

right end of the housing 2 and the right end of the standby part 27 of the sub housing 16. A seal cap 34 as a cover is horizontally installed in an arm 33 connected to the elevating base of the boat elevator 32. The seal cap 34 is configured to vertically support the boat 26 and to hermetically seal the furnace port part with the boat 26 loaded into the process chamber 29.

[0023] The boat 26 is configured to support a plurality of substrates 18 in a horizontal posture and in multiple stages with the centers of the substrates 18 aligned with one another.

[0024] A clean unit 35 is disposed at a position opposite to the boat elevator 32 side, and is configured by a supply fan and a dustproof filter so as to supply a cleaned atmosphere or a clean air 36 as an inert gas. A notch matching device (not shown) as a substrate matching device for matching positions of the substrates 18 in the peripheral direction is installed between the substrate transfer mechanism 24 and the clean unit 35.

[0025] The clean air 36 discharged from the clean unit 35 is configured to be flowed through the notch matching device (not shown), the substrate transfer mechanism 24 and the boat 26, and then to be sucked in by a duct (not shown) and discharged to the outside of the housing 2 or injected into the transfer chamber 23 by the clean unit 35.

[0026] Next, an operation of the substrate processing apparatus 1 will be described.

[0027] When the pod 9 is supplied to the load port 8, the pod loading/unloading port 6 is opened by the front shutter 7. The pod 9 on the load port 8 is loaded into the housing 2 by the pod transfer device 15 via the pod loading/unloading port 6, and is held on the specified shelf board 13 of the rotary pod shelf 11. The pod 9 is temporarily stored in the rotary pod shelf 11, and is then transferred from the shelf board 13 to one of the pod openers 14 by the pod transfer device 15 and is transferred to the mounting stand 21 or transferred directly from the load port 8 to the mounting stand 21.

[0028] At this time, the substrate loading/unloading port 19 is closed by the opening/closing mechanism 22, and the clean air 36 is flowed through and filled in the transfer chamber 23. For example, the transfer chamber 23 is filled with a nitrogen gas as the clean air 36.

[0029] The opening side end surface of the pod 9 held on the mounting stand 21 is pressed against the opening edge side of the substrate loading/unloading port 19 on the front wall 17 of the sub housing 16, and the cover thereof is removed by the opening/closing mechanism 22 to open the wafer entrance.

[0030] When the pod 9 is opened by the pod opener 14, the substrates 18 are discharged from the pod 9 by the wafer transfer mechanism 24 and transferred to the notch matching device (not shown) to match the substrates 18. Thereafter, the wafer transfer mechanism 24 loads the substrates 18 into the standby part 27 at the rear of the transfer chamber 23 and charges (charging) them on the boat 26.

[0031] The wafer transfer mechanism 24, which transfers the substrates 18 to the boat 26, returns them to the pod 9 and charges a next substrate 18 on the boat 26.

[0032] During the charging operation of the substrates 18 on the boat 26 by the wafer transfer mechanism 24 in the pod opener 14 of one side (the upper stage or the lower stage), another pod 9 is transferred from the rotary pod shelf 11 to the pod opener 14 of the other side (the lower stage or the upper stage) by the pod transfer device 15, in which the operation of opening the pod 9 with the other pod opener 14 is performed at the same time.

[0033] If a plurality of substrates 18 is charged on the boat 26, the furnace port part of the process furnace 28 which has been closed by the furnace port shutter 31 is opened by the furnace port shutter 31. Subsequently, the boat 26 is lifted up by the boat elevator 32 and is loaded (loading) into the process chamber 29.

[0034] After the loading, the furnace port part is hermetically sealed by the seal cap 34. Furthermore, in the present embodiment, at this timing (after the loading), a purge step (pre-purge step) is performed in which the process chamber 29 is substituted by an inert gas.

[0035] The process chamber 29 is vacuum-exhausted by a gas exhaust mechanism (not shown) so as to reach a desired pressure (degree of vacuum). In addition, the process chamber 29 is heated by a heater driving part (not shown) to a predetermined temperature so as to have a

apparatus 1 through the operation screen. The operation screen of the operation display section 227 is a touch panel using, e.g., liquid crystal. The operation display section 227 receives operator's input data (input instruction) from the operation screen and transmits the input data to the main controller 201. The operation display section 227 is also configured to receive an instruction (control instruction) to execute a recipe developed in the memory (RAM) 226 or the like, or any substrate processing recipe (also referred to as a process recipe) among a plurality of recipes stored in the main-controller storage section 222, and to transmit it to the main-controller section 220.

[0057] Furthermore, in the present embodiment, the device management controller 215 is configured to develop each stored screen file and data table by executing various programs or the like when it activated, and to display each screen indicating the health condition (operation state) of the device on the operation display section 227 or a screen display section 215a as described hereinbelow by reading the device data.

[0058] The main-controller communication section 228 is connected to a switching hub or the like. The main controller 201 is configured to transmit and receive various data to and from an external computer or any other controller in the apparatus 1 via a network.

[0059] The main controller 201 also transmits the device data such as the state of the substrate processing apparatus 1 to an external higher computer via a network (not shown). Furthermore, the substrate processing of the substrate processing apparatus 1 is controlled by the control system 200 based on each recipe file, each parameter file or the like stored in the main-controller storage section 222.

(Substrate Processing Method)

[0060] Next, a predetermined processing step to be performed using the substrate processing apparatus 1 according to the present embodiment will be described. Here, the predetermined processing step is a substrate processing step (here, a film forming step), which is one of the steps for

manufacturing a semiconductor apparatus.

[0061] In performing the substrate processing step, a substrate processing recipe (process recipe) corresponding to the substrate processing to be performed is developed in, for example, the memory such as the RAM in the process system controller 212. Then, an operation instruction is given from the main controller 201 to the process system controller 212 or the transfer system controller 211 as necessary. The substrate processing step performed in this manner has at least a loading step, a film-forming step, an unloading step.

(Transfer Step)

[0062] An instruction to drive the substrate transfer mechanism 24 is issued from the main controller 201 to the transfer system controller 211. Then, the substrate transfer mechanism 24 starts the transfer processing of the substrates 18 from the pod 9 on a delivery stage 21 as the mounting stand to the boat 26 according to an instruction from the transfer system controller 211. This transfer processing is performed until the charging of all the scheduled substrates 18 on the boat 26 is completed.

(Loading Step)

[0063] If the substrates 18 are charged on the boat 26, the boat 26 is lifted up by the boat elevator 32 that operates according to an instruction from the transfer system controller 211 and is loaded into the process chamber 29 formed in the process furnace 28 (boat loading). When the boat 26 is completely loaded, the seal cap 34 of the boat elevator 32 hermetically seals the lower end of a manifold of the process furnace 28.

(Film-Forming Step)

[0064] Thereafter, the process chamber 29 is vacuum-exhausted by a vacuum exhaust device so as to reach a predetermined film-forming pressure (degree of vacuum) according to an instruction from the pressure controller 212b. Also, the process

value or the like of the reaction chamber temperature) that the apparatus 1 should target. That is, the device data of the apparatus 1 is compared with the standard data and monitored every moment. This makes it possible to realize monitoring of the device status with less false alarm. Details of the device status monitoring function will be described later.

(Data-Analysis-Support Controller 215f)

[0075] The data-analysis-support controller 215f has a data analysis program, and when an abnormal phenomenon (for example, a film thickness abnormality of a substrate as a product) occurs, the maintenance personnel may display analysis data for analyzing the factor of the abnormal phenomenon on the operation display section 227. This contributes to reduction of analysis time and reduction of analysis errors due to variations in maintenance personnel skills. In addition, as will be described later, the data-analysis-support controller 215f is configured to facilitate abnormality factor analysis, device status monitoring, or the like. Details of the data analysis support function will be described later.

[0076] Furthermore, the device management controller 215 has a function as a database that collects the device data and accumulates it in the storage section 215h, and can process the accumulated device data to graph it and display it on the operation display section 227. This makes it possible to improve the work efficiency in a clean room (CR) of the operator (for example, a customer and a field service engineer (FSE)) who uses the apparatus 1.

[0077] Furthermore, in the present embodiment, it is configured that the device management controller 215 is installed separately from the main controller 201, but the present disclosure is not limited to such a configuration. Also, in the present embodiment, the functions (for example, the device status monitoring, the data analysis support and the like) of the device management controller 215 may be incorporated in any of the main controller 201 as the operation section, the transfer system controller 211 as the transfer control part, and the process system controller 212 as the process control part.

further configured to display the device data related to the abnormality analysis information on the display device in a manner that goes back to the past time from a specified abnormality occurrence time.

5. The apparatus of Claim 1, wherein the abnormality analysis information is configured to include event information that includes event data indicating information that an alarm has been generated.

6. The apparatus of Claim 5, wherein the analysis-support controller is further configured to display the information of the generated alarm on the display device in the manner that goes back to the past time from the time when the latest recipe specified by the recipe name is executed.

7. The apparatus of Claim 1, wherein the abnormality analysis information is configured to include:

substrate-processing-specific information that specifies a substrate process executed by the substrate processing apparatus in which abnormal data is generated;

the recipe-specific information that specifies a recipe executed by the substrate processing apparatus at a time when the abnormal data is generated;

data time information that specifies a time when the abnormal data is generated; and
abnormal-phenomenon-specific information that specifies an abnormal phenomenon.

8. A substrate processing apparatus comprising a device management controller, wherein the device management controller includes:

a device-status-monitoring controller that stores, in a storage section, device data generated by the apparatus; and

an analysis-support-controller that acquires the device data related to abnormality analysis information from the storage section based on basic information that includes:

information that defines an abnormal event, at least one of the device data corresponding to the abnormal event, and step information indicating a step where the at least one of the device data is generated; and

recipe-specific information that includes at least a recipe name, and

wherein the apparatus comprises a display device that displays the device data related to the abnormality analysis information in a manner that goes back to a past time from a time when a latest recipe specified by the recipe name is executed.

9. The apparatus of Claim 8, wherein the device management controller includes the storage section configured to store a device name and an IP address of a master apparatus, and the device management controller is configured to perform communication connection with the master apparatus with the IP address, and then to compare a device name of the master apparatus acquired by the communication connection with the device name of the master apparatus stored in the storage section.

10. The apparatus of Claim 9, wherein the device management controller is configured to acquire a recipe file from the master apparatus when the device names in comparison match each other and copy the recipe file acquired from the master apparatus to create a recipe file of the apparatus.

11. The apparatus of Claim 1, wherein the analysis-support-controller acquires the device data related to abnormality analysis information from the storage section based on basic information that includes:

information that defines an abnormal event, at least one of the device data corresponding to the abnormal event, and step information indicating a step where the at least one of the device data is generated;

information that specifies a time (abnormality occurrence time) when the abnormal event has occurred; and

recipe-specific information that includes a recipe name.

12. A device management controller, comprising:

a device-status-monitoring controller that stores, in a storage section, device data generated by an apparatus ;

an analysis-support controller that acquires the device data related to abnormality analysis information from the storage section based on basic information that includes:

information that defines an abnormal event, at least one of the device data corresponding to the abnormal event, and step information indicating a step where the at least one of the device data is generated; and

recipe-specific information that includes at least a recipe name; and

a display device that displays the device data related to the abnormality analysis information in a manner that goes back to a past time from a time when a latest recipe specified by the recipe name is executed.

13. A computer-readable recording medium storing a program that causes to perform a process in a device management controller, the process comprising:

storing, in a storage section, device data generated by an apparatus;