

reference to FIG. 1C. In FIG. 1C, the linear portions of the main surface 11p, the side wall surface 11w, and the chamfered surface 11c are expressed as Lp, Lw, and Lc, respectively. In addition, in FIG. 1C, the intersection of the linear portion Lp of the main surface 11p and the linear portion Lc of the chamfered surface 11c is given as P11, the intersection of the linear portion Lw of the side wall surface 11w and the linear portion Lc of the chamfered surface 11c is given as P12, and the intersection of the linear portion Lp of the main surface 11p and the linear portion Lw of the side wall surface 11w is given as P13.

It is preferable that the angle formed by the linear portion Lp of the main surface 11p and the linear portion Lc of the chamfered surface 11c (chamfering angle: $\theta 1$) is, for example, 40 to 70 degrees. It is preferable that the angle formed by the linear portion Lp of the main surface 11p and the linear portion Lc of the chamfered surface 11c (chamfering angle: $\theta 2$) is, for example, 20 to 50 degrees. Also, it is preferable that a distance D1 between the point P11 and the point P13 is set to 0.05 to 0.20 mm and a distance D2 between the point P12 and the point P13 is set to 0.10 to 0.30 mm. By forming the shape within the above-described ranges, it is possible to prevent problems such as chipping of the outer circumferential end portion and dropping of the substrate, even when the outer circumferential end portion is held in an inspection step, a film forming step, a HDD assembling step, and the like after finishing the manufacture of the glass substrate.

It should be noted that while the end portion near one main surface on the outer circumferential side of the magnetic-disk glass substrate has been described with reference to FIG. 1C, other end portions (that is, the end portion near the other main surface on the outer circumferential side and the end portions on the inner circumferential side) are formed in the same manner.

In the description below, the side wall surface 11w and the chamfered surfaces 11c and 12c are collectively referred to as the "outer circumferential end surface", and the side wall surface and the chamfered surfaces on the inner circumferential side (not shown) are collectively referred to as the "inner

generating means, and thus, as shown in FIG. 3B, form magnetic field lines 29 that extend from the magnet 22 to the magnet 24. The magnetic field lines 29 extend so as to project outward from the center between the magnets 22 and 24 and also extend in the thickness direction of the raw glass plate. The spacer 5 26 made of a non-magnetic substance is provided between the magnets 22 and 24 in order to, for example, form the mass 30 of magnetic slurry as shown in FIG. 3C around the outer circumference of the pipe 28.

Although it is sufficient that a magnetic flux density of the magnetism generating means is set so that the mass 30 of the magnetic slurry is formed, 10 the magnetic flux density is preferably 0.1 to 10 tesla for the purpose of performing end surface polishing efficiently.

It should be noted that in the example shown in FIGS. 3A to 3C and FIG. 4, permanent magnets are used as the magnetism generating means, but electromagnets can also be used. Also, the magnets 22 and 24 can be fixed to 15 the pipe 28 to ensure a constant distance between the end surface on the N-pole side of the magnet 22 and the end surface on the S-pole side of the magnet 24 without the spacer 26.

[0036] Known glass substrate polishing abrasive particles such as cerium oxide, colloidal silica, zirconia oxide, alumina abrasive particles, or diamond 20 abrasive particles can be used as the polishing abrasive particles contained in the magnetic slurry. The polishing abrasive particles have the average particle diameter (D50) of, for example, 0.5 to 10 μm . Using the polishing abrasive particles having a particle diameter within this range makes it possible to favorably polish the inner end surface of the raw glass plate. The 25 polishing abrasive particles are contained in the magnetic slurry in an amount of, for example, 1 to 20 vol%. Here, the average particle diameter (D50) means a particle diameter at which the cumulative volume frequency calculated in volume percentage in ascending order from small to large particle diameters reaches 50%.

30 [0037] (5) Precision grinding step

500# diamond grindstone and final grinding was performed using a 3000# diamond grindstone in the chamfering step in step (3), and that the machining allowance was set to 8 μm in the end surface polishing in step (4).

[Working Example 4]

5 A magnetic-disk glass substrate was manufactured in the same manner as in Working Example 3, except that the machining allowance was set to 5 μm in the end surface polishing in step (4).

[Working Example 5]

10 A magnetic-disk glass substrate was manufactured in the same manner as in Working Example 3, except that the magnets and the raw glass plate were rotated in the down-cutting direction at the processing point in the end surface polishing in step (4).

[Working Example 6]

15 A magnetic-disk glass substrate was manufactured in the same manner as in Working Example 5, except that the machining allowance was set to 8 μm in the end surface polishing in step (4).

[Working Example 7]

20 A magnetic-disk glass substrate was manufactured in the same manner as in Working Example 5, except that the machining allowance was set to 4 μm in the end surface polishing in step (4).

[0045] [Comparative Example 1]

25 On the other hand, in Comparative Example 1, rough grinding for forming chamfered surfaces was performed using a 400# diamond grindstone in the chamfering in step (3). It should be noted that final grinding was not performed on the comparative example.

In addition, in the end surface polishing in step (4), the end surfaces of the raw glass plate were polished with a polishing brush using cerium oxide as loose abrasive particles. The machining allowance of the chamfered surfaces was 50 μm in step (4).

30 [Comparative Example 2]

Fluttering of each magnetic disk of Working Examples 1, 9, 10 and 11 and Comparative Examples 1, 3, 4 and 5 was evaluated in the same manner as described above, except that a 2.5 inch HDD having a rotation rate of 5400 rpm was used. The improved widths in the fluttering characteristic values between working examples and comparative examples having the same thickness (values obtained by subtracting the fluttering measurement value of the working example from the fluttering characteristic value of the comparative example) that were determined are as follows.

- Improved width when thickness was 1.000 mm: 2.6 nm
- Improved width when thickness was 0.800 mm: 5.0 nm
- Improved width when thickness was 0.635 mm: 10.0 nm
- Improved width when thickness was 0.500 mm: 20.5 nm

It is confirmed from the above-described results that the present invention exhibits a particularly large improved effect in the case where the thickness is 0.635 mm or less.

[0056] Next, the relationship between fluttering and the difference between surface A and surface B in the difference in curvature radius between the neighboring points was examined. Specifically, the average values of the difference in curvature radius between the neighboring points of surface A and surface B were determined, and the difference between surface A and surface B (ΔR) was obtained in an absolute value by determining the difference between the average value in surface A and the average value in surface B. ΔR was changed by controlling the tangential velocity at the processing point during the end surface polishing based on the manufacturing conditions of Working Example 1. The difference in the tangential velocity was set to 800 m/min or less in Working Examples 12 and 13, and to more than 800 m/min in Working Examples 14 and 15.

Moreover, fluttering was evaluated in the same manner as described above, except that a 2.5 inch HDD having a rotation rate of 15000 rpm was used. It should be noted that this evaluation was purposely performed under

CLAIMS

1. A doughnut-shaped magnetic-disk glass substrate having a circular
5 hole provided in the center, a pair of main surfaces, and an outer
circumferential end surface and an inner circumferential end surface each
including a side wall surface and a chamfered surface that is formed between
each main surface and the side wall surface,
wherein a measurement point is provided on the outer circumferential
10 end surface every 30 degrees in the circumferential direction with reference to
a center of the glass substrate, and when a curvature radius of a shape of a
portion between the side wall surface and the chamfered surface is determined
at each measurement point, a difference in the curvature radius between
neighboring measurement points is 0.01 mm or less.
15
2. The magnetic-disk glass substrate according to claim 1,
wherein the difference in the curvature radius between neighboring
measurement points is 0.005 mm or less.
- 20 3. The magnetic-disk glass substrate according to claim 1 or 2,
wherein a measurement point is provided every 30 degrees in the
circumferential direction with reference to the center of the glass substrate,
and when a curvature radius of a shape of a portion between the main surface
and the chamfered surface is determined at each measurement point as a
25 second curvature radius, a difference in the second curvature radius between
neighboring measurement points is 0.004 mm or less.
4. The magnetic-disk glass substrate according to any one of claims 1 to 3,
wherein the glass substrate has a thickness of 0.635 mm or less.

5. A magnetic disk in which at least a magnetic layer is formed on the magnetic-disk glass substrate according to any one of claims 1 to 4.

reference to FIG. 1C. In FIG. 1C, the linear portions of the main surface 11p, the side wall surface 11w, and the chamfered surface 11c are expressed as Lp, Lw, and Lc, respectively. In addition, in FIG. 1C, the intersection of the linear portion Lp of the main surface 11p and the linear portion Lc of the chamfered surface 11c is given as P11, the intersection of the linear portion Lw of the side wall surface 11w and the linear portion Lc of the chamfered surface 11c is given as P12, and the intersection of the linear portion Lp of the main surface 11p and the linear portion Lw of the side wall surface 11w is given as P13.

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It should be noted that in the example shown in FIGS. 3A to 3C and FIG. 4, permanent magnets are used as the magnetism generating means, but electromagnets can also be used. Also, the magnets 22 and 24 can be fixed to
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wherein a measurement point is provided on the outer circumferential end surface every 30 degrees in the circumferential direction with reference to a center of the glass substrate, and when a curvature radius of a shape of a portion between the side wall surface and the chamfered surface is determined at each measurement point, a difference in the curvature radius between neighboring measurement points is 0.01 mm or less.

2. The magnetic-disk glass substrate according to claim 1,
wherein the difference in the curvature radius between neighboring measurement points is 0.005 mm or less.

3. The magnetic-disk glass substrate according to claim 1 or 2,
wherein a measurement point is provided every 30 degrees in the circumferential direction with reference to the center of the glass substrate, and when a curvature radius of a shape of a portion between the main surface and the chamfered surface is determined at each measurement point as a second curvature radius, a difference in the second curvature radius between neighboring measurement points is 0.004 mm or less.

4. The magnetic-disk glass substrate according to any one of claims 1 to 3,
wherein the glass substrate has a thickness of 0.635 mm or less.

5. A magnetic disk in which at least a magnetic layer is formed on the magnetic-disk glass substrate according to any one of claims 1 to 4.