

CLAIMS

1. A glass substrate for a magnetic disk, wherein the glass substrate is configured such that, in regions with respect to two places arbitrarily selected on a surface of the glass substrate on a central portion side relative to an outer peripheral end, a surface shape with a shape wavelength in a band of 60 to 500 μ m is extracted from surface shapes in each of the regions and, assuming that a root mean square of the surface shape is given as a microwaviness (MW-Rq),

a difference between the microwavinesses (MW-Rq) of the regions is 0.02nm or less, and

a ratio between the microwavinesses (MW-Rq) of the regions is 1.1 or less,

wherein one of the two places is a region along a circumferential direction falling within a range of radius 31.5 ± 0.05 mm from a center of the glass substrate while the other place of the two places is a region along the circumferential direction falling within a range of radius 25 ± 3 mm from the center of the glass substrate,

wherein the microwaviness (MW-Rq) is measured using a laser Doppler vibrometer.

2. A glass substrate for a magnetic disk according to claim 1, wherein an outer peripheral end portion shape of the glass substrate is a shape falling within a range of ± 30 nm with respect to a main surface as a reference plane.

3. A glass substrate for a magnetic disk according to claim 1, wherein the glass substrate is for use with a magnetic head having a flying height of 5nm or less.

4. A glass substrate for a magnetic disk according to claim 1, wherein the magnetic disk is a magnetic disk for a load/unload system.

5. A magnetic disk having at least a magnetic layer formed over a surface of a glass substrate for a magnetic disk according to claim 1.

6. A magnetic disk manufacturing method, comprising the steps of:
producing a glass substrate for a magnetic disk according to claim 1, and
forming at least a magnetic layer over a surface of the glass substrate for the magnetic disk.

7. A glass substrate for a magnetic disk according to claim 1, wherein the microwaviness (MW-Rq) at the outer peripheral end is greater than the microwaviness (MW-Rq) on the central portion side.

8. A glass substrate for a magnetic disk according to claim 1, wherein an average value of the microwaviness (MW-Rq) on a main surface of the glass substrate is 0.4nm or less.

9. A glass substrate for a magnetic disk according to claim 1, wherein an average value and the standard deviation are calculated for the microwaviness (MW-Rq) measured continuously along the circumferential direction at the same radius.

10. A perpendicular magnetic recording disk, comprising:
at least a perpendicular magnetic recording layer formed over the glass substrate according to claim 1.

11. A hard disk drive, comprising:
at least the magnetic disk according to claim 1, and
a magnetic head.

12. A glass substrate for a magnetic disk, wherein the glass substrate is configured such that, in regions with respect to two places arbitrarily selected on a surface of the glass substrate on a central portion side relative to an outer peripheral

end, a surface shape with a shape wavelength in a band of 60 to 500 μ m is extracted from surface shapes in each of the regions and, assuming that a root mean square of the surface shape is given as a microwaviness (MW-Rq),

a difference between standard deviations of the microwavinesses (MW-Rq) of the regions is 0.04nm or less, and

a ratio between standard deviations of the microwavinesses (MW-Rq) of the regions is 1.1 or less,

wherein one of the two places is a region along a circumferential direction falling within a range of radius 31.5 ± 0.05 mm from a center of the glass substrate while the other place the two places is a region along the circumferential direction falling within a range of radius 25 ± 3 mm from the center of the glass substrate,

wherein the microwaviness (MW-Rq) is measured using a laser Doppler vibrometer.

13. A glass substrate for a magnetic disk according to claim 12, wherein an outer peripheral end portion shape of the glass substrate is a shape falling within a range of ± 30 nm with respect to a main surface as a reference plane.

14. A glass substrate for a magnetic disk according to claim 12, wherein the glass substrate is for use with a magnetic head having a flying height of 5nm or less.

15. A glass substrate for a magnetic disk according to claim 12, wherein the magnetic disk is a magnetic disk for a load/unload system.

16. A magnetic disk having at least a magnetic layer formed over a surface of a glass substrate for a magnetic disk according to claim 12.

17. A magnetic disk manufacturing method, comprising the steps of:
producing a glass substrate for a magnetic disk according to claim 12, and
forming at least a magnetic layer over a surface of the glass substrate for the magnetic disk.

18. A glass substrate for a magnetic disk according to claim 12, wherein the microwaviness (MW-Rq) at the outer peripheral end is greater than the microwaviness (MW-Rq) on the central portion side.

19. A glass substrate for a magnetic disk according to claim 12, wherein an average value of the microwaviness (MW-Rq) on a main surface of the glass substrate is 0.4nm or less.

20. A glass substrate for a magnetic disk according to claim 12, wherein an average value and the standard deviation are calculated for the microwaviness (MW-Rq) measured continuously along the circumferential direction at the same radius.

21. A perpendicular magnetic recording disk, comprising:
at least a perpendicular magnetic recording layer formed over the glass substrate according to claim 12.

22. A hard disk drive, comprising:
at least the magnetic disk according to claim 12, and
a magnetic head.

23. A glass substrate for a magnetic disk according to claim 12, wherein the standard deviations of the microwaviness (MW-Rq) at the outer peripheral end is greater than the standard deviations of the microwaviness (MW-Rq) on the central portion side.

CLAIMS

1. A glass substrate for a magnetic disk, wherein the glass substrate is configured such that, in regions with respect to two places arbitrarily selected on a surface of the glass substrate on a central portion side relative to an outer peripheral end, a surface shape with a shape wavelength in a band of 60 to 500 μ m is extracted from surface shapes in each of the regions and, assuming that a root mean square of the surface shape is given as a microwaviness (MW-Rq),

a difference between the microwavinesses (MW-Rq) of the regions is 0.02nm or less, and

a ratio between the microwavinesses (MW-Rq) of the regions is 1.1 or less,

wherein the two places are an outer peripheral end portion of the disk and a central portion of a recording/reproducing area of the disk,

wherein the outer peripheral end portion of the disk is a region falling within a predetermined distance inward and outward from a point located 1.0mm inward from an outer peripheral end of the disk toward a center of the disk,

wherein the microwaviness (MW-Rq) is measured using a laser Doppler vibrometer.

2. A glass substrate for a magnetic disk, wherein the glass substrate is configured such that, in regions with respect to two places arbitrarily selected on a surface of the glass substrate on a central portion side relative to an outer peripheral end, a surface shape with a shape wavelength in a band of 60 to 500 μ m is extracted from surface shapes in each of the regions and, assuming that a root mean square of the surface shape is given as a microwaviness (MW-Rq),

a difference between standard deviations of the microwavinesses (MW-Rq) of the regions is 0.04nm or less, and

a ratio between standard deviations of the microwavinesses (MW-Rq) of the regions is 1.1 or less,

wherein the two places are an outer peripheral end portion of the disk and a central portion of a recording/reproducing area of the disk,

wherein the outer peripheral end portion of the disk is a region falling within a predetermined distance inward and outward from a point located 1.0mm inward,

wherein the microwaviness (MW-Rq) is measured using a laser Doppler vibrometer.

3. A glass substrate for a magnetic disk according to claim 1 or 2, wherein an outer peripheral end portion shape of the glass substrate is a shape falling within a range of $\pm 30\text{nm}$ with respect to a main surface as a reference plane.

4. A glass substrate for a magnetic disk according to claim 1 or 2, wherein the glass substrate is for use with a magnetic head having a flying height of 5nm or less.

5. A glass substrate for a magnetic disk according to claim 1 or 2, wherein the magnetic disk is a magnetic disk for a load/unload system.

6. A glass substrate for a magnetic disk according to claim 1 or 2, wherein the microwaviness (MW-Rq) at the outer peripheral end is greater than the microwaviness (MW-Rq) on the central portion side.

7. A glass substrate for a magnetic disk according to claim 1 or 2, wherein an average value of the microwaviness (MW-Rq) on a main surface of the glass substrate is 0.4nm or less.

8. A glass substrate for a magnetic disk according to claim 1 or 2, wherein an average value and the standard deviation are calculated for the microwaviness (MW-Rq) measured continuously along the circumferential direction at the same radius.

9. A glass substrate for a magnetic disk according to claim 1 or 2, wherein one of the two places is a region along a circumferential direction falling within a range of radius $31.5 \pm 0.05\text{mm}$ from a center of the glass substrate while the other place of the two places is a region along the circumferential direction falling within a range of radius $25 \pm 3\text{mm}$ from the center of the glass substrate.

10. A glass substrate for a magnetic disk according to **claim 2**, wherein the standard deviations of the microwaviness (MW-Rq) at the outer peripheral end is greater than the standard deviations of the microwaviness (MW-Rq) on the central portion side.

11. A magnetic disk having at least a magnetic layer formed over a surface of a glass substrate for a magnetic disk according to claim 1 or 2.

12. A perpendicular magnetic recording disk, comprising:
at least a perpendicular magnetic recording layer formed over the glass substrate according to claim 1 or 2.

13. A magnetic disk manufacturing method, comprising the steps of:
producing a glass substrate for a magnetic disk according to claim 1 or 2, and
forming at least a magnetic layer over a surface of the glass substrate for the

magnetic disk.

14. A hard disk drive, comprising:

at least the magnetic disk according to claim 1 or 2, and
a magnetic head.