any one of Aspects 1 to 3, in which in the opening formation processing, an amount by which the raw material is shaved is 5 μm or less.

[0013] Aspect 5

The method for manufacturing a magnetic-disk substrate according to any one of Aspects 1 to 4, in which a thickness of the raw material after the opening formation processing is 300 to 800 μm.

[0014] Aspect 6

The method for manufacturing a magnetic-disk substrate according to any one of Aspects 1 to 5,

in which the raw material is a resin foam material, and

a ratio between an arithmetic average roughness Ra1 of the surface of the resin foam material before the opening formation processing is performed and an arithmetic average roughness Ra2 of the surface of the resin foam material after the opening formation processing is performed is such that $1<Ra2/Ra1\leq4$, and an arithmetic average roughness Ra of the resin foam material after the opening formation processing is performed is 1.0 μm or less.

[0015] Aspect 7

The method for manufacturing a magnetic-disk substrate according to any one of Aspects 1 to 6, in which with regard to microwaviness having a wavelength of 50 to 200 μm after the main surface of the substrate is polished, a root mean square roughness Rq of the substrate is 0.06 nm or less.

[0016] Another aspect of the present invention is a method for manufacturing a magnetic-disk ~~substrate~~, and includes the following aspect.

[0017] Aspect 8

In the method for manufacturing a magnetic-disk ~~substrate~~, at least a magnetic layer is formed on a main surface of the magnetic-disk substrate manufactured with the method for manufacturing a magnetic-disk substrate according to any one of Aspects 1 to 7.

[Advantageous Effects of the Invention]

[0018] Microwaviness having a wavelength of 50 to 200 μm on a main surface

magnetic disk has a disk shape, a central portion is hollowed out in a concentric shape so that the magnetic disk has a ring shape, and the magnetic disk rotates using the center of the ring as the rotation axis. The magnetic disk is obtained by stacking a magnetic layer and the like on the magnetic-disk glass substrate. For example, an adherent layer, a soft magnetic layer, a nonmagnetic base layer, a vertical magnetic recording layer, a protecting layer, a lubricant layer, and the like are formed on the glass substrate. Accordingly, a magnetic disk is manufactured. Thus, it is important to precisely manage the surface unevenness of the magnetic-disk glass substrate.

[0022] For example, urethane foam, which is the resin foam material, is used in a polishing pad that is used in processing for polishing a glass substrate of the present embodiment, such as a polishing pad used in polishing processing (second polishing processing). This resin foam material has a void layer (a void layer 24e shown in FIG. 3(b)) having an independent bubble structure whose inner portion is provided with a plurality of voids, and a surface film (surface film 24~~d~~c shown in FIG. 3(b)) provided on the surface side of the void layer, and the polishing pad is a so-called suede polishing pad having a portion in which a void cross section decreases in size from the inner portion to the surface of the polishing pad. Opening formation processing in which void openings are evenly formed in the surfaces of the polishing pad by shaving at least a surface film of this resin foam material has been performed on this polishing pad. This opening formation processing is performed before processing for polishing the glass substrate. This resin foam material is the raw material for the polishing pad. The resin foam material on which the opening formation processing has been performed refers to a raw material on which the opening formation processing has been performed or a resin foam material that has undergone the opening formation processing.

In the present embodiment, a resin foam material having, among surface roughnesses of a surface film of the resin foam material, an arithmetic average roughness Ra of 0.65 μm or less before the opening formation

surface plate 12 and the main surfaces on the upper side of the glass substrates G come into contact with the polishing pad 20 on the upper surface plate 14. By performing polishing in such a state, the main surfaces on both sides of the glass substrates G that were formed into an annular shape can be polished.

[0032] As shown in FIG. 1(b), the annular glass substrates G are held in circular holes provided in the carriers 18. On the other hand, the glass substrates G are held above the lower surface plate 12 by the carrier 18, which each have a gear 19 on the outer circumference. The carrier 18 engages with the sun gear 22 and the internal gear 16 provided in the lower surface plate 12. Due to the sun gear 22 being rotated in the direction of the arrow shown in FIG. 1(b), the carriers ~~208~~18 respectively revolve while rotating as planet gears in the arrow direction. Accordingly, the glass substrate G is polished using the polishing pads 20. At the time of polishing, the glass substrate G is polished by being pressed at 0.002 to 0.02 MPa, for example. The slurry that is used in the polishing is supplied to the upper surface plate 14 as shown in FIG. 1(a), flows to the lower surface plate 12, and is collected in an external container.

[0033] Note that the type, particle diameter, and variation in the particle diameter of the loose abrasive particles that are used in the second polishing processing, the hardness of a resin used for the polishing pad 20, the opening diameter of a later-described pore on the surface of the polishing pad 20, and the like are changed from those in the first polishing as appropriate. In the present embodiment, in order to reduce microwaviness having a wavelength of 50 to 200 μm on the polished glass substrate in at least the polishing processing, the surfaces of the polishing pads 20 are managed through the opening formation processing.

After the second polishing, the glass substrate G is cleaned to obtain a magnetic-disk glass substrate. Note that after the second polishing, polishing processing with which surface unevenness including the surface roughness and microwaviness of the main surfaces of the glass substrate do not change may be further performed.

processing. However, the arithmetic average roughness Ra of the resin foam material after the opening formation processing can be reduced by finding the correlational relationship between arithmetic average roughnesses Ra before and after the opening formation processing, as shown in FIG. 4, in advance, and selecting an appropriate resin foam material that has not undergone ~~foaming treatment~~ opening formation processing.

[0045] FIG. 5 is a diagram expressing a relationship between arithmetic average roughnesses Ra of the surface of the resin foam material before the opening formation processing and root mean square roughnesses Rq of the main surface of the glass substrate after the second polishing processing. As is understood from FIG. 5, as the arithmetic average roughness Ra of the surface of the resin foam material before the opening formation processing approaches 0.65 μm from a region of being slightly larger than 0.65 μm, Rq sharply decreases, or in other words, when Ra is close to 0.65 μm, Rq critically changes to 0.06 nm or less. As a result of this, it is found that the root mean square roughness Rq of the main surface of the glass substrate after the second polishing processing can be set to 0.06 nm or less by setting the arithmetic average roughness Ra of the surface of the resin foam material that has not undergone the opening formation processing to 0.65 μm or less.

[0046] As described above, although a method for manufacturing a magnetic-disk substrate and a method for manufacturing a magnetic disk of the present invention have been described in detail, the present invention is not limited to the above-described embodiment and working examples, and it will be appreciated that various improvements and modifications can be made without departing from the gist of the present invention.

[Descriptions of Reference Numerals]

[0047] 10 Polishing apparatus
12 Lower surface plate
14 Upper surface plate
16 Internal gear