DESCRIPTION

Title of Invention: METHOD OF MANUFACTURING DISK-SHAPED SUBSTRATE, AND DEVICE FOR MANUFACTURING DISK-SHAPED SUBSTRATE

Technical Field

[0001] The present disclosure relates to a method of manufacturing a disk-shaped substrate and a device for manufacturing a disk-shaped substrate.

Background Art

[0002] As a method of manufacturing a disk-shaped substrate, Japanese Patent Application Laid-Open (JP-A) Nos. 2023-032363 and 2020-107384 disclose a method of manufacturing a substrate for a magnetic disk, the method including a cutting step of performing cutting processing on a disk blank.

SUMMARY OF INVENTION

Technical Problem

[0003] When cutting a disk-shaped substrate, one surface of the disk-shaped substrate may be held by suction, and then the other surface of the disk-shaped substrate may be cut. At this time, in order to prevent foreign matter from adhering to a holding surface of a holding portion that holds the disk-shaped substrate, a method is conceivable in which a fluid is supplied to the holding surface, and the foreign matter adhered to the holding surface is removed.

Here, in a case in which the foreign matter removed from the holding surface floats in the air, for example, the foreign matter may re-adhere to the disk-shaped substrate or the like. In a case in which the foreign matter has re-adhered to the disk-shaped substrate, the foreign matter may be sandwiched between the disk-shaped substrate and the holding surface, and cause a concave defect to occur in the disk-shaped substrate. Note that examples of the foreign matter include cutting chips and fragments generated by cutting the disk-shaped substrate.

[0004] Therefore, an object of the disclosure is to provide a method of manufacturing a disk-shaped substrate and a device for manufacturing a disk-shaped substrate, in which re-adhesion of the foreign matter removed from the holding surface of the holding portion to the disk-shaped substrate is suppressed.

Solution to Problem

[0005] The disclosure includes the following aspects.

<1> A method of manufacturing a disk-shaped substrate, the method including

a first step of supplying a fluid to a holding surface of a holding portion that holds one

surface of a disk-shaped substrate during a period in which the disk-shaped substrate is not held, and removing foreign matter adhered to the holding surface;

a second step of suctioning the foreign matter removed from the holding surface while executing the supply of the fluid in the first step;

a third step of causing the one surface of the disk-shaped substrate to be held to the holding surface to which the fluid has been supplied; and

a fourth step of executing, with respect to the disk-shaped substrate held to the holding surface, at least one process selected from the group consisting of cutting processing, grinding processing, and polishing processing.

<2> The method of manufacturing a disk-shaped substrate according to <1>, in which

a supply portion that supplies the fluid is provided at a holding unit that holds the disk-shaped substrate and transfers the disk-shaped substrate to the holding surface, and

a suction portion that suctions the foreign matter removed from the holding surface is provided at the holding unit.

<3> The method of manufacturing a disk-shaped substrate according to <2>, in which

the supply portion and the suction portion move together with the holding unit, and, before the disk-shaped substrate is transferred to the holding surface, the supply portion supplies the fluid to the holding surface, and the suction portion suctions the removed foreign matter.

<4> The method of manufacturing a disk-shaped substrate according to <2> or <3>, in which,

in a state in which the holding unit holds the disk-shaped substrate with the one surface facing the holding surface, the supply portion supplies the fluid to the holding surface, and the suction portion suctions the removed foreign matter.

<5> The method of manufacturing a disk-shaped substrate according to any one of <1> to <4>, in which

the fluid is supplied to the holding surface while the holding surface is rotated during a period in which the disk-shaped substrate is not held to the holding surface, and the foreign matter adhered to the holding surface is removed.

<6> The method of manufacturing a disk-shaped substrate according to any one of <1> to <5>, in which,

in the first step, the fluid is intermittently supplied to the holding surface during a period in which the disk-shaped substrate is not held to the holding surface, and the foreign matter adhered to the holding surface is removed.

<7> The method of manufacturing a disk-shaped substrate according to <6>, in which

a supply interval for intermittently supplying the fluid is in a range of from 0.05

seconds to 1 second.

<8> A device for manufacturing a disk-shaped substrate, the device including:

a processing device including a holding portion that holds one surface of a disk-shaped substrate, and a processing portion that executes, with respect to the disk-shaped substrate held by the holding portion, at least one process selected from the group consisting of cutting processing, grinding processing, and polishing processing;

a foreign matter removal device including a supply portion that supplies a fluid to a holding surface of the holding portion, the foreign matter removal device supplying the fluid during a period in which the disk-shaped substrate is not held to the holding surface and removing foreign matter adhered to the holding surface; and

a foreign matter suction device that suctions the foreign matter removed from the holding surface when the foreign matter removal device supplies the fluid.

<9> The device for manufacturing a disk-shaped substrate according to <8>, in which

the supply portion is provided at a holding unit that holds the disk-shaped substrate and transfers the disk-shaped substrate to the holding portion.

<10> The device for manufacturing a disk-shaped substrate according to <8> or <9>, in which

the foreign matter removal device intermittently supplies the fluid to the holding surface during a period in which the disk-shaped substrate is not held to the holding surface, and removes foreign matter adhered to the holding surface.

<11> The device for manufacturing a disk-shaped substrate according to <10>, in which

a supply interval for intermittently supplying the fluid is in a range of from 0.05 seconds to 1 second.

Advantageous Effects of Invention

[0006] According to the disclosure, it is possible to provide a method of manufacturing a disk-shaped substrate and a device for manufacturing a disk-shaped substrate, in which re-adhesion of the foreign matter removed from the holding surface of the holding portion to the disk-shaped substrate is suppressed.

BRIEF DESCRIPTION OF DRAWINGS

[0007] Fig. 1 is a perspective view illustrating a manufacturing device according to an embodiment of the disclosure.

Fig. 2 is a perspective view illustrating a state in which an arm is positioned at a receiving position in the manufacturing device of the embodiment of the disclosure.

Fig. 3 is a perspective view illustrating a state in which the arm is positioned at a transfer position in the manufacturing device of the embodiment of the disclosure.

Fig. 4 is a perspective view illustrating a state in which cutting is performed on a disk-shaped substrate in the manufacturing device of the embodiment of the disclosure.

Fig. 5 is a perspective view illustrating a state in which foreign matter is removed in the manufacturing device according to the embodiment of the disclosure.

DESCRIPTION OF EMBODIMENTS

[0008] Embodiments of the disclosure will be described below. However, the disclosure is not limited to the following embodiments. In the following embodiments, the constituent elements are not essential unless specifically stated otherwise.

In a case in which embodiments are described with reference to drawings in the disclosure, the configuration of the embodiment is not limited to the configuration illustrated in the drawings. In addition, the sizes of the constituent elements in each drawing are conceptual. Accordingly, dimensional ratios of front-rear, left-right, and up-down dimensions in each constituent element, and dimensional ratios of front-rear, left-right, and up-down dimensions between the constituent elements, are not limited to the illustrated dimensional ratios. In addition, the dimensional ratios of front-rear, left-right, and up-down dimensions in each constituent element may differ from actual dimensional ratios.

In addition, unless otherwise specified in the disclosure, the number of each constituent element of the disclosure is not limited to one, and more than one constituent element may be present. Note that, in the following descriptions of the drawings, like reference signs are assigned to like portions.

[0009] <Manufacturing Device 90>

A manufacturing device 90 will be described as an example of a device for manufacturing a disk-shaped substrate of the disclosure, with reference to the drawings. Note that the device for manufacturing a disk-shaped substrate of the disclosure is not limited to the manufacturing device 90.

As illustrated in Fig. 4, the manufacturing device 90 is a device that manufactures a disk-shaped substrate 200 from an unprocessed disk-shaped substrate 100. The disk-shaped substrate 200 is a processed disk-shaped substrate on which processing has been performed with respect to the disk-shaped substrate 100. As illustrated in Fig. 1, the manufacturing device 90 includes a foreign matter removal device 50, a cutting device 60, and a foreign matter suction device 30. The disk-shaped substrate 100, respective units of the manufacturing device 90, and modifications of the manufacturing device 90 will be described below.

[0010] <Disk-Shaped Substrate 100>

As illustrated in Fig. 4, the disk-shaped substrate 100 is a substrate formed in a disk shape. Specifically, the disk-shaped substrate 100 is formed, in a plan view, in an annular shape having an inner periphery 100A and an outer periphery 100B. Note that the plan view here means a case in which the disk-shaped substrate 100 is viewed from one side in a thickness direction of the disk-shaped substrate 100. The disk-shaped substrate 100 is a substrate before cutting by a cutting device 60 is performed.

[0011] Furthermore, the disk-shaped substrate 100 is formed in a plate shape having a surface 100J on one side and a surface 100K on the other side. Hereinafter, the surface 100J on the one side is referred to as the first surface 100J. Hereinafter, the surface 100K on the other side is referred to as the second surface 100K.

Note that the boundary portion between the first surface 100J of the disk-shaped substrate 100 and the inner periphery 100A may be understood as part of the first surface 100J. The boundary portion between the first surface 100J of the disk-shaped substrate 100 and the outer periphery 100B may be understood as part of the first surface 100J.

The boundary portion between the second surface 100K of the disk-shaped substrate 100 and the inner periphery 100A may be understood as part of the second surface 100K. The boundary portion between the second surface 100K of the disk-shaped substrate 100 and the outer periphery 100B may be understood as part of the second surface 100K. Note that the boundary portions described above can also be said to be ridge line portions.

[0012] The disk-shaped substrate 100 may be, for example, a substrate for a magnetic recording medium. As the disk-shaped substrate 100, a substrate formed of a metal material such as aluminum or an aluminum alloy, glass, or the like can be used. The metal material may have a surface subjected to surface treatment such as plating. In this case, a target surface for cutting processing or the like can be a plating layer. An aluminum substrate is advantageous in that an aluminum substrate has excellent processability and manufacturing costs can be suppressed. Note that, in the disclosure, the term "aluminum substrate" is a generic term including an aluminum alloy substrate in addition to an aluminum substrate.

[0013] In contrast, a glass strengthening layer may be formed on a surface of the glass substrate. In this case, a target surface for cutting processing or the like can be the glass strengthening layer. The formation of the glass strengthening layer is not essential in the glass substrate. The disclosure can also be applied to a case in which cutting processing or the like is performed on a surface of a solid glass substrate on which no glass strengthening layer is formed. Since a glass substrate is excellent in strength, surface flatness, heat resistance, and the like as compared with an aluminum substrate, downsizing and higher density of a disk-

shaped substrate can be easily achieved.

Note that, although the disk-shaped substrate 100 is for a magnetic recording medium, the disclosure is not limited thereto, and various disk-shaped substrates whose use, material, type, and the like are not limited to those described above can be used.

[0014] <Cutting Device 60>

The cutting device 60 is a device that performs cutting processing on the disk-shaped substrate 100. Specifically, as illustrated in Fig. 1, the cutting device 60 has, for example, a holding portion 70, a cutting portion 64, and a holding unit 68.

[0015] The holding portion 70 has a function of holding the first surface 100J of the disk-shaped substrate 100. Specifically, as illustrated in Fig. 1, the holding portion 70 has, for example, a holding body 72, a support body 74, and a rotation mechanism 76.

[0016] The holding body 72 is formed in a cylindrical shape. The holding body 72 has a holding surface 71 formed in a circular shape as viewed in an axial direction of the holding body 72. A holding port 73 that opens at the holding surface 71 is formed in the holding body 72. The holding port 73 is formed, for example, in an annular shape as viewed in the axial direction of the holding body 72. In the holding portion 70, the first surface 100J of the disk-shaped substrate 100 is held to the holding surface 71 by drawing in air through the holding port 73.

[0017] The support body 74 rotatably supports the holding body 72 about an axis along the axial direction of the holding body 72. The rotation mechanism 76 rotates the holding body 72 about the axis. In the holding portion 70, in a state in which the disk-shaped substrate 100 is held to the holding surface 71, the rotation mechanism 76 rotates the holding body 72, thereby rotating the disk-shaped substrate 100.

[0018] The cutting portion 64 is an example of a processing portion and has a function of cutting the disk-shaped substrate 100. In the cutting portion 64, the second surface 100K of the disk-shaped substrate 100 is cut by bringing a cutting blade into contact with the disk-shaped substrate 100 rotating in a state in which the disk-shaped substrate 100 is held to the holding surface 71. In the cutting portion 64, for example, cutting may be performed, in the disk-shaped substrate 100, on the second surface 100K and a boundary portion between the second surface 100K and the outer periphery 100B. In the cutting portion 64, for example, cutting may be performed, in the disk-shaped substrate 100, on the first surface 100J and a boundary portion between the first surface 100J and the outer periphery 100B. Note that, in a case in which the first surface 100J and the boundary portion between the first surface 100J and the outer periphery 100B are cut, the cutting is performed in a state in which the disk-shaped substrate 100 is inverted and the second surface 100K is held to the holding surface 71.

Note that a cutting target to be cut by the cutting portion 64 may be, for example, only the outer periphery 100B, and, in addition to or instead of the outer periphery, may be the first surface 100J or the second surface 100K, or both of these surfaces. In the disk-shaped substrate 100, a portion excluding a portion held by the holding portion 70 can be a cutting target.

[0019] The holding unit 68 has a function of holding the disk-shaped substrate 100 and transferring the disk-shaped substrate 100 to the holding surface 71. Specifically, the holding unit 68 has, for example, a shaft portion 80, an arm 81, a moving mechanism 83, and a holding mechanism 84.

The shaft portion 80 is formed in a cylindrical shape having a hollow inside. The shaft portion 80 is supported by a support body not illustrated so as to be movable in an axial direction and rotatable.

[0020] A one end portion 81A of the arm 81 is attached to one end portion 80A in the axial direction of the shaft portion 80, and the arm 81 rotates integrally with the shaft portion 80. The arm 81 extends outward in a radial direction of the shaft portion 80 from the one end portion 80A of the shaft portion 80. A first hole 81D through which a nozzle 56 of the foreign matter removal device 50 is passed is formed in the one end portion 81A of the arm 81. Furthermore, a second hole 81E through which the nozzle 56 is passed is formed in an intermediate portion 81C of the arm 81. Note that the intermediate portion 81C of the arm 81 is a portion between the one end portion 81A and the other end portion 81B of the arm 81.

[0021] The holding mechanism 84 is a mechanism that holds the disk-shaped substrate 100. The holding mechanism 84 is provided at the other end portion 81B of the arm 81 and rotates integrally with the arm 81. Specifically, the holding mechanism 84 has, for example, a plurality of claw portions arranged along a circumferential direction of the inner periphery 100A of the disk-shaped substrate 100, and holds the disk-shaped substrate 100 by pressing the claw portions against the inner periphery 100A.

[0022] The moving mechanism 83 is, for example, a mechanism that rotates the arm 81 about an axis of the shaft portion 80 and moves the arm 81 along the axial direction of the shaft portion 80. Specifically, the moving mechanism 83 rotates the arm 81 between an opposing position and a receiving position. Furthermore, the moving mechanism 83 moves the arm 81 in an axial direction of the shaft portion 80 between the opposing position and a transfer position.

[0023] Note that the opposing position is the position illustrated in Fig. 1. The receiving position is the position illustrated in Fig. 2. The transfer position is the position illustrated in Fig. 3.

The opposing position is a position facing the holding surface 71 in a state in which the disk-shaped substrate 100 held by the arm 81 is separated from the holding surface 71.

The receiving position is a position at which the arm 81 receives the disk-shaped substrate 100, and is a position at which the disk-shaped substrate 100 held by the arm 81 does not face the holding surface 71. The receiving position is set, for example, to a position to which the arm 81 has rotated 180 degrees from the opposing position.

The transfer position is a position at which the arm 81 transfers the disk-shaped substrate 100 to the holding portion 70. At the transfer position, for example, the disk-shaped substrate 100 held by the arm 81 comes into contact with the holding surface 71.

[0024] <Cutting Processing by Cutting Device 60>

In the cutting device 60, for example, cutting processing of the disk-shaped substrate 100 is performed as follows. That is, in the cutting device 60, first, at the receiving position, the holding mechanism 84 provided at the arm 81 holds the disk-shaped substrate 100, whereby the arm 81 receives the disk-shaped substrate 100. At this time, the disk-shaped substrate 100 is held by the holding mechanism 84 in a state in which the second surface 100K faces the arm 81 side.

[0025] Next, the arm 81 that has received the disk-shaped substrate 100 is rotated by the moving mechanism 83 from the receiving position to the opposing position. Next, the arm 81 is moved by the moving mechanism 83 from the opposing position to the transfer position. Next, the holding portion 70 draws in air through the holding port 73, thereby holding the first surface 100J of the disk-shaped substrate 100 to the holding surface 71. At this time, holding of the disk-shaped substrate 100 by the holding mechanism 84 is released.

[0026] Next, as illustrated in Fig. 4, while the rotation mechanism 76 rotates the holding body 72 about an axis along the axial direction of the holding body 72, the cutting portion 64 brings a cutting blade into contact with the disk-shaped substrate 100. As a result, the disk-shaped substrate 100 is cut. The cutting is performed, for example, on the second surface 100K of the disk-shaped substrate 100 and a boundary portion between the second surface 100K and the outer periphery 100B.

[0027] Note that, in a case in which the first surface 100J and a boundary portion between the first surface 100J and the outer periphery 100B are cut, the cutting is performed in a state in which the disk-shaped substrate 100 is inverted by an inverting mechanism not illustrated, and the second surface 100K is held to the holding surface 71.

[0028] <Modifications of Cutting Device 60>

The holding portion 70 in the cutting device 60 is not limited to the configuration described above. The holding portion of the disclosure may, for example, hold a disk-shaped substrate by means other than suction. Accordingly, the holding portion of the disclosure need only hold one surface of the disk-shaped substrate.

The cutting portion 64 in the cutting device 60 is not limited to the configuration described above. The cutting portion of the disclosure need only cut the disk-shaped substrate held by the holding portion.

The holding unit 68 in the cutting device 60 is not limited to the configuration described above. As the holding unit of the disclosure, for example, an arm of the holding unit may move linearly instead of rotating, and various holding units can be used.

[0029] In the present embodiment, the cutting device 60 is used as an example of a processing device of the disclosure, but the processing device is not limited to this configuration. An example of the processing device of the disclosure may be, for example, a device that performs at least one of physical polishing or chemical polishing on the disk-shaped substrate 100. An example of the processing device of the disclosure need only be a device that performs at least one process selected from the group consisting of cutting processing, grinding processing, and polishing processing.

Note that cutting processing, grinding processing, and polishing processing are processes that may be accompanied by generation of foreign matter during processing. Examples of foreign matter generated in cutting processing, grinding processing, and polishing processing include cutting chips, fragments, and the like generated from the disk-shaped substrate 100 by processing on the disk-shaped substrate 100, or a processing agent such as a polishing agent.

[0030] <Foreign Matter Removal Device 50>

The foreign matter removal device 50 is a device that supplies air to the holding surface 71 of the holding portion 70 during a period in which the disk-shaped substrate 100 is not held, and removes foreign matter adhered to the holding surface 71.

[0031] As illustrated in Fig. 5, the foreign matter removal device 50 has a supply portion 52 that supplies air to the holding surface 71. The supply portion 52 intermittently supplies air to the holding surface 71 during a period in which the disk-shaped substrate 100 is not held, and removes foreign matter adhered to the holding surface 71. Specifically, as illustrated in Fig. 5, the supply portion 52 has a supply source 53, a supply pipe 54, an on-off valve 55, and a nozzle 56.

[0032] The supply source 53 supplies air to the supply pipe 54. As the supply source 53, for example, a compressor that generates compressed air and supplies the compressed air to the supply pipe 54 can be used. The supply pipe 54 is a pipe that supplies air from the supply source 53 to the nozzle 56.

[0033] The nozzle 56 is provided at the arm 81 in the holding unit 68 of the cutting device 60, and supplies air from the supply pipe 54 toward the holding surface 71. Specifically, the nozzle

56 is connected to the supply pipe 54 inside the shaft portion 80, and is passed through the first hole 81D and the second hole 81E of the arm 81. The on-off valve 55 is a valve that opens and closes a flow path of the supply pipe 54. As the on-off valve 55 opens and closes the flow path, air is intermittently supplied from the nozzle 56 to the holding surface 71. Note that the on-off valve 55 may open and close a flow path in a portion of the nozzle 56.

[0034] As the supply portion 52, for example, a pulse air blow device that controls opening and closing of the on-off valve 55 by a pulse signal can be used. A supply period of air by the supply portion 52 can be set according to a processing time of the entire processing step from the viewpoint of foreign matter removal, and is set, for example, as appropriate from periods that are 0.1 seconds or longer, 0.5 seconds or longer, or 1 second or longer, and 2 seconds or shorter. The supply period is a period during which the supply portion 52 supplies air in one supply operation. A supply interval in intermittent supply of air differs depending on a length of the supply period, and, from the viewpoint of foreign matter removal, is set, for example, as appropriate from periods that are 0.05 seconds or longer, 0.1 seconds or longer, or 0.2 seconds or longer, and 1 second or shorter. Note that the supply interval is an interval from a time point at which supply of air is started to a time point at which supply of air is next started in intermittent supply of air. A discharge pressure of air from the nozzle 56 is set, from the viewpoint of foreign matter removal, for example, in a range of 0.05 MPa or higher, 0.1 MPa or higher, 0.2 MPa or higher, or 0.5 MPa or higher. An upper limit value of the discharge pressure of air is not particularly limited, and can be, for example, 2 MPa or lower.

[0035] In the supply portion 52, as described above, the nozzle 56 is provided at the arm 81 in the holding unit 68 of the cutting device 60, and air can be supplied to the holding surface 71 from the arm 81 side.

[0036] <Modifications of Foreign Matter Removal Device 50>

In the foreign matter removal device 50, air is supplied to the holding surface 71, but the foreign matter removal device 50 is not limited to this configuration. The foreign matter removal device of the disclosure may supply, for example, a gas such as nitrogen or a liquid such as water. Examples of the supply portion of the foreign matter removal device of the disclosure include an ejector, a sprayer, and a supply head. The supply portion may be a supply portion that supplies a fluid through, for example, a pipe, an opening, and a slit, and various supply portions can be used. The foreign matter removal device of the disclosure need only supply a fluid that can be supplied to the holding surface.

In the foreign matter removal device 50, the supply portion 52 is provided at the holding unit 68 of the cutting device 60, but the foreign matter removal device 50 is not limited to this configuration. In the foreign matter removal device of the disclosure, the supply portion

may be provided, for example, at a device main body of the cutting device. In the foreign matter removal device of the disclosure, the supply portion can be installed at various locations.

In the foreign matter removal device 50, the supply portion 52 intermittently supplies air to the holding surface 71 during a period in which the disk-shaped substrate 100 is not held, but the foreign matter removal device 50 is not limited to this configuration. The supply portion of the disclosure may, for example, continuously supply air. Specifically, as the supply portion of the disclosure, for example, air may be supplied at a constant supply amount from the start to the end of a period in which the disk-shaped substrate 100 is not held.

[0037] <Foreign Matter Suction Device 30>

The foreign matter suction device 30 is a device that suctions foreign matter removed from the holding surface 71 by the foreign matter removal device 50. In the present embodiment, when the foreign matter removal device 50 supplies air, the foreign matter suction device 30 performs suction of foreign matter. As illustrated in Fig. 1, the foreign matter suction device 30 has, for example, a suction portion 32 and a drive portion 36.

The suction portion 32 has a distal end portion 34 having a suction port 33, and a suction pipe 35. One end portion of the suction pipe 35 is connected to the distal end portion 34. At the one end portion, an inside of the suction pipe 35 communicates with the suction port 33. The other end portion of the suction pipe 35 is connected to the drive portion 36. At the other end portion, the inside of the suction pipe 35 communicates with the drive portion 36.

The suction portion 32 is provided at the arm 81 in the holding unit 68 of the cutting device 60. Specifically, for example, the suction pipe 35 of the suction portion 32 is arranged from one end portion 81A to the other end portion 81B of the arm 81 on a side of the arm 81 opposite to the holding mechanism 84.

[0038] The drive portion 36 is a drive source that suctions air inside the suction portion 32. As the drive portion 36, for example, a suction pump, a suction fan, an ejector, or the like can be used.

In the foreign matter suction device 30, driving of the drive portion 36 causes the inside of the suction pipe 35 of the suction portion 32 to have a negative pressure, and foreign matter removed from the holding surface 71 is suctioned through the suction port 33. In the present embodiment, for example, while supply of air in the supply portion 52 of the foreign matter removal device 50 is executed, the drive portion 36 of the foreign matter suction device 30 is driven to perform suction of foreign matter. That is, the present embodiment has a period during which removal of foreign matter and suction of foreign matter are performed simultaneously. Note that the timing of starting suction of foreign matter may be the same as the timing of starting removal of foreign matter, or may be shifted from the timing of starting removal of

foreign matter. For example, suction of foreign matter may be started after removal of foreign matter is started. The timing of ending suction of foreign matter may be the same as the timing of ending removal of foreign matter, or may be shifted from the timing of ending removal of foreign matter. For example, suction of foreign matter may be ended after removal of foreign matter is ended.

[0039] <Modifications of Foreign Matter Suction Device 30>

In the foreign matter suction device 30, the suction portion 32 is provided at the holding unit 68 of the cutting device 60, but the foreign matter suction device 30 is not limited to this configuration. In the foreign matter suction device of the disclosure, the suction portion may be provided, for example, at a device main body of the cutting device. In the foreign matter suction device of the disclosure, the suction portion can be installed at various locations.

[0040] <Modifications of Manufacturing Device 90>

In the manufacturing device 90, as described above, the cutting device 60 performs cutting on the disk-shaped substrate 100, as a result of which the disk-shaped substrate 200 is manufactured.

Note that, in the disclosure, the manufacturing device 90 may include, for example, one or more other devices necessary for manufacturing the disk-shaped substrate 200. Examples of the other devices include a grinding device that grinds the disk-shaped substrate 100, a polishing device that polishes the disk-shaped substrate 100, a cleaning device that cleans the disk-shaped substrate 100, a drying device that dries the disk-shaped substrate 100, a conveying device that conveys the disk-shaped substrates 100 and 200, and an accommodation rack that accommodates the disk-shaped substrates 100 and 200.

[0041] <Method of Manufacturing Disk-Shaped Substrate 200>

The manufacturing method of the present embodiment is a method of manufacturing the disk-shaped substrate 200. The disk-shaped substrate 200 is a processed disk-shaped substrate on which processing has been performed with respect to the disk-shaped substrate 100.

In the present embodiment, the method of manufacturing the disk-shaped substrate 200 includes removing foreign matter adhered to the holding surface 71 of the holding portion 70 that holds the first surface 100J of the disk-shaped substrate 100, then holding the disk-shaped substrate 100 to the holding portion 70, and thereafter executing cutting processing. In the disclosure, the method of manufacturing the disk-shaped substrate 200 may be configured to include one or more other ordinarily known processes necessary for manufacturing the disk-shaped substrate 200 according to the type of the disk-shaped substrate 200.

[0042] For example, in the case of an aluminum substrate, the method of manufacturing the disk-shaped substrate 200 includes the following steps.

Blank substrate preparing step: an aluminum alloy ingot is rolled to obtain an aluminum alloy plate material having a thickness of about 2 mm or less, and the obtained aluminum alloy plate material is punched into a disk shape to prepare an aluminum substrate having desired dimensions.

Cutting step: chamfering of inner and outer diameters and cutting of both main surfaces are performed on the prepared aluminum alloy substrate.

Grinding step: in order to reduce surface roughness, undulation, and the like of the aluminum alloy substrate after cutting, grinding with a grindstone is performed on both main surfaces of the aluminum alloy substrate.

Plating step: with the aim of imparting surface hardness and suppressing surface defects to the substrate on which grinding has been performed, plating such as NiP is performed on a surface of the aluminum alloy substrate.

Polishing step: polishing processing is performed on both main surfaces of the aluminum alloy substrate on which a plating film has been formed.

[0043] In the case of a glass substrate, the method of manufacturing the disk-shaped substrate 200 includes, for example, the following steps.

Blank substrate preparing step: a glass blank serving as a material of a plate-shaped glass substrate for a magnetic recording medium having a pair of main surfaces is produced by press molding, and a circular hole is formed in a central portion of the produced glass blank to make the produced glass blank annular. Next, shape processing is performed to obtain a glass substrate having chamfered surfaces. Grinding and polishing are performed on inner and outer peripheral end surfaces of the shape-processed glass substrate.

Grinding step: grinding with fixed abrasive grains is performed on a main surface of the glass substrate after end-surface polishing.

Polishing step: polishing with a predetermined polishing agent is performed on the main surface of the glass substrate after the grinding step. Chemical strengthening treatment may be performed on the glass substrate during the polishing step.

[0044] Details of the manufacturing method according to the present embodiment will be described below.

The manufacturing method according to the present embodiment includes a foreign matter removal step, a foreign matter suction step, a holding step, and a cutting step. In the manufacturing method according to the present embodiment, the foreign matter removal step, the holding step, and the cutting step are executed in this order. The manufacturing method of the present embodiment can be executed, for example, by using the manufacturing device 90 described above. Note that the foreign matter removal step, the foreign matter suction step, the

holding step, and the cutting step are examples of the first step, the second step, the third step, and the fourth step, respectively.

[0045] In the foreign matter removal step, as illustrated in Fig. 5, air is supplied to the holding surface 71 of the holding portion 70 during a period in which the disk-shaped substrate 100 is not held, and foreign matter adhered to the holding surface 71 is removed.

In the foreign matter suction step, the foreign matter removed from the holding surface 71 is suctioned while supply of air in the foreign matter removal step is executed. As a result, the foreign matter removed from the holding surface 71 is less likely to float in the air, and re-adhesion of the foreign matter to the disk-shaped substrate 100 or the like is suppressed.

[0046] In the present embodiment, the supply portion 52 that supplies air may be provided at the holding unit 68 that holds the disk-shaped substrate 100 and transfers the disk-shaped substrate 100 to the holding surface 71. In this case, in the foreign matter removal step, air is supplied to the holding surface 71 from the supply portion 52 provided at the holding unit 68 that transfers the disk-shaped substrate 100 to the holding surface 71.

In the present embodiment, furthermore, the suction portion 32 may be provided at the holding unit 68. In this case, in the foreign matter suction step, the suction portion 32 provided at the holding unit 68 suctions the foreign matter removed from the holding surface 71. As a result, the foreign matter can be suctioned in the vicinity of a location where the foreign matter is likely to float. As a result, the foreign matter removed from the holding surface 71 is less likely to float in the air, and re-adhesion of the foreign matter to the disk-shaped substrate 100 and the holding unit 68 is suppressed.

According to the manufacturing method, when the disk-shaped substrate 100 is transferred from the holding unit 68 to the holding surface 71, removal of foreign matter from the holding surface 71 and suction of the foreign matter after removal can be performed. Specifically, according to the manufacturing method, for example, immediately before the disk-shaped substrate 100 is transferred, removal of foreign matter and suction of the foreign matter after removal can be performed.

[0047] In the present embodiment, the supply portion 52 and the suction portion 32 may move together with the holding unit 68, and, before the disk-shaped substrate 100 is transferred to the holding surface 71, the supply portion 52 may supply air to the holding surface 71 and the suction portion 32 may suction the removed foreign matter. According to the manufacturing method, since the supply portion 52 and the suction portion 32 move together with the holding unit 68, air can be supplied to a wide range of the holding surface 71, and the removed foreign matter can be suctioned over a wide range. As a result, remaining of foreign matter on the holding surface 71 and re-adhesion of foreign matter are suppressed.

Note that, in this case, while the holding unit 68 is moved in a movement direction in which the supply portion 52 and the suction portion 32 move along the holding surface 71, air may be supplied from the supply portion 52 to the holding surface 71, and the suction portion 32 may suction the removed foreign matter. At this time, by rotating the arm 81 forward and reverse, distal end portions of the nozzle 56 and the suction portion 32 may be reciprocated along the holding surface 71.

[0048] In the present embodiment, in a state in which the holding unit 68 holds the disk-shaped substrate 100 with the first surface 100J facing the holding surface 71, the supply portion 52 may supply air to the holding surface 71 and the suction portion 32 may suction the removed foreign matter.

As a result, after supply of air and suction of foreign matter are executed, the disk-shaped substrate 100 can be held to the holding surface 71 without changing the orientation of the disk-shaped substrate 100, and therefore work efficiency is improved.

[0049] In the present embodiment, the supply portion 52 may supply air to the holding surface 71 while the rotation mechanism 76 rotates the holding surface 71.

According to the manufacturing method, since air is supplied to the holding surface 71 while the holding surface 71 is rotated, air can be supplied to a wide range of the holding surface 71. As a result, remaining of foreign matter on the holding surface 71 is suppressed.

In the foreign matter removal step according to the present embodiment, supply of air to the holding surface 71 is executed, for example, after the arm 81 has rotated to the opposing position and before the arm 81 moves to the transfer position.

[0050] In the foreign matter removal step, air may be intermittently supplied to the holding surface 71 of the holding portion 70 during a period in which the disk-shaped substrate 100 is not held.

As a result, as compared with supplying air at a constant supply amount from the start to the end of the period, the supply amount of air has stronger and weaker phases, thereby making foreign matter adhered to the holding surface 71 more easily separated from the holding surface 71. As a result, remaining of foreign matter on the holding surface 71 is suppressed.

According to the present embodiment, since foreign matter is easily separated from the holding surface 71, remaining of foreign matter on the holding surface 71 can be suppressed without extending the supply period of air. As a result, the yield of the disk-shaped substrate 200 to be manufactured is improved.

[0051] In the holding step, the first surface 100J of the disk-shaped substrate 100 is held to the holding surface 71 to which air has been supplied. Specifically, the holding portion 70 draws in air through the holding port 73, thereby holding the first surface 100J of the disk-

shaped substrate 100 to the holding surface 71.

[0052] In the cutting step, the disk-shaped substrate 100 held to the holding surface 71 is cut. Specifically, as illustrated in Fig. 4, while the rotation mechanism 76 rotates the holding body 72 about an axis along the axial direction of the holding body 72, the cutting portion 64 brings a cutting blade into contact with the disk-shaped substrate 100, thereby cutting the disk-shaped substrate 100. The cutting is performed, for example, on the second surface 100K of the disk-shaped substrate 100 and a boundary portion between the second surface 100K and the outer periphery 100B.

[0053] Note that, in a case in which the first surface 100J and a boundary portion between the first surface 100J and the outer periphery 100B are cut, the cutting is performed in a state in which the disk-shaped substrate 100 is inverted by an inverting mechanism not illustrated, and the second surface 100K is held to the holding surface 71. In the manufacturing method, before the foreign matter removal step is performed, the manufacturing device 90 including the foreign matter removal device 50 and the cutting device 60 is prepared.

[0054] <Modifications of Manufacturing Method>

In the manufacturing method according to the present embodiment, air is supplied to the holding surface 71 from the supply portion 52 provided at the holding unit 68 that transfers the disk-shaped substrate 100 to the holding surface 71, but the manufacturing method is not limited to this configuration. In the manufacturing method of the disclosure, for example, air may be supplied to the holding surface from a supply portion provided at a location other than the holding unit, such as a device main body of the cutting device. In the manufacturing method of the disclosure, air can be supplied from various locations.

[0055] In the manufacturing method according to the present embodiment, air is supplied from the supply portion 52 to the holding surface 71 while the holding unit 68 is moved in a movement direction in which the supply portion 52 moves along the holding surface 71, but the manufacturing method is not limited to this configuration. In the manufacturing method of the disclosure, for example, air may be supplied from the supply portion to the holding surface in a state in which the holding unit is stopped.

[0056] In the manufacturing method according to the present embodiment, air is supplied from the supply portion 52 to the holding surface 71 while the rotation mechanism 76 rotates the holding surface 71, but the manufacturing method is not limited to this configuration. In the manufacturing method of the disclosure, for example, air may be supplied from a supply portion to a holding surface in a state in which the holding surface is stopped.

[0057] In the manufacturing method according to the present embodiment, supply of air to the holding surface 71 is executed, for example, after the arm 81 has rotated to the opposing

position and before the arm 81 moves to the transfer position, but the manufacturing method is not limited to this configuration. In the manufacturing method of the disclosure, supply of air to the holding surface 71 can be performed at various timings.

[0058] In the manufacturing method according to the present embodiment, the foreign matter removal step is included as one step of manufacturing the disk-shaped substrate 200, but the manufacturing method is not limited to this configuration. The foreign matter removal step may be executed alone as a foreign matter removal method independently from the manufacturing method according to the present embodiment.

[0059] In the present embodiment, the manufacturing device 90 has been described as a device including a cutting device as a processing device, but the manufacturing device 90 is not limited thereto, and the manufacturing device 90 may be a device including a grinding device or may be a device including a polishing device.

In the present embodiment, foreign matter removal is performed during cutting processing as the method of manufacturing the disk-shaped substrate, but the method is not limited thereto, and foreign matter removal may be performed during any one of cutting processing, grinding processing, and polishing processing, foreign matter removal processing may be performed during two processes selected from these kinds of processing, or foreign matter removal processing may be performed during processing in all three of these processes.

Examples

[0060] The disclosure will be specifically described below by way of Examples, but the scope of the disclosure is not limited to these Examples.

[0061] (Manufacture of Aluminum Alloy Substrate)

As a plate material of an aluminum alloy, an A5086-equivalent product (Mg: 4% by mass, Mn: 0.5% by mass, Fe: 0.3% by mass, Cr: 0.2% by mass, Si: 0.2% by mass, Zn: 0.2% by mass, balance Al) was used. Note that this plate material was manufactured by obtaining an aluminum alloy ingot by a semi-continuous casting method and then rolling the aluminum alloy ingot.

[0062] Next, a plate material having a thickness of 1.2 mm was punched into a donut disk shape to obtain an aluminum alloy substrate having a diameter of 97 mm and a center hole, and then the aluminum alloy substrate was annealed at 380°C for 1 hour. Thereafter, the above-described foreign matter removal step, holding step, and cutting step were executed on the aluminum alloy substrate, thereby obtaining an aluminum alloy substrate having a diameter of 95 mm and a thickness of 0.8 mm.

[0063] In each Example and each Comparative Example, as shown in Table 1 below, the foreign matter removal step was executed while changing an air supply operation, the number

of discharges in one supply operation, and a discharge pressure. Note that the air supply operation and the number of discharges in one supply operation were under the same conditions in each Example and each Comparative Example.

In each Example and each Comparative Example, a manufacturing method including the foreign matter removal step, the holding step, and the cutting step was executed while changing whether the foreign matter suction step was executed. In each Example and each Comparative Example, steps other than the foreign matter removal step and the foreign matter suction step were executed under the same conditions.

[0064] [Comparative Examples 1 and 2]

In Comparative Examples 1 and 2, the discharge pressure of air from the nozzle was set to 0.1 MPa or 0.2 MPa, respectively, as shown in Table 1, and air was intermittently supplied to the holding surface 71 of the holding portion 70 at intervals of 0.1 seconds. Accordingly, in Comparative Examples 1 and 2, the supply period of air in one supply operation was 1 second, and the number of discharges of air from the nozzle in one supply operation was 10 times.

In Comparative Examples 1 and 2, the manufacturing method according to the present embodiment including the foreign matter removal step, the holding step, and the cutting step was executed without executing the foreign matter suction step. That is, in Comparative Examples 1 and 2, the manufacturing method was executed in a state in which the drive portion 36 of the foreign matter suction device 30 was stopped.

[0065] [Examples 1 and 2]

In Examples 1 and 2, the discharge pressure of air from the nozzle was set to 0.1 MPa or 0.2 MPa, respectively, as shown in Table 1, and air was intermittently supplied to the holding surface 71 of the holding portion 70 at intervals of 0.1 seconds. In Examples 1 and 2, the supply period of air in one supply operation was 1 second, and the number of discharges of air from the nozzle in one supply operation was 10 times.

In Examples 1 and 2, the manufacturing method according to the present embodiment including the foreign matter removal step, the foreign matter suction step, the holding step, and the cutting step was executed. That is, in Examples 1 and 2, the foreign matter suction step of suctioning the foreign matter removed from the holding surface 71 while executing the supply of air in the foreign matter removal step was executed.

[0066] [Table 1]

[Table 1]

	Suction	Supply operation	Number of discharges in one supply operation	Discharge pressure	Number of concave defects (among 100 surfaces)	Processing time
Comparative	None	Intermittent at	10 times	0.1 MPa	1	No

Example 1		intervals of 0.1 seconds				extension
Comparative Example 2	None	Intermittent at intervals of 0.1 seconds	10 times	0.2 MPa	1	No extension
Example 1	Present	Intermittent at intervals of 0.1 seconds	10 times	0.1 MPa	0	No extension
Example 2	Present	Intermittent at intervals of 0.1 seconds	10 times	0.2 MPa	0	No extension

[0067] The manufacturing method according to the present embodiment was also executed for the following Reference Examples and Reference Comparative Examples, as shown in Table 2. In each Reference Example and each Reference Comparative Example, the foreign matter removal step was executed while changing an air supply operation, the number of discharges in one supply operation, and a discharge pressure. In each Reference Example and each Reference Comparative Example, the manufacturing method according to the present embodiment including the foreign matter removal step, the holding step, and the cutting step was executed without executing the foreign matter suction step. In each Reference Example and each Reference Comparative Example, steps other than the foreign matter removal step were executed under the same conditions.

[0068] [Reference Comparative Examples 1, 2, and 3]

In Reference Comparative Examples 1, 2, and 3, the discharge pressure of air from the nozzle was set to 0.1 MPa, 0.2 MPa, or 0.5 MPa, respectively, as shown in Table 2, and air was supplied to the holding surface 71 of the holding portion 70 continuously for 1 second. Accordingly, in Reference Comparative Examples 1, 2, and 3, the supply period of air in one supply operation was 1 second, and the number of discharges of air from the nozzle in one supply operation was 1 time.

[0069] [Reference Comparative Examples 4 and 5]

In Reference Comparative Examples 4 and 5, the discharge pressure of air from the nozzle was set to 0.1

MPa or 0.5 MPa, respectively, as shown in Table 2, and air was supplied to the holding surface 71 of the holding portion 70 continuously for 2 seconds. Accordingly, in Reference Comparative Examples 4 and 5, the supply period of air in one supply operation was 2 seconds, and the number of discharges of air from the nozzle in one supply operation was 1 time.

[0070] [Reference Examples 1, 2, and 3]

In Reference Examples 1, 2, and 3, the discharge pressure of air from the nozzle was set to 0.1 MPa, 0.2 MPa, or 0.5 MPa, respectively, as shown in Table 2, and air was

intermittently supplied to the holding surface 71 of the holding portion 70 at intervals of 0.05 seconds. In Reference Examples 1, 2, and 3, the supply period of air in one supply operation was 1 second, and the number of discharges of air from the nozzle in one supply operation was 20 times.

[0071] [Reference Examples 4, 5, and 6]

In Reference Examples 4, 5, and 6, the discharge pressure of air from the nozzle was set to 0.1 MPa, 0.2 MPa, or 0.5 MPa, respectively, as shown in Table 2, and air was intermittently supplied to the holding surface 71 of the holding portion 70 at intervals of 0.1 seconds. In Reference Examples 4, 5, and 6, the supply period of air in one supply operation was 1 second, and the number of discharges of air from the nozzle in one supply operation was 10 times.

[0072] [Table 2]

[Table 2]

	Supply operation	Number of discharges in one supply operation	Discharge pressure	Number of concave defects (among 100 surfaces)	Processing time
Reference Comparative Example 1	Continuous for 1 second	1 time	0.1 MPa	3	No extension
Reference Comparative Example 2	Continuous for 1 second	1 time	0.2 MPa	2	No extension
Reference Comparative Example 3	Continuous for 1 second	1 time	0.5 MPa	2	No extension
Reference Comparative Example 4	Continuous for 2 seconds	1 time	0.1 MPa	2	Extension by 1 second
Reference Comparative Example 5	Continuous for 2 seconds	1 time	0.5 MPa	2	Extension by 1 second
Reference Example 1	Intermittent at intervals of 0.05 seconds	20 times	0.1 MPa	0	No extension
Reference Example 2	Intermittent at intervals of 0.05 seconds	20 times	0.2 MPa	0	No extension
Reference Example 3	Intermittent at intervals of 0.05 seconds	20 times	0.5 MPa	0	No extension
Reference Example 4	Intermittent at intervals of 0.1 seconds	10 times	0.1 MPa	1	No extension
Reference Example 5	Intermittent at intervals of 0.1 seconds	10 times	0.2 MPa	1	No extension
Reference	Intermittent at	10 times	0.5 MPa	0	No extension

Example 6	intervals of 0.1 seconds				

[0073] (Evaluation of Concave Defects)

Entire surfaces of the aluminum alloy substrates obtained in the above-described Examples 1 and 2, Comparative Examples 1 and 2, the above-described Reference Examples 1 to 6, and Reference Comparative Examples 1 to 5 were observed using an optical inspection machine (OSA7100 manufactured by KLA-Tencor Corporation), and the number of concave defects over the entire surfaces of the substrates was counted. For each Reference Comparative Example and each Reference Example, concave defects were evaluated on both surfaces of 50 aluminum alloy substrates (a total of 100 surfaces).

[0074] (Evaluation of Processing Time)

A case in which the processing time in the foreign matter removal step did not exceed a predetermined reference time was evaluated as "No extension". In a case in which the processing time in the foreign matter removal step exceeded a predetermined reference time, the exceeded number of seconds N was evaluated as "Extension by N seconds".

[0075] As shown in Table 1, no concave defects occurred in Examples 1 and 2, whereas concave defects occurred in Comparative Examples 1 and 2.

[0076] As shown in Table 2, in Reference Examples 1 to 6, the number of concave defects was one or less. In Reference Examples 1 to 6, there was also no extension of the processing time, and the processing efficiency was also favorable. In Reference Comparative Examples 1 to 5, the number of concave defects was two or more. In Reference Comparative Examples 4 and 5, the processing time in the foreign matter removal step exceeded a predetermined reference time by 1 second.

[0077] The disclosure of Japanese Patent Application No. 2024-048654 filed on March 25, 2024 and the disclosure of Japanese Patent Application No. 2024-193629 filed on November 5, 2024 are incorporated herein by reference in their entirety. All documents, patent applications, and technical standards described in the present specification are incorporated herein by reference to the same extent as if each individual document, patent application, and technical standard were specifically and individually indicated to be incorporated by reference.