[Document Name] Description

[Title of Invention] MOVING STAGE

[Technical Field]

[0001]

The present invention relates to a moving stage that is installed in a processing room in which a processing target is processed under an adjusted atmosphere and moves while supporting the processing target.

[Background Art]

[0002]

Slide mechanisms that are used to move objects in production and inspection lines of semiconductor products in clean rooms are required to have high conveyance accuracy. A slide mechanism adopting air support is known as one of the mechanisms having high conveyance accuracy. Further, the slide mechanisms are required to be mechanisms in which dust is not generated as much as possible.

[0003]

Patent Literature 1 proposes a slide mechanism with fine particle discharge holes. The slide mechanism includes a rolling bearing and a guide rod inserted through the rolling bearing. The guide rod includes: a hollow part that passes through a central part thereof in the axial direction; and the discharge holes that are formed from a surface thereof toward the hollow part and serve to discharge fine particles inside of the rolling bearing. In this mechanism, fine particles that are generated by mechanical abrasion

in the rolling bearing can be absorbed and discharged from the discharge holes.

[Citation List]

[Patent Literature]

[0004]

[Patent Literature 1]

Japanese Patent Publication No. 5-82482

[Summary of Invention]

[Technical Problem]

[0005]

Meanwhile, the slide mechanism adopting air support is a slide mechanism not involving mechanical contact. Accordingly, dust is not generated from the mechanism adopting air support itself. However, there is a problem that, if fine particles exist on a surface close to the mechanism adopting air support or in the vicinity of the air support area, the fine particles are swirled up by jetted gas. In particular, an air pad for floating included in the slide mechanism jets air toward a horizontal plane of granite, a guide, or the like, to thereby travel while floating above the plane. Dust of fine particles and the like are likely to be deposited on the horizontal plane, and hence "swirling-up" due to such air jetting as described above is particularly likely to occur. Such swirling-up of the fine particles adversely influences performance of a semiconductor product as a processing target. The cleanliness in semiconductor manufacture is required to be higher along with enhancement in semiconductor performance. Particularly

in a semiconductor manufacturing apparatus that performs annealing treatment by laser irradiation, fine-particle dust is taken into a semiconductor along with melting and coagulation of the semiconductor, and decreases the quality of the semiconductor. Accordingly, such swirling-up of the fine particles as described above is required to be eliminated as much as possible.

[0006]

In the configuration proposed in Patent Literature 1, fine particles generated in the rolling bearing can be discharged. That is, the fine particles generated in the rolling bearing move while staying in the bearing, and are absorbed and discharged from the fine particle discharge ports formed in the guide rod. Hence, the absorption and discharge efficiency of the fine particles is not sufficient. Further, fine-particle dust that is generated in the vicinity of the air pad by jetting air does not move together with the air pad while staying in the vicinity of the air pad, but is scattered in the atmosphere. Hence, the configuration proposed in Patent Literature 1 cannot effectively absorb and discharge the fine-particle dust generated by the air pad.

[0007]

The present invention, which has been made against the backdrop of the above-mentioned circumstances, has an object to provide a moving stage that can effectively discharge fine-particle dust generated in the vicinity of an air support unit, to the outside of an atmosphere.

[Solution to Problem]

[0008]

That is, according to a first invention of a moving stage of the present invention, provided is a moving stage that is installed in a processing room in which a processing target is processed under an adjusted atmosphere, including: a stage main body on which the processing target is placed; and a gas support unit that supports the stage main body in a non-contact manner by a gas pressure. The gas support unit includes one or more gas pads that face at least a lying surface or/and a standing surface of the processing room and each blow out gas toward the surface. The moving stage further comprises a pad cover that covers, with a space, an outer peripheral surface of the gas pad and a gas pad rear surface opposite to a support surface of the gas support unit. A fine-particle dust suction port is provided by a gap between the outer peripheral surface of the gas pad and a peripheral edge of the pad cover. A suctioned gas exhaust line extended to an outside of the processing room is provided so as to be opened in a space between the gas pad rear surface and the pad cover and be communicated with the fine-particle dust suction port with an intermediation of a space in the pad cover.

[0009]

According to a moving stage of a second aspect, in the first invention, the gas support portion is provided to the stage main body.

[0010]

According to a moving stage of a third aspect, in the first or second invention, the gas support unit is provided to a guide that guides the stage main body.

[0011]

A plurality of the fine-particle dust suction ports are provided along a periphery of the gas pad.

[0012]

The fine-particle dust suction port

includes an opening that is continuous over an entire periphery of the gas pad.

[0013]

According to a moving stage of a fourth invention, in any of the first to third inventions, the fine-particle dust suction port is located behind of a blow-out end surface of the gas pad in a blow-out direction within a range of 100 mm or less.

[0014]

The moving stage further includes a pad cover that surrounds the gas pad and has an outer edge substantially along a peripheral edge of the gas pad. The fine-particle dust suction port is provided to the pad cover, and the fine-particle dust suction port and the suctioned gas exhaust line are connected to each other via a space in the pad cover.

[0015]

The fine-particle dust suction port is formed by a gap between the pad cover and the gas pad.

[0016]

According to a moving stage of a fifth invention, in any of the first to fourth inventions, a size of the gap falls within a range of 100 mm or less.

[0017]

According to a moving stage of a sixth invention, in any of the first to fifth inventions, the gas support unit includes a gas bearing that supports the stage main body in a non-contact manner with respect to an axis part.

[0018]

A difference between a total gas suction amount of the fine-particle dust suction port and a total gas blow-out amount of the gas support unit is adjusted to a predetermined amount range.

[0019]

According to a moving stage of a seventh invention, in any of the first to sixth inventions, the moving stage is installed in a semiconductor manufacture processing room whose processing target is a semiconductor.

[Advantageous Effects of Invention]

[0020]

According to the present invention, the fine-particle dust suction port placed around the gas pad enables fine-particle dust generated by the gas jetted from the gas pad to be effectively suctioned and discharged to the outside of the processing room, whereby harmful effects on the processing target due to the fine-particle dust can be avoided. Further, there is another effect that, if the moving stage is repetitively moved, fine-particle dust in the vicinity of the blow-out area can be removed and the inside of the processing room can be cleaned.

[Brief Description of Drawings]

[0021]

[Figure 1] Figure 1 is a schematic view illustrating a semiconductor manufacturing apparatus including a moving stage according to an embodiment of the present invention.

[Figure 2] Figure 2 is a schematic view illustrating a partial configuration including gas pads of the moving stage as well.

[Figures 3] Figures 3 are an enlarged view (a) illustrating the gas pad and a pad cover according to the embodiment, a view (b) illustrating a conventional gas pad, a simplified view (c) illustrating side surfaces of the gas pad and the pad cover according to the embodiment, and a simplified view (d) illustrating bottom surfaces of the gas pad and the pad cover according to the embodiment.

[Figure 4] Figure 4 is a view illustrating a gas pad and a fine-particle dust suction port according to another embodiment of the present invention.

[Figure 5] Figure 5 is a view illustrating a gas pad and fine-particle dust suction ports according to still another embodiment as well.

[Figure 6] Figure 6 is a view illustrating a gas pad and a fine-particle dust suction port according to still another embodiment as well.

[Figures 7] Figures 7 are views each illustrating a gas pad and fine-particle dust suction port(s) according to still another embodiment as well.

[Figure 8] Figure 8 is a view illustrating a gas pad and a fine-particle dust suction port according to still another embodiment as well.

[Figure 9] Figure 9 is a view illustrating a gas pad and a fine-particle dust suction port according to still another embodiment as well.

[Description of Embodiments]

[0022]

Hereinafter, a moving stage according to an embodiment of the present invention is described with reference to the attached drawings.

A semiconductor manufacturing apparatus 1 relatively scans and irradiates a semiconductor substrate 100 as a processing target with laser light, to thereby obtain an annealed semiconductor. The annealing treatment is intended for, for example, crystallization of amorphous semiconductor and impurity activation of a semiconductor.

[0023]

The semiconductor manufacturing apparatus 1 includes a hermetically sealed processing room 2, and the inside of the processing room 2 is adjusted to an appropriate atmosphere such as inert gas. In the present invention, the content of the atmosphere is not particularly limited, and examples thereof include an inert gas atmosphere, a vacuum atmosphere, and an atmosphere whose temperature and humidity are adjusted. Note that known means can be adopted as means for adjusting the atmosphere, and description and illustration thereof are omitted in the present embodiment. A surface plate 20 of the processing room 2 is made of granite, and the upper surface of the surface plate 20 corresponds to a floor surface.

[0024]

In the processing room 2, X-axis guides 10, 10 are placed in parallel on both sides, and a Y-axis guide 11 is provided between

the X-axis guides 10, 10 so as to be movable in an X-axis direction by means of a gas bearing (not illustrated).

A moving stage 3 is installed on the Y-axis guide 11 so as to be movable by means of an air slide bearing 31 using a gas bearing. The moving stage 3 includes a stage main body 30 on which the semiconductor substrate 100 is mounted. The stage main body 30 includes a mounting pedestal 32 on its upper side. The mounting pedestal 32 is provided with a mechanism for making the semiconductor substrate 100 movable upward and downward.

[0025]

On the lower side of the stage main body 30, gas pads 35 are respectively attached to four points that are located on both sides in a Y-axis direction and both sides sandwiching the Y-axis guide 11, with the intermediation of a lower frame 33.

[0026]

Each gas pad 35 includes a gas jetting portion (not illustrated) on its lower side, and a gas supply pipe 36 communicated with the gas jetting portion is connected to the gas pad 35. Examples of the gas jetting portion include an orifice type and a cross type. In the present embodiment, the gas jetting portion is not limited to a particular structure, and a known configuration can be applied thereto. The gas supply pipe 36 is connected to a gas supply unit (not illustrated) installed outside of the processing room 2 or the like. Gas is supplied to the gas jetting portion of the gas pad 35 through the gas supply unit and the gas supply pipe 36, and the gas is jetted from the lower surface of the gas pad 35 through the gas jetting portion, whereby the stage main body 30 can be floated from the upper surface of the

surface plate 20. The upper surface of the surface plate 20 corresponds to a lying surface of the present invention. Note that the shape of the gas pad 35 is circular in bottom view in the present embodiment, but the shape of the gas pad 35 is not limited to a particular shape in the present invention.

Further, in the present embodiment, description is given assuming that the lower surface of the gas pad 35 faces the surface plate 20. Alternatively, the lower surface of the gas pad 35 can be placed so as to face not the surface plate 20 but a lying surface of a guide surface and the like.

Further, in the present embodiment, description is given assuming that the gas pad 35 is attached to the stage main body 30. Alternatively, the gas pad 35 can be coupled to the stage main body 30 with the intermediation of another gas support unit, and can be provided to a member (for example, a guide) that can move in conjunction with the stage main body 30.

[0027]

The stage main body 30 that is gas-floated by gas jetting from the gas pads 35 can be moved in the Y-axis direction along the Y-axis guide 11 by a drive unit (for example, a linear motor) (not illustrated) while being gas-supported in a non-contact state. Further, the stage main body 30 can be moved in the X-axis direction along the X-axis guides 10 by a drive unit (for example, a linear motor) (not illustrated) while being gas-supported in a non-contact state together with the Y-axis guide 11.

[0028]

Accordingly, the gas bearing of the Y-axis guide 11 with respect to the X-axis guides 10 and the gas slide bearing 31 of the

Y-axis guide 11 constitute a gas support unit of the present invention together with the gas pads 35. Note that, in the present invention, the type of gas used for the gas support unit is not particularly limited, and atmosphere gas can be preferably used therefor.

[0029]

Moreover, as illustrated in Figure 2 and Figure 3(a), a fine-particle dust suction port (which is omitted in Figure 1) is provided around each gas pad 35. Description thereof is given below.

Note that Figure 3(b) illustrates a conventional gas pad 35, which is not provided with a fine-particle dust suction port.

[0030]

In the present embodiment, a pad cover 40 that covers the gas pad 35 is provided. The pad cover 40 covers an upper part and a surrounding side part of the gas pad 35. A suctioned gas exhaust pipe 41 is connected to the pad cover 40, and the gas in the pad cover 40 can be suctioned and exhausted through the suctioned gas exhaust pipe 41. The suctioned gas exhaust pipe 41 is extended to the outside of the processing room 2 directly or via another exhaust passage and the like, and is connected to an appropriate suction drive unit. In the present invention, the suction drive unit is not limited to a particular configuration, and a vacuum pump, a suction line in a factory, and the like can be used therefor. The suctioned gas exhaust pipe corresponds to a suctioned gas exhaust line of the present invention.

[0031]

The pad cover 40 has an outer edge along the peripheral edge of the gas pad 35, and the outer edge is located outside of the gas

pad 35. In the present embodiment, the pad cover 40 has a cylindrical container shape having an opened bottom surface and a closed upper part. With this configuration, a ring-shaped gap is formed between the outer surface of the gas pad 35 and the lower-end inner surface of the pad cover 40. This gap forms a fine-particle dust suction port 42.

[0032]

Note that it is desirable that the lower end of the pad cover 40 be located slightly above the lower end of the gas pad 35 as illustrated in Figure 3(c). This is to avoid the pad cover 40 from contacting and damaging the surface plate 20 when the gas pad 35 is installed on the surface plate 20. The surface plate 20 is manufactured so as to have precise flatness, and occurrence of damage can impair a function thereof as a manufacturing apparatus.

[0033]

In the present invention, a difference ΔH in height between the lower end surface of the pad cover 40 and the lower end of the gas pad 35 is not particularly limited. For example, in the present embodiment, the difference ΔH can fall within a range of 100 mm or less. If the difference in height is small, the pad cover 40 might contact the surface plate 20 when the gas pad 35 is installed on the surface plate 20. On the other hand, if the difference in height is excessively large, an action of effectively suctioning the gas that leaks out of the lower surface of the gas pad 35 decreases, and the suction efficiency of fine-particle dust generated by gas jetting becomes lower accordingly. Note that it is more desirable that ΔH be set to 10 mm or less in terms of suction at a position closer to the blowout plane.

[0034]

Further, as illustrated in Figures 3(c) and 3(d), the pad cover 40 has the outer edge larger than the peripheral edge of the gas pad 35. As a result, the fine-particle dust suction port 42 having a gap G is formed. If the gap G is small, the suction efficiency becomes insufficient when the fine-particle dust is diffused to the outside of the gas pad 35. On the other hand, if the gap is large, the suction pressure cannot be sufficiently obtained, and the suction efficiency of the fine-particle dust becomes lower. From these perspectives, it is desirable that the gap G in the plane direction between the pad cover 40 and the gas pad 35 fall within a range of 100 mm or less. Note that, in the present invention, the amount of the gap is not limited to a particular range. In the case where the suction speed is desired to be increased by making the gap G smaller, it is more desirable that the gap G be set to 50 mm or less.

[0035]

In the moving stage 3, as described above, gas is supplied from each gas supply pipe 36, and the gas is jetted from the lower surface of each gas pad 35, whereby the gas pad 35 is floated from the surface plate 20. As a result, the stage main body 30 is floated from the surface plate 20. Further, gas is supplied to the gas slide bearing 31, and the axis of the moving stage 3 is supported by the gas bearing in a non-contact manner. In this state, the stage main body 30 can be moved in the Y-axis direction by a linear motor or the like while the stage main body 30 is supported in a non-contact manner along the Y-axis guide 11. The moving speed is not particularly limited, and a moving speed of 3 to 50

mm/second is given in the case of, for example, laser annealing treatment.

[0036]

When the moving stage 3 is moved in the X-axis direction, similarly, the stage main body 30 is floated by the gas pads 35, and the Y-axis guide 11 is supported by the air bearing in a non-contact manner. In this state, the moving stage 3 can be moved by a linear motor or the like in the X-axis direction together with the Y-axis guide 11.

[0037]

Note that, during the movement in the X-axis direction or the Y-axis direction, the gas in the pad cover 40 is suctioned through the suctioned gas exhaust pipe 41, and is discharged to the outside of the processing room 2. As illustrated in Figure 3(a), fine-particle dust 50 stays on the surface plate 20. If the gas pad 35 moves above the upper surface of the surface plate 20, the fine-particle dust 50 below the gas pad 35 is swirled up by the gas jetted from the gas pad 35. Fortunately, the fine-particle dust 50 that has swirled up is suctioned from the fine-particle dust suction port 42, is taken into the pad cover 40, and is further suctioned by the suctioned gas exhaust pipe 41. Hence, the fine-particle dust 50 can be immediately and efficiently suctioned and exhausted to the outside of the processing room 2, and the fine-particle dust 50 can be prevented from drifting in the atmosphere in the processing room 2.

Further, if the moving stage 3 is repetitively moved, the amount of the fine-particle dust 50 that stays on the surface plate 20 can be gradually reduced.

[0038]

The gas jetting amount of the gas pad 35 and the gas suction amount of the fine-particle dust suction port 42 can be set to be equivalent to each other per unit time, and one of the amounts can be set to be larger than the other, but it is desirable that the difference therebetween be adjusted to fall within a predetermined range. This can reduce an influence on the atmosphere in the processing room 2. Further, in the case where gas suction for atmosphere adjustment is separately provided, it is desirable that the difference between the gas jetting amount of the gas pad 35 and the gas suction amount of the fine-particle dust suction port 42 fall within a predetermined range so as to be suited to the gas suction amount for the atmosphere adjustment.

[0039]

In the above-mentioned embodiment, the pad cover 40 that covers the gas pad 35 is provided. Alternatively, even if the pad cover 40 is not provided, fine-particle dust can also be suctioned and discharged.

Figure 4 illustrates a suctioned gas exhaust pipe 43 including the fine-particle dust suction port 42 in the vicinity of the gas pad 35. The fine-particle dust suction port 42 faces a slightly outer side of an outer peripheral edge bottom part of the gas pad 35. The suctioned gas exhaust pipe 43 moves together with the gas pad 35, and hence the positional relation between the gas pad 35 and the fine-particle dust suction port 42 does not change.

As illustrated in Figure 4, one fine-particle dust suction port 42 can be placed. As illustrated in Figure 5, a plurality of fine-particle dust suction ports 42 can be placed around the gas

pad 35. In the case where the plurality of fine-particle dust suction ports 42 are placed, the fine-particle dust suction ports 42 can be placed at regular intervals in the circumferential direction. Alternatively, in consideration of how much fine-particle dust is swirled up at each position in the circumferential direction, the fine-particle dust suction ports 42 can be unevenly distributed by, for example, placing a larger number of fine-particle dust suction ports 42 in a direction in which the swirling-up is more remarkable.

[0040]

Further, in the present invention, the shape of the fine-particle dust suction port is not particularly limited.

Figure 6 illustrates an embodiment including a nozzle-like suction part 45 including a slit-shaped fine-particle dust suction port 44. The fine-particle dust suction port 44 faces a slightly outer side of the outer peripheral edge bottom part of the gas pad 35. A suctioned gas exhaust pipe 46 is connected to a suction part 45, and fine-particle dust swirled up around the gas pad 35 is suctioned and discharged through the fine-particle dust suction port 44. The suctioned gas exhaust pipe 46 moves together with the gas pad 35, and the positional relation between the gas pad 35 and the fine-particle dust suction port 44 does not change.

[0041]

Note that a slit-shaped fine-particle dust suction port can have a shape along the peripheral edge shape of the gas pad 35. Figure 7(a) illustrates a plurality of slit-shaped fine-particle dust suction ports 47 placed along the peripheral edge shape of the gas pad 35, and Figure 7(b) illustrates a slit-shaped fine-particle

dust suction port 48 placed entirely along the peripheral edge shape of the gas pad 35.

[0042]

In the above-mentioned embodiments, description is given of the case where the gas jetting surface of the gas pad 35 faces downward and where the gas pad 35 is gas-supported by the lying surface (in the above, the horizontal surface as the upper surface of the surface plate 20) of the processing room 2. Alternatively, a gas pad that is gas-supported by the standing surface of the processing room 2 can also be provided with a fine-particle dust suction port, and fine-particle dust that is swirled up by gas jetting can be suctioned and discharged to the outside of the processing room 2. This example is described with reference to Figures 8 and 9. Note that the lying surface and the standing surface of the processing room 2 can be inclined to the horizontal direction and the vertical direction.

[0043]

In this example, a gas pad 37 that jets gas to be gas-supported in a non-contact manner is located with its jetting surface facing a side surface 21 provided to the surface plate 20, and the gas is jetted from the jetting surface toward the side surface 21, whereby the gas support can be achieved in a non-contact manner in a transverse direction. In this case, a gas support unit such as a gas pad for gas floating can also be provided, and the gas pad 35 described in the above embodiments can also be provided.

[0044]

In the example of Figure 8, a suctioned gas exhaust pipe 50 is placed around the gas pad 37, and the leading end thereof is configured as a fine-particle dust suction port 51. A gas supply pipe 38 for gas support is connected to the gas pad 37.

In Figure 8, only one fine-particle dust suction port 51 is illustrated, but a plurality of fine-particle dust suction ports 51 can be placed along the periphery of the gas pad 37. Note that, in the case where the plurality of fine-particle dust suction ports 51 are placed, the fine-particle dust suction ports 51 can be placed at regular intervals in the circumferential direction, and can be unevenly placed if how much fine-particle dust is swirled up is different for each direction.

[0045]

In the example of Figure 9, a pad cover 52 is placed around the gas pad 37. A suctioned gas exhaust pipe 53 is connected to the pad cover 52, and the gas in the pad cover 52 can be suctioned. The suctioned gas exhaust pipe 53 is extended to the outside of the processing room 2 directly or via another exhaust line and the like. The suctioned gas exhaust pipe 53 corresponds to the suctioned gas exhaust line of the present invention.

The pad cover 52 surrounds the entire periphery of the gas pad 37, and the leading end thereof is located behind of the jetting surface of the gas pad 37 in the jetting direction. The distance between the jetting surface and the leading end position of the pad cover 52 falls within a range of, desirably, 100 mm or less and, more desirably, 10 mm or less, similarly to the pad cover 40.

Further, the pad cover 52 is located outside of the outer edge of the gas pad 37, and the gap therebetween forms a fine-particle

dust suction port 54. The size of the gap falls within a range of, desirably, 100 mm or less and, more desirably, 50 mm or less, similarly to the pad cover 40.

[0046]

Hereinabove, the present invention has been described by way of the above-mentioned embodiments, but the present invention is not limited to the description of the above-mentioned embodiments, and can be changed as appropriate within a range not departing from the scope of the present invention.

[Reference Signs List]

[0047]

1 semiconductor manufacturing apparatus
2 processing room
3 moving stage
30 stage main body
31 gas slide bearing
35 gas pad
36 gas supply pipe
37 gas pad
38 gas supply pipe
40 pad cover
41 suctioned gas exhaust pipe
42 fine-particle dust suction port
43 suctioned gas exhaust pipe
44 fine-particle dust suction port
45 suction part
46 suctioned gas exhaust pipe

47 fine-particle dust suction port

48 fine-particle dust suction port

50 suctioned gas exhaust pipe

51 fine-particle dust suction port

52 pad cover

53 suctioned gas exhaust pipe

54 fine-particle dust suction port

Claims

[Claim 1]

A moving stage that is installed in a processing room in which a processing target is processed under an adjusted atmosphere, comprising:

a stage main body on which the processing target is placed; and

a gas support unit that supports the stage main body in a non-contact manner by a gas pressure, wherein

the gas support unit includes one or more gas pads that face at least a lying surface or/and a standing surface of the processing room and each blow out gas toward the surface,

the moving stage further comprises a pad cover that covers, with a space, an outer peripheral surface of the gas pad and a gas pad rear surface opposite to a support surface of the gas support unit,

a fine-particle dust suction port is provided by a gap between the outer peripheral surface of the gas pad and a peripheral edge of the pad cover, and

a suctioned gas exhaust line extended to an outside of the processing room is provided so as to be opened in a space between the gas pad rear surface and the pad cover and be communicated with the fine-particle dust suction port with an intermediation of a space in the pad cover.

[Claim 2]

The moving stage according to claim 1, wherein the gas support unit is provided to the stage main body.

[Claim 3]

The moving stage according to claim 1 or 2, wherein the gas support unit is provided to a guide that guides the stage main body.

[Claim 4]

The moving stage according to any of claims 1 to 3, wherein the fine-particle dust suction port is located behind of a blow-out end surface of the gas pad in a blow-out direction within a range of 100 mm or less.

[Claim 5]

The moving stage according to any of claims 1 to 4, wherein a size of the gap falls within a range of 100 mm or less.

[Claim 6]

The moving stage according to any of claims 1 to 5, wherein the gas support unit includes a gas bearing that supports the stage main body in a non-contact manner with respect to an axis part.

[Claim 7]

The moving stage according to any of claims 1 to 6, being installed in a semiconductor manufacture processing room whose processing target is a semiconductor.