SPECIFICATION

SUBSTRATE TRANSFER APPARATUS, SUBSTRATE TRANSFER METHOD AND EXPOSURE APPARATUS

TECHNICAL FIELD

[0001] The present invention pertains to a substrate transfer apparatus that carries substrates on which patterns are formed to a substrate exposure apparatus equipped with a substrate transfer method and a substrate transfer apparatus.

BACKGROUND ART

[0002] With reticles (also known as masks) used in next-generation lithography such as EPL and EUVL, a common problem is the weakness that pellicles that prevent the adhering of defect-causing particles onto the reticle pattern face cannot be used.

As a means to resolve this problem, there is a proposal to attach a protective cover when a reticle is not used and only remove it during exposure.

[0003] For example, refer to U.S. Pat. No. 6,239,863.

DISCLOSURE OF INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] However, in the above method, there was the problem that the protective cover for the reticle used during exposure is left in a state wherein the inner surface of the protective cover is exposed, and it is easy for particles and the like to become adhered to the inner surface of the protective cover.

The object of the present invention is to prevent contamination of the inner surface of the protective cover when a substrate is used.

MEANS TO SOLVE THE PROBLEM

[0005] A substrate transfer apparatus of the first invention carries substrates on which patterns are formed, the substrate transfer apparatus includes a protective cover that protects the substrate when the substrate is not used, and a cover protection means that covers the inner surface of the protective cover when the substrate is used.

A substrate transfer apparatus of the second invention is according to the substrate transfer apparatus of the first invention, wherein the cover protection means covers the inner surface of the protective cover when the substrate is used in exposure.

[0006] A substrate transfer apparatus of the third invention is according to the substrate transfer apparatus of the first or the second invention, wherein the protective cover includes a plurality of cover members that cover the substrate and are disposed so as to be attachable and removable, and the cover protective means holds the plurality of cover members in a closed state in a standby position.

A substrate transfer apparatus of the fourth invention is according to the substrate transfer apparatus of the third invention, wherein the cover protective means, after carrying the substrate along with one part of the plurality of cover members to the substrate exposure position, returns the one part of the cover members to the standby position and bringing the plurality of cover members into a closed state.

[0007] A substrate transfer apparatus of the fifth invention is according to the substrate transfer apparatus of the third or the fourth invention, wherein the closed state of the plurality of cover members is a state in which the plurality of cover members are sealed.

A substrate transfer apparatus of the sixth invention is according to the substrate transfer apparatus of the first or the second invention, wherein the protective cover includes a cover member that covers the pattern on the substrate and is disposed so as to be attachable and removable, and the cover protective means holds the cover member in a standby position in a state mounted to a dummy member that imitates the shape of the substrate.

[0008] A substrate transfer apparatus of the seventh invention is according to the substrate transfer apparatus of any one of the third to sixth inventions, wherein the standby position is a position that performs the alignment of the substrate.

A substrate transfer apparatus of the eighth invention is according to the substrate transfer apparatus of any one of the third to sixth inventions, wherein in the standby position, the cover member is removed from the substrate.

[0009] A substrate transfer apparatus of the ninth invention is according to the substrate transfer apparatus of any one of the third to sixth inventions, wherein the standby position is a library part that stores the substrate in an exposure atmosphere.

A substrate transfer apparatus of the tenth invention is according to the substrate transfer apparatus of any one of the third to ninth inventions, wherein the protective cover is grounded at the standby position.

[0010] A substrate transfer apparatus of the eleventh invention carries substrates on which patterns are formed, the substrate transfer apparatus includes in a state protected by a protective cover when the substrate is not used, and a grounding means that grounds the substrate or the protective cover.

A substrate transfer apparatus of the twelfth invention is according to the

substrate transfer apparatus of the eleventh invention, wherein the grounding means is provided on the setting machine that sets the substrate or the protective cover.

[0011] A substrate transfer apparatus of the thirteenth invention is according to the substrate transfer apparatus of the eleventh or the twelfth invention, wherein the substrate is grounded via the protective cover.

A substrate transfer method of the fourteenth invention carries substrates on which patterns are formed, the substrate transfer method includes the steps of carrying the substrates in a state protected by a protective cover when the substrate is not used, and holding the protective cover on standby so that the inner surface of the protective cover is covered when the substrate is used.

[0012] A substrate exposure apparatus of the fifteenth invention has the substrate transfer apparatus according any one of the first to thirteenth inventions.

ADVANTAGEOUS EFFECT OF THE INVENTION

[0013] According to one aspect of the substrate transfer apparatus of the present invention, the inner surface of the protective cover is covered by a cover protection means when the substrate is used. Therefore, when the substrate is used, contamination of the inner surface of the protective cover can be prevented.

According to another aspect of the substrate transfer apparatus of the present invention, the cover protection means covers the inner surface of the protective cover when the substrate is used in exposure. Therefore, when the substrate is used in exposure, contamination of the inner surface of the protective cover can be prevented.

[0014] According to another aspect of the substrate transfer apparatus of the present

invention, the protective cover includes a plurality of cover members disposed so as to cover the substrate and to be attachable and removable, and the cover protection means holds the plurality of cover members in a closed state in a standby position. Therefore, in a standby position, contamination of the inner surface of the protective cover can be prevented.

According to another aspect of the substrate transfer apparatus of the present invention, the cover protection means, after carrying the substrate along with one part of the plurality of cover members to the substrate exposure position, returns the one part of the cover members to the standby position and brings the plurality of cover members into a closed state. Therefore, when carrying the substrate to the substrate exposure position, contamination of the substrate can be prevented. Further, in a standby position, contamination of the inner surface of the protective cover can be prevented.

[0015] According to another aspect of the substrate transfer apparatus of the present invention, the closed state of the plurality of cover members is a state in which the plurality of cover members are sealed. Therefore, contamination of the inner surface of the plurality of cover members can be prevented.

According to another aspect of the substrate transfer apparatus of the present invention, the protective cover includes a cover member disposed so as to cover the pattern on the substrate and to be attachable and removable, and the cover protection means holds the cover member in a standby position in a state mounted to a dummy member that imitates the shape of the substrate. Therefore, in a standby position, since the inner surface of the cover member is covered with the dummy member, contamination of the inner surface of the cover member can be prevented.

[0016] According to another aspect of the substrate transfer apparatus of the present invention, the standby position is a position that performs alignment of the substrate. Therefore, at the alignment position of the substrate, contamination of the inner surface of the cover member can be prevented.

According to another aspect of the substrate transfer apparatus of the present invention, the standby position is a position where the cover member is removed from the substrate. Therefore, at the position where the cover member is removed from the substrate, contamination of the inner surface of the cover member can be prevented.

[0017] According to another aspect of the substrate transfer apparatus of the present invention, the standby position is a library part that stores the substrate in an exposure environment. Therefore, at the library part, contamination of the inner surface of the cover member can be prevented.

According to another aspect of the substrate transfer apparatus of the present invention, the protective cover is grounded at the standby position. Therefore, electrostatic charging of the substrate is prevented, and adhering of the particles to the protective cover can be reduced.

[0018] According to another aspect of the substrate transfer apparatus of the present invention, the grounding means grounds the substrate or the protective cover. Therefore, electrostatic charging of the substrate or the protective cover is prevented, and adhering of the particles to the substrate or the protective cover can be reduced.

According to another aspect of the substrate transfer apparatus of the present invention, the grounding means is provided on a setting machine that sets the substrate or the protective cover. Therefore, the substrate or the protective cover can be

grounded by setting the substrate or the protective cover on the setting machine.

[0019] According to another aspect of the substrate transfer apparatus of the present invention, the substrate is grounded via the protective cover. Therefore, the substrate and the protective cover can be grounded at the same time.

According to an aspect of the substrate transfer method of the present invention, when the substrate is used, the protective cover is held in standby in a state wherein the inner surface of the protective cover is covered. Therefore, contamination of the inner surface of the protective cover can be prevented.

[0020] According to an aspect of the exposure apparatus of the present invention, since a substrate transfer apparatus of the present invention are used, a product with high yield can be obtained using the substrates with little contamination.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. 1 is an illustration showing a first embodiment of the substrate transfer apparatus of the present invention.

FIG. 2 is an illustration showing a reticle carrier from FIG. 1.

FIG. 3 is an illustration showing the details of a CFP stage from FIG. 1.

FIG. 4 is an illustration showing the state exposing the reticle from the CFP in FIG. 3.

FIG. 5 is an illustration showing a state wherein the reticle is transferred from a CFP stage to a reticle stage of FIG. 1.

FIG. 6 is an illustration showing the state in the CFP stage of FIG. 1 where the CFP is in standby.

FIG. 7 is an illustration showing a second embodiment of the substrate transfer apparatus of the present invention.

FIG. 8 is an illustration showing a third embodiment of the substrate transfer apparatus of the present invention.

FIG. 9 is an illustration showing an embodiment of the exposure apparatus of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0022] Below we will explain the details of embodiments of the present invention using drawings. Note that the present invention is not limited to the following embodiments.

(First Embodiment)

FIG. 1 shows the first embodiment of the substrate transfer apparatus of the present invention.

This substrate transfer apparatus is provided adjacent to an exposure chamber 13 wherein reticle stage 11 and the like are disposed. On one side of reticle chamber 13, a robot chamber 17 is provided wherein a vacuum robot 15 is disposed. On one side of robot chamber 17, a vacuum reticle library 19 is provided, and on the other side a clean filter pod opener 21 (hereafter called "CFP opener") is provided. Exposure chamber 13, robot chamber 17, vacuum reticle library 19 and CFP opener 21 are in vacuum atmosphere.

[0023] In the position where robot chamber 17 faces exposure chamber 13, a load-lock chamber 23 is disposed. Load-lock chamber 23 communicates to robot chamber 17 via a second gate valve 25. In addition, [load-lock chamber 23] communicates to atmospheric

air via a first gate valve 27.

On the other side of load-lock chamber 23, a reticle carrier opener 31 is disposed via a second atmospheric robot 29. On the other side of reticle carrier opener 31, an atmospheric reticle library 35 is disposed via a first atmospheric robot 33.

[0024] With the above substrate transfer apparatus, in the atmospheric reticle library 35, as shown in FIG. 2, an EUVL reticle 37 used in exposure is placed in a state doubly protected by a reticle carrier 39 and a clean filter pod (hereafter called "CFP") 41. CFP 41 has the function of a protective cover protecting reticle 37 in a decompression atmosphere.

The reticle carrier 39 placed in atmospheric reticle library 35 is transferred by the first atmospheric robot 33 to reticle carrier opener 31. Then, reticle carrier 39 is identified by reticle carrier ID reader 43. At this reticle carrier opener 31 reticle carrier 39 is opened and CFP 41 is exposed. The exposed CFP 41 is heated about 2-3 degrees Celsius by temperature compensation lamp 45. The heated CFP 41 is transferred by a second atmospheric robot 29 onto load-lock chamber 23 wherein only the first gate valve 27 is opened. Note that the steps from reticle carrier opener 31 to load-lock chamber 23 are in a clean environment.

[0025] In load-lock chamber 23, vacuum drawing occurs for each CFP 41 in a state where the first gate valve 27 and second gate valve 25 are closed. When a specified state of vacuum is achieved in load-lock chamber 23, only second gate valve 25 opens and CFP 41 is transferred to vacuum reticle library 19 by vacuum robot 15.

In vacuum reticle library 19, for example around 5 sheets of reticle 37 are stored housed in CFP 41. The reticles 37 are held at a specified temperature by a temperature

adjustment mechanism (not shown). The reticles 37 stored in CFP 41 are identified by reticle ID reader 47. The identified reticles 37 are transferred by vacuum robot 15 to CFP opener 21 while housed in CFP 41.

[0026] In CFP opener 21, CFP 41 is opened and reticle 37 exposed.

In this embodiment, as shown in FIG. 3, the CFP 41 transferred to CFP opener 21 is set on CFP stage 49. CFP 41 includes upper cover member (upper lid) 51 and lower cover member (lower lid) 53. Then, as shown in FIG. 4, by lowering CFP stage 49 the exterior of upper cover member 51 is locked by locking member 57 on the upper end of support member 55, exposing reticle 37.

[0027] In this embodiment, at the lower region of CFP stage 49, a reference microscope 59 is disposed for performing prealignment of reticle 37. Then, a prealignment mark 37*a* formed on the lower surface of reticle 37 is detected by reference microscope 59 from a perforating hole 49*a* formed in CFP stage 49 and a transparent window 53*a* established in lower cover member 53 through transparent window 53*a*, and prealignment occurs by driving CFP stage 49. At this time, the reticle ID can be confirmed by detecting the reticle ID, such as a bar code, through the transparent window 53*a* in lower cover member 53.

[0028] The reticle 37 that has completed prealignment, as shown in FIG. 5, is transferred housed in the lower cover 53 of CFP 41 to reticle stage 11 by transfer arm 61 of vacuum robot 15. In reticle stage 11, electrostatic chuck 63 is disposed with adsorption face 63*a* facing down. Then, in a state where reticle 37 is crimped to adsorption face 63*a* of electrostatic chuck 63 by transfer arm 61 via lower cover member 53, the upper surface of reticle 37 is chucked to adsorption face 63*a* by turning on electrostatic chuck 63.

[0029] After chucking reticle 37, transfer arm 61 carries lower cover member 53 to CFP

opener 21, and lower cover member 53 is set on CFP stage 49, which is in the descended position shown in FIG. 4. Then, the upper cover member 51 and lower cover member 53 of CFP 41 are adhered by raising CFP stage 49, and the inside of upper cover member 51 and lower cover member 53 is sealed airtight. In this embodiment, the closed CFP 41 is held during exposure inside CFP opener 21 in that state. Note that in other cases it is acceptable to hold the CFP opener 21 and prealignment part at the prealignment part. Also, it is acceptable to transfer these to vacuum reticle library 19 and then hold them.

[0030] When exposure is completed and the exchange of reticle 37 of reticle stage 11 occurs, the upper cover member 51 and lower cover member 53 of the CFP 41 held in the state shown in FIG. 6 are separated by lowering CFP stage 49 and lowering the lower cover member 53 (corresponding to the state in FIG. 4 without reticle 37), and lower cover member 53 is transferred to the reticle 37 exchange position by transfer arm 61.

[0031] Then, with the lower cover member 53 in contact with reticle 37, which is attached to electrostatic chuck 63 (refer to FIG. 5), reticle 37 is set on lower cover member 53 by turning off electrostatic chuck 63. In this state, reticle 37 is transferred to CFP opener 21 by transfer arm 61 and lower cover member 53, on which is set reticle 37, is set on CFP stage 49, which is in the descended position as shown in FIG. 4. Then, by raising CFP stage 49, the upper cover member 51 of CFP 41 and lower cover member 53 are sealed (refer to FIG. 3) and CFP 41 is sealed airtight while reticle 37 is contained inside CFP 41.

[0032] In the above substrate transfer apparatus and method, when reticle 37 is used in exposure, the upper cover member 51 and lower cover member 53 of CFP 41 are closed and the inner surfaces of upper cover member 51 and lower cover member 53 are

covered; therefore, when reticle 37 is used in exposure, contamination of the inner surface of CFP 41 can be easily and reliably prevented. Then, because the inner surface of CFP 41 is not contaminated, there is very little contamination of reticle 37.

(Embodiment 2)

FIG. 7 shows a second embodiment of the substrate transfer apparatus of the present invention.

[0033] Note that in this embodiment, the same members as in the first embodiment are assigned the same symbols, so detailed explanation has been omitted.

In this embodiment, as shown in FIG. 7(*a*), the cover member 65 that is a protective cover is mounted so that it can be attached and removed and so that it covers only pattern 37*b* on reticle 37.

Then, as shown in FIG. 7(*b*), cover member 65 is transferred as mounted to cover member 65 by transfer arm 61 to electrostatic chuck 63 of reticle stage 11, then only reticle 37 is chucked to electrostatic chuck 63.

[0034] On the other hand, as shown in FIG. 7(*c*) cover member 65, which remains on transfer arm 61, is transferred to a standby part by transfer arm 61. In the standby part, as shown in FIG. 7(*d*), an imitation part 67 that imitates the shape of reticle 37 is disposed, and by mounting cover member 65 to this dummy member 67, the inner surface of cover member 65 is covered and protected by dummy member 67.

Then, when exposure is completed and the exchange of reticle 37 of reticle stage 11 occurs, cover member 65 is released from dummy member 67 and transferred to the reticle 37 exchange position by transfer arm 61. Then, after mounting cover 65 to the reticle 37 adhered to electrostatic chuck 63, reticle 37 is removed by turning electrostatic

chuck 63 off. The removed reticle 37 is transferred along with cover member 65 by transfer arm 61 to vacuum reticle library 19, for example.

[0035] In this embodiment the same result as in the first embodiment can be obtained.

(Embodiment 3)

FIG. 8 shows a third embodiment of the substrate transfer apparatus of the present invention.

Note that in this embodiment, the same members as in the first embodiment are assigned the same symbols, so detailed explanation has been omitted.

[0036] In this embodiment, a stage-side conductive layer 69 made of aluminum is formed on the upper surface of CFP stage 49 (setting machine) of CFP opener 21, for example. This stage-side conductive layer 69 is grounded via ground wire 71.

On the other hand, on the side surface of lower cover member 53 of CFP 41, when lower cover member 53 is set on stage-side conductive layer 69, a lower cover conductive layer 53*b* that contacts stage-side conductive layer 69 is formed. This lower cover conductive layer 53*b* contacts an upper cover conductive layer 51*b* formed on upper cover member 51 when upper cover member 51 is set on lower cover member 53. Also, on the upper surface of reticle 37, when upper cover member 51 is set, a reticle conductive layer 37*b* is formed that contacts upper cover conductive layer 51*b*.

[0037] With this embodiment, the same result as in the first embodiment can be obtained, but in this embodiment, at CFP stage 49 , lower cover member 53 of CFP 41, upper cover member 51, or reticle 37 are grounded, therefore electrostatic charging of lower cover member 53, upper cover member 51, or reticle 37 can be easily, reliably prevented. Accordingly, adhesion of particles to these members and the like can be

reduced.

[0038] Note that in this embodiment, we explained an example where lower cover member 53, upper cover member 51, or reticle 37 are grounded at CFP stage 49; however, it is acceptable for example to ground the plate of vacuum reticle library 19 on which CFP 41 is set, the setting machine of load-lock chamber 23, or the parts (end effectors) of vacuum robot 15 or atmospheric robot 29 that contact CFP 41. In this case, there is no need to ground at every location; it is acceptable to ground just those locations where one wants to prevent charging of CFP 41 and reticle 37.

[0039] Also, in the above embodiment, conductive layers 51*b* and 53*b* are formed on upper cover member 51 and lower cover member 53 of CFP 41 and when upper cover member 51 and lower cover member 53 are closed, they create a configuration where both are electrically connected. However, if upper cover member 51 and lower cover member 53 are made of conductive material (for example, aluminum), there is no special need to form a conductive layer. Then, just by placing CFP 41 on CFP stage 49 it becomes grounded. However, in case there is an insufficient electrical contact, it is acceptable to dispose a mechanical means of making a reliable electrical contact (for example a conductive needle). The same applies to conductive layer 51*b* of CFP 41 upper cover member 51 and conductive layer 37*b* of reticle 37.

[0040] Also, in the above embodiment, a reticle-side conductive layer 37*b* is formed only on the upper surface of reticle 37, but it is also acceptable to form a conductive layer on a side surface or lower surface (surface where circuit pattern is formed). In this case, it is necessary to form the conductive layer so that it does not harm exposure, inspection, or various alignments. Also, stage-side conductive layer 69 was formed on the entire

upper surface of CFP stage 49, but it is also acceptable to form only a portion of stage-side conductive layer 69, such that at the least reticle 37 or CFP 41 can be grounded.

[0041] Also, as shown in FIG. 7, in the case that cover member 65 is established only on the pattern surface 37*b* of reticle 37, because the upper surface of reticle 37 is exposed, grounding of reticle 37 can be made directly from its upper surface, and it is also possible to ground in the same manner as the above example via cover member 65.

(Embodiment of Exposure Apparatus)

FIG. 9 shows the patterning of the EUV light lithography system inside the exposure chamber 13 of FIG. 1. Note that in this embodiment, the same members as in the first embodiment are assigned the same symbols. In this embodiment, EUV light is used as the exposure light. EUV light has a wavelength of 0.1~400 nm, and for this embodiment a wavelength of 1~50 nm is preferable. The projection image uses an image optics system 101, and a reduction image of the pattern is formed on wafer 103 by reticle 37.

[0042] The pattern exposed onto wafer 103 is determined by the reflecting reticle 37 disposed on the lower side of reticle stage 11 via electrostatic chuck 63. This reflecting reticle 37 is loaded in and out by the vacuum robot 15 of the above embodiment (indication of vacuum robot 15 on the drawing is omitted). Also, wafer 103 is set on top of wafer stage 105. Typically, exposure is done by step scan.

[0043] The EUV light used as the illumination light during exposure has low transparency in atmospheric air; for this reason the light path traveled by EUV light is enclosed by vacuum chamber 106, which maintains a vacuum using an appropriate

vacuum pump 107. Also, EUV light is generated by a laser plasma X-ray source. The laser plasma X-ray source includes laser source 108 (operated as an excitation light source) and xenon gas supply apparatus 109. The laser plasma X-ray source is enclosed by vacuum chamber 110. The EUV light generated by the laser plasma X-ray source passes through window 111 of vacuum chamber 110.

[0044] Laser source 108 generates laser light having a wavelength below ultraviolet, for example using a YAG laser or excimer laser. The laser light from laser source 108 is focused and exposed in a flow of xenon gas ejected from nozzle 112 (supplied from xenon supply apparatus 109). When laser light is exposed in the xenon flow, the laser light sufficiently warms the xenon gas, generating plasma. When the xenon gas molecules excited by the laser fall into a low energy state, EUV light photons are emitted.

[0045] A parabolic mirror 113 is disposed adjacent to the xenon gas ejection part. Parabolic mirror 113 forms a condenser optics system and is disposed so that the focus point is adjacent to the position where xenon gas is emitted from nozzle 112. EUV light is reflected on the multi-layer film of parabolic mirror 113 and reaches condenser mirror 114 through window 111 of vacuum chamber 11.0. Condenser mirror 114 focuses EUV light on reflecting reticle 37 and reflects it. EUV light is reflected by condenser mirror 114 and illuminates a specific portion of reticle 37. That is to say, parabolic mirror 113 and condenser 114 compose the illumination system of this apparatus.

[0046] Reticle 37 has a multilayer film that reflects EUV light and an absorbent pattern layer for forming a pattern. By reflecting EUV light with reticle 37, the EUV light is "patternized." The "patternized" EUV light reaches wafer 103 through projection system

101.

The image optics system 101 of this embodiment includes 4 reflective mirrors: concave first mirror 115*a*, convex second mirror 115*b*, convex third mirror 115 *c* and concave fourth mirror 115*d*. A multilayer film that reflects EUV light is provided on each mirror 115*a* - *115d*.

[0047] The EUV light reflected from reticle 37 is reflected sequentially from first mirror 115*a* through to fourth mirror 115*d*, forming a reduced (for example, 1/4, 1/5, 1/6) image of the reticle pattern. Image optics system 101 is made to be telecentric on the image side (wafer 103 side).

Reticle 37 is supported on at least the X and Y planes by movable reticle stage 11. Wafer 103 is preferably supported in the X, Y and Z directions by movable wafer stage 105. When the die on wafer 103 is exposed, EUV light is exposed to a specific region on reticle 37 by illumination system 101, and reticle 37 and wafer 103 are moved relative to image optics system 101 at a specified speed according to the reduction percentage of image optics system 101. In this manner, the reticle pattern is exposed in the specified exposure area (toward the die) on wafer 103.

[0048] At time of exposure, it is desirable that wafer 103 be disposed behind a partition 116 so that the gas that is generated from the resist on wafer 103 not influence mirrors 115*a* - *115d* of image optics system 101. Partition 116 has an opening 116*a*, and EUV light is exposed through it from mirror 115*d* to wafer 103. The space inside partition 116 is evacuated by vacuum pump 117. In this manner, refuse in the form of gas generated by illuminating the resist is prevented from adhering to mirrors 115*a*~*d* or to reticle 37. For that reason, deterioration of the optical properties thereof is prevented.

[0049] With the exposure apparatus of this embodiment, transfer of reticle 37 is performed by the above substrate transfer apparatus; therefore a high yield product can be obtained using a reticle 37 with little contamination.

(Supplemental Items for the Embodiments)

(1) For the above embodiment, we explained an example where the inner surface of CFP 41 is covered when reticle 37 is used in exposure, but it is also acceptable for example to cover the inner surface of CFP 41 when reticle 37 is used in inspection, cleaning, etc.

[0050] (2) For the above first embodiment, we explained an example where the protective cover for reticle 37 is composed on an upper cover member 51 and a lower cover member 53, but it is also acceptable for example to be composed of 3 or more members.

(3) For the above embodiment, we explained an example of an exposure apparatus that uses EUV light, but other than this it is also acceptable to broadly apply an exposure apparatus using charged particle rays, i-line, g-line, KrF, ArF, F2 and the like.

[0051] In the above we explained the present invention in detail, however, the invention is not limited to the above embodiments and various modifications may be made without departing from the spirit and scope of the invention. Any improvement may be made in part or all of the components.

INDUSTRIAL APPLICABILITY

[0052] In the substrate transfer apparatus of the present invention, the inner surface of the protective cover is covered by a cover protection means when the substrate is used.

Therefore, contamination of the inner surface of the protective cover can be prevented when the substrate is used.

In the substrate transfer apparatus of the present invention, the protective cover is grounded at the standby position. Therefore, electrostatic charging of the substrate is prevented, and adhering of the particles to the protective cover can be reduced.

[0053] In the substrate transfer method of the present invention, when the substrate is used, the protective cover is held in standby in a state wherein the inner surface of the protective cover is covered. Therefore, contamination of the inner surface of the protective cover can be prevented.

In the exposure apparatus of the present invention, since a substrate transfer apparatus of the present invention are used, a product with high yield can be obtained using the substrates with little contamination.

CLAIMS

1. A substrate transfer apparatus that carries a substrate on which patterns are formed, the substrate transfer apparatus comprising:

a protective cover that protects the substrate when the substrate is not used, and

a cover protection means that covers the inner surface of the protective cover when the substrate is used.

2. The substrate transfer apparatus according to claim 1, wherein the cover protection means covers the inner surface of the protective cover when the substrate is used in exposure.

3. The substrate transfer apparatus according to claim 1 or 2, wherein the protective cover comprises a plurality of cover members disposed so as to cover the substrate and to be attachable and removable, and the cover protection means holds the plurality of cover members in a closed state in a standby position.

4. The substrate transfer apparatus according to claim 3, wherein the cover protection means, after carrying the substrate along with one part of the plurality of cover members to the substrate exposure position, returns the one part of the cover members to the standby position and brings the plurality of cover members into a closed state.

5. The substrate transfer apparatus according to claim 3 or 4, wherein the closed state of the plurality of cover members is a state in which the plurality of cover members are sealed.

6. The substrate transfer apparatus according to claim 1 or 2, wherein the protective cover comprises a cover member disposed so as to cover the patterns on the substrate and to be attachable and removable, and the cover protection means holds the

cover member in a standby position in a state mounted to a dummy member that imitates the shape of the substrate.

7. The substrate transfer apparatus according to any one of claims 3 to 6, wherein the standby position is a position that performs alignment of the substrate.

8. The substrate transfer apparatus according to any one of claims 3 to 6, wherein in the standby position, the cover member is removed from the substrate.

9. The substrate transfer apparatus according to any one of claims 3 to 6, wherein the standby position is a library part that stores the substrate in an exposure environment.

10. The substrate transfer apparatus according to any one of claims 3 to 9, wherein the protective cover is grounded at the standby position.

11. A substrate transfer apparatus that carries substrates on which patterns are formed, the substrate transfer apparatus comprising:

in a state protected by a protective cover that protects the substrate when the substrate is not used, and

a grounding means that grounds the substrate or the protective cover.

12. The substrate transfer apparatus according to claim 11, wherein the grounding means is provided on a setting machine that sets the substrate or the protective cover.

13. The substrate transfer apparatus according to claim 11 or 12, wherein the substrate is grounded via the protective cover.

14. A substrate transfer method that carries substrates on which patterns are formed, the substrate transfer method comprising the steps of:

carrying a substrates in a state protected by a protective cover when the

substrate is not used, and

holding the protective cover on standby so that the inner surface of the protective cover is covered when the substrate is used.

15. An exposure apparatus having a substrate transfer apparatus according to any one of claims 1 to 13.