an amount

view of the polishing device (double-side polishing device) used in the first polishing processing. FIG. 5 is a cross-sectional view of the polishing device (double-side polishing device) used in the first polishing processing. It should be noted that a configuration similar to this polishing device can also be applied in the grinding device used in the grinding processing described above.

[0046] As shown in FIG. 4, the polishing device has a pair of upper and lower surface plates, that is, an upper surface plate 40 and a lower surface plate 50. An annular raw glass plate G is held between the upper surface plate 40 and the lower surface plate 50, and the raw glass plate G and the surface plates are relatively moved by moving one or both of the upper surface plate 40 and the lower surface plate 50, so that two main surfaces of the raw glass plate G can be polished.

[0047] The configuration of the polishing device will be more specifically described with reference to FIGS. 4 and 5.

In the polishing device, planar polishing pads 10 having an annular shape as a whole are attached to the upper surface of the lower surface plate 50 and the bottom surface of the upper surface plate 40. A carrier 30 has a toothing 31 that is provided on its outer circumferential portion and is meshed with a sun gear 61 and an inner gear 62, and one or more hole portions 31 for accommodating and holding the raw glass plate G. The sun gear 61, the inner gear 62 provided on the outer edge and the disc-shaped carrier 30 constitute, as a whole, a planetary gear mechanism that has a central axis CTR as the center. The disc-shaped carrier 30 is meshed with the sun gear 61 on the inner circumferential side and with the inner gear 62 on the outer circumferential side, and accommodates and holds one or more raw glass plates G (workpieces). On the lower surface plate 50, the carrier 30 revolves around the sun gear while rotating on its own axis as a planetary gear, and the raw glass plate G and the lower surface plate 50 are moved relative to each other. For example, when the sun gear 61 rotates in a counterclockwise (CCW) direction, the carrier 30 rotates in a clockwise (CW) direction and the inner gear 62 rotates in the CCW

After the film deposition as described above, by forming the protecting layer using C_2H_4 by, for example, a CVD method and performing nitriding processing that introduces nitrogen to the surface in the same chamber, a magnetic recording medium can be formed. Thereafter, by coating the protecting layer with polyfluoropolyether (PFPE) by a dip coat method, the lubricant layer can be formed.

In addition, a soft under layer (SUL), a seed layer, an intermediate layer and the like may be formed between the attaching layer and the magnetic recording layer by a known film deposition method such as a sputtering method (including a DC magnetron sputtering method, RF magnetron sputtering method, and the like) or a vapor deposition method. It is possible to refer to, for example, JP 2009-110626A, paragraphs [0027] to [0032] for detailed description on the above-described layers.

It should be noted that as described above, using the magnetic-disk glass substrate of this embodiment makes it possible to obtain a high SNR even if the thickness of the SUL is 30 nm or less.

[0056] It should be noted that the composition of the magnetic-disk glass substrate of this embodiment may include SiO_2, Li_2O and Na_2O, and one or more alkaline earth metal oxides selected from the group consisting of MgO, CaO, SrO and BaO as essential components, the molar ratio of the content of CaO to the total content of MgO, CaO, SrO and BaO (CaO/(MgO+CaO+SrO+BaO)) may be 0.20 or less, and the glass-transition temperature may be 650°C or higher. The magnetic-disk glass substrate having such a composition is preferably for a magnetic-disk glass substrate to be used in a magnetic disk for energy-assisted magnetic recording.

[0057] It is thought that it is preferable to use a high Ku magnetic material to form a magnetic recording layer in a magnetic disk for energy-assisted magnetic recording. For example, the magnetic recording layer can be made of an L10 ordered alloy including a magnetic material containing an alloy of Pt, and Fe and/or Co as a main component. In order to obtain such a magnetic

aluminosilicate glass that preferably contains, in mass%, SiO_2 in an amount of 57 to 75%, Al_2O_3 in an amount of 5 to 20% (it should be noted that the total amount of SiO_2 and Al_2O_3 is 74% or more), ZrO_2, HfO_2, Nb_2O_5, Ta_2O_5, La_2O_3, Y_2O_3 and TiO_2 in a total amount of more than 0% to 6% or less, Li_2O in an amount of more than 1% to 9% or less, Na_2O in an amount of 5 to 18% (it should be noted that a mass ratio Li_2O/Na_2O is 0.5 or less), K_2O in an amount of 0 to 6%, MgO in an amount of 0 to 4%, CaO in an amount of more than 0% to 5% or less (it should be noted that the total amount of MgO and CaO is 5% or less and the content of CaO is larger than that of MgO), and SrO+BaO in an amount of 0 to 3%.

[0027] Also, the glass substrate of this embodiment may contain, in terms of oxide amount in mass%,

SiO_2: 45.60 to 60%,

Al_2O_3: 7 to 20%,

B_2O_3: 1.00 or more to less than 8%,

P_2O_5: 0.50 to 7%,

TiO_2: 1 to 15%, and

the total amount of RO (it should be noted that R represents Zn and Mg): 5 to 35%.

In this case, it is also preferable to use glass containing CaO in an amount of 3.00% or less, BaO in an amount of 4% or less, no PbO, no As_2O_3, no Sb_2O_3, no Cl^- component, no NO^- component, no $SO2^-$ component, and no F^- component (second glass composition). By performing crystallization processing on such glass, crystallized glass can be obtained that contains one or more selected from RAl_2O_4 and R_2TiO_4 (it should be noted that R represents one or more selected from Zn and Mg) as a main crystal phase and in which the particle size of crystals in the main crystal phase is within a range of 0.5 nm to 20 nm, the degree of crystallization is 15% or less, and the specific gravity is 2.95 or less.

That is, crystallized glass may be used that contains SiO_2 in an amount

view of the polishing device (double-side polishing device) used in the first polishing processing. FIG. 5 is a cross-sectional view of the polishing device (double-side polishing device) used in the first polishing processing. It should be noted that a configuration similar to this polishing device can also be applied in the grinding device used in the grinding processing described above.

[0046] As shown in FIG. 4, the polishing device has a pair of upper and lower surface plates, that is, an upper surface plate 40 and a lower surface plate 50. An annular raw glass plate G is held between the upper surface plate 40 and the lower surface plate 50, and the raw glass plate G and the surface plates are relatively moved by moving one or both of the upper surface plate 40 and the lower surface plate 50, so that two main surfaces of the raw glass plate G can be polished.

[0047] The configuration of the polishing device will be more specifically described with reference to FIGS. 4 and 5.

In the polishing device, planar polishing pads 10 having an annular shape as a whole are attached to the upper surface of the lower surface plate 50 and the bottom surface of the upper surface plate 40. A carrier 30 has a toothing 31 that is provided on its outer circumferential portion and is meshed with a sun gear 61 and an inner gear 62, and one or more hole portions 32 for accommodating and holding the raw glass plate G. The sun gear 61, the inner gear 62 provided on the outer edge and the disc-shaped carrier 30 constitute, as a whole, a planetary gear mechanism that has a central axis CTR as the center. The disc-shaped carrier 30 is meshed with the sun gear 61 on the inner circumferential side and with the inner gear 62 on the outer circumferential side, and accommodates and holds one or more raw glass plates G (workpieces). On the lower surface plate 50, the carrier 30 revolves around the sun gear while rotating on its own axis as a planetary gear, and the raw glass plate G and the lower surface plate 50 are moved relative to each other. For example, when the sun gear 61 rotates in a counterclockwise (CCW) direction, the carrier 30 rotates in a clockwise (CW) direction and the inner gear 62 rotates in the CCW

After the film deposition as described above, by forming the protecting layer using C_2H_4 by, for example, a CVD method and performing nitriding processing that introduces nitrogen to the surface in the same chamber, a magnetic recording medium can be formed. Thereafter, by coating the protecting layer with perfluoropolyether (PFPE) by a dip coat method, the lubricant layer can be formed.

In addition, a soft under layer (SUL), a seed layer, an intermediate layer and the like may be formed between the attaching layer and the magnetic recording layer by a known film deposition method such as a sputtering method (including a DC magnetron sputtering method, RF magnetron sputtering method, and the like) or a vapor deposition method. It is possible to refer to, for example, JP 2009-110626A, paragraphs [0027] to [0032] for detailed description on the above-described layers.

It should be noted that as described above, using the magnetic-disk glass substrate of this embodiment makes it possible to obtain a high SNR even if the thickness of the SUL is 30 nm or less.

[0056] It should be noted that the composition of the magnetic-disk glass substrate of this embodiment may include SiO_2, Li_2O and Na_2O, and one or more alkaline earth metal oxides selected from the group consisting of MgO, CaO, SrO and BaO as essential components, the molar ratio of the content of CaO to the total content of MgO, CaO, SrO and BaO (CaO/(MgO+CaO+SrO+BaO)) may be 0.20 or less, and the glass-transition temperature may be 650°C or higher. The magnetic-disk glass substrate having such a composition is preferably for a magnetic-disk glass substrate to be used in a magnetic disk for energy-assisted magnetic recording.

[0057] It is thought that it is preferable to use a high Ku magnetic material to form a magnetic recording layer in a magnetic disk for energy-assisted magnetic recording. For example, the magnetic recording layer can be made of an L10 ordered alloy including a magnetic material containing an alloy of Pt, and Fe and/or Co as a main component. In order to obtain such a magnetic