Wet Process Module and Method of Operation

The invention relates to a wet process module, in particular to a lacquering module for the treatment of substrates, and to a method of operating such a wet process module.

Wet process modules are known and include a process chamber having a process pot in which the substrate is treated with a liquid, usually a lacquer. During operation, conditioned air flows through the process chamber, which flows into the process chamber at a specific temperature and humidity via a supply unit and is discharged via an extraction line. Depending on the application, different volume flows of air flowing through the process chamber are required during the treatment process.

This often leads to fluctuations in the volume flow at other modules of the system, since all modules are usually connected to a common air supply and/or a common extraction line. In addition, fluctuations of the air supply and the air discharge, in particular due to inadequate or missing regulation, will affect the process conditions.

Summary

In an aspect, the present disclosure refers to a wet process module, in particular a lacquering module, for the treatment of substrates, in particular wafers, including a process chamber which has a process pot for treating the substrate, an air inlet for supplying air into the process chamber, at least one bypass outlet and at least one process pot outlet, wherein the at least one bypass outlet and the at least one process pot outlet are air outlets for discharging air out of the process chamber, and wherein the at least one process pot outlet is provided in the process

pot and the at least one bypass outlet is provided outside the process pot.

In an aspect, the present disclosure refers to a method of operating a wet process module according to the above aspect, comprising the following steps:

a) feeding a known, in particular a constant, volume flow of air through the air inlet into the process chamber, and

b) controlling via closed-loop or open-loop the volume flow of air exiting the process chamber through the at least one bypass outlet.

The object of the ~~invention~~ disclosure is to provide a wet process module which ensures an improved process environment and thus products of higher quality or less waste. The object of the disclosure ~~invention~~ is also to provide a method of operating such a wet process module.

To achieve the object, in an example, a wet process module, in particular a lacquering module, is provided for the treatment of substrates, in particular wafers. The wet process module includes a process chamber which has a process pot for treating the substrate, an air inlet for supplying air into the process chamber, at least one bypass outlet and at least one process pot outlet. The at least one bypass outlet and the at least one process pot outlet are air outlets for discharging air from the process chamber. Furthermore, the at least one process pot outlet is provided in the area of the process pot, and the at least one bypass outlet is provided outside

the process pot. In this way, the air in the process chamber can flow out of the process chamber both through the at least one process pot outlet, and thus through the process pot, and also through the at least one bypass outlet, and thus past the process pot, i.e. not through the process pot. The bypass outlet thus forms a bypass via which an air flow can be directed past the process pot. Due to this design, the volume flow of air flowing out of the process chamber via the process pot through the at least one process pot outlet can be adjusted by the volume flow flowing out of the process chamber via the bypass. The wet process module can thus always extract the same volume flow of air, thus preventing fluctuations to other wet process modules.

In particular, the flow connection between the air inlet and the at least one bypass outlet always runs outside the process pot.

For example, air is supplied via the air inlet into the process chamber by a supply unit.

The wet process module may have a diffuser coupled to the air inlet via which the air flows into the interior of the process chamber in a distributed manner. In this way, a uniform, in particular laminar volume flow of air into the process chamber can be generated.

Alternatively or additionally, a filter coupled to the air inlet may be provided, through which the air flowing into the process chamber is cleaned. In this way, contamination of the process chamber by particles can be reduced or prevented.

For example, the filter is located in front of the diffuser in the direction of flow.

It may also be provided that the filter is integrated in the diffuser or vice versa. In other words, the filter may have an air distribution function, or the diffuser may have a filtering function.

In one ~~embodiment~~example, the air inlet on the one hand and the air outlets on the other hand are provided on different, particularly opposite sides of the process chamber. Additionally or alternatively, the at least one process pot outlet and the at least one bypass outlet may be provided on the same side of the process chamber. A particularly favorable flow pattern in the process chamber is thus ensured.

The air inlet may be provided on a roof of the process chamber and/or the at least one process pot outlet and the at least one bypass outlet may be provided on a bottom of the process chamber.

It may also be provided that the at least one bypass outlet extends at least in sections in an annular shape around the process pot and/or that a plurality of bypass outlets arranged around the process pot is provided. This has the advantage that at several points around the process pot, air can flow out of the process chamber via the bypass, thus forming a flow pattern in the process chamber which ensures a particularly good process environment.

In a further ~~embodiment~~example, the wet process module includes an exhaust air device having at least one process pot channel and at least one bypass channel. Here, the at least one process pot channel extends from the at least one process pot outlet and the at least one bypass channel from the at least one bypass outlet. In this way, the air flowing out of the process chamber via the at least one process pot outlet can be directed through the at least one process pot channel, while the air flowing out of the process chamber via the at least one bypass outlet can be directed through the at least one bypass channel.

It is advantageous here if a regulating means, in particular a throttle valve is provided in the at least one bypass channel, by means of which the cross-section of the bypass channel through which a flow can pass can be regulated. The volume flow which flows out of the process chamber via the bypass and thus indirectly the volume flow which flows out of the process chamber via the process pot can therefore be regulated.

In ~~embodiments~~ examples having several bypass channels, these can open into a common channel section.

In this case, the regulating means is preferably arranged in this common channel section in order to be able to control via closed-loop and/or open-loop the volume flow through all bypass outlets together using a regulating means.

According to one ~~embodiment~~example, the at least one process pot channel is fluidically connected to the at least one bypass channel so that the air volume flowing through the at least one process pot channel and the air volume flowing through the at least one bypass channel can be discharged together via an extraction line.

Furthermore, the exhaust air device can thus have a common exhaust air port for the at least one process pot channel and the at least one bypass channel via which the exhaust air device can be connected to an extraction line.

In particular, the at least one process pot channel is fluidically connected to the at least one bypass channel downstream of the regulating means of the bypass channel, so that the regulating means cannot be contaminated by substances such as lacquer which are introduced into the at least one process pot channel, and thus the function thereof cannot be impaired.

To prevent contamination of the at least one process pot channel and/or of downstream channels, the at least one process pot channel may have a lacquer trap. The lacquer trap is designed to separate and collect solid and liquid substances by means of gravity.

In ~~embodiments~~ examples having several process pot channels, these can open into a common channel section.

In this case, the lacquer trap is preferably arranged in this common channel section in order to be able to separate the substances which are introduced via all process pot outlets by means of a lacquer trap.

In addition or alternatively, it is advantageous if the at least one process pot channel has no regulating means, such as a throttle valve, which can be contaminated by substances introduced into the at least one process pot channel, such as lacquer, and the function of which can thus be impaired.

In particular, the at least one process pot channel has no regulating means at all.

According to a further ~~embodiment~~example, the wet process module has a pressure sensor configured to detect the air pressure in the process chamber. The air pressure in the process chamber is an important parameter which determines the volume flows via the supply unit into the process chamber and/or through the at least one process pot outlet and the at least one bypass outlet, and thus has a decisive influence on the quality of the process environment.

The pressure sensor may in particular be located within the process chamber and/or adjacent to the air volume within the process chamber.

For example, the pressure sensor is arranged outside the process chamber and is fluidically coupled to the air volume within the process chamber via a pipe.

It may furthermore be provided that the wet process module has a control unit which is connected in a signal-transmitting manner to the regulating means and/or to a supply unit of the wet process module and is set up to control via closed-loop or open-loop the regulating means and/or the supply unit, in particular depending on the air pressure in the process chamber and/or the current process step. In this way, a particularly high-quality process environment can be reliably and effectively ensured, resulting in products of particularly high quality.

In particular, the control unit is set up to carry out the following process.

According to ~~the invention~~an example, a method of operating a wet process module~~ according to the invention~~ is also provided for achieving the above mentioned object, comprising the following steps:

a) feeding a known, in particular a constant, volume flow of air through the air inlet into the process chamber, and

b) controlling or regulating the volume flow of air exiting the process chamber through the at least one bypass outlet

In this way, the volume flow flowing out of the process chamber via the process pot is indirectly controlled via closed-loop or open-loop by the volume flow flowing out of the process chamber via the bypass. However, the total amount of air flowing out of the process chamber remains essentially constant. Therefore, a particularly favorable process environment with advantageous flow patterns, in particular in the process pot, can be reliably provided, in particular over the entire treatment process of a substrate.

The volume flow of air exiting the process chamber through the at least one bypass outlet can be controlled via closed-loop or open-loop by a regulating means in the at least one bypass channel. It is thus possible to adjust the volume flow particularly quickly and accurately.

The advantages and features discussed for the wet process module apply equally to the process and vice versa.

The components that perform steps of the process are of course also set up to perform the steps.

The regulating means and/or the supply means is in particular controlled by the control unit.

In one ~~embodiment~~example, the cross-section of the at least one process pot channel through which a flow pass is not actively changed, i.e. in particular not actively controlled via closed-loop or open-loop. Thus, the cross-section of the at least one process pot channel remains constant, apart from secondary effects such as contamination which accumulates in the at least one process pot channel during operation.

It may also be provided that the air pressure in the process chamber is regulated such that there is a slight overpressure in the process chamber compared to the ambient pressure at the installation site of the wet process module. The advantage of an overpressure compared to a negative pressure in the process chamber is that in this way no particles are sucked into the process area if the process chamber is not completely sealed from the environment. This effectively reduces the amount of particles which can negatively influence the process result.

For example, the volume flow of air into the process chamber is regulated by regulating the supply unit via the control unit, in particular on the basis of the data acquired by the pressure sensor, in order to generate an essentially constant air pressure, in particular overpressure in the process chamber.

Within the meaning of the invention, a slight overpressure is a pressure which is between 100.1% and 110% of the ambient pressure.

According to a further ~~embodiment~~example, a known, in particular constant volume flow of air is extracted from the process chamber via the exhaust air device. In particular, the volume flow extracted by the exhaust air device is smaller than the volume flow of air supplied to the process chamber. In this way, an overpressure in the process chamber can be reliably ensured.

Further advantages and features will become apparent from the description below and from the accompanying drawings, in which:

Claims

1. A wet process module, in particular a lacquering module, for the treatment of substrates, in particular wafers, including a process chamber (12) which has a process pot (24) for treating the substrate, an air inlet (16) for supplying air into the process chamber (12), at least one bypass outlet (38) and at least one process pot outlet (36),

wherein the at least one bypass outlet (38) and the at least one process pot outlet (36) are air outlets for discharging air out of the process chamber (12), and

wherein the at least one process pot outlet (36) is provided in the process pot (24) and the at least one bypass outlet (38) is provided outside the process pot (24).

2. The wet process module according to claim 1, characterized in that the air inlet (16) on the one hand and the air outlets (36, 38) on the other hand are provided on different, in particular opposite sides of the process chamber (12), and/or in that the at least one process pot outlet (36) and the at least one bypass outlet (38) are provided on the same side of the process chamber (12).

3. The wet process module according to claim 1 or 2, characterized in that the at least one bypass outlet (38) extends at least in sections in an annular shape around the process pot (24) and/or in that a plurality of bypass outlets (38) arranged around the process pot (24) is provided.

4. The wet process module according to any of the preceding claims, characterized in that the wet process module (10) has a pressure sensor (54) which is configured so as to determine the air pressure in the process chamber (12).

5. The wet process module according to any of the preceding claims, characterized in that the wet process module (10) comprises an exhaust air device (14) having at least one process pot channel (40) and at least one bypass channel (42), wherein the at least one process pot channel (40) extends from the at least one process pot outlet (36) and the at least one bypass channel (42) extends from the at least one bypass outlet (38).

6. The wet process module according to claim 5, characterized in that a regulating means (56), in particular a throttle valve, is provided in the at least one

bypass channel ~~(42)~~, by means of which the cross-section of the bypass channel ~~(42)~~ through which a flow can pass can be regulated.

7. The wet process module according to claim 6, characterized in that the wet process module ~~(10)~~ has a control unit ~~(52)~~ which is connected to the regulating means ~~(56)~~ and/or a supply unit ~~(15)~~ of the wet process module and is arranged to control or regulate the regulating means ~~(56)~~ and/or the supply unit ~~(15)~~, in particular depending on the air pressure in the process chamber ~~(12)~~ and/or the current process step.

8. The wet process module according to any of claims 5 to 7, characterized in that the at least one process pot channel ~~(40)~~ is fluidically connected to the at least one bypass channel ~~(42)~~, in particular downstream of the regulating means ~~(56)~~ of the bypass channel ~~(42)~~.

9. The wet process module according to any of claims 5 to 8, characterized in that the at least one process pot channel ~~(40)~~ has a lacquer trap ~~(50)~~ and/or no regulating means ~~(56)~~.

10. A method of operating a wet process module ~~(10)~~ according to any of the preceding claims, comprising the following steps:

a) feeding a known, in particular a constant, volume flow of air through the air inlet ~~(16)~~ into the process chamber ~~(12)~~, and

b) controlling via closed-loop or open-loop the volume flow of air exiting the process chamber ~~(12)~~ through the at least one bypass outlet ~~(38)~~.

11. The method according to claim 10, characterized in that the volume flow of air exiting the process chamber ~~(12)~~ through the at least one bypass outlet ~~(38)~~ is controlled via closed-loop or open-loop by a regulating means ~~(56)~~ in the at least one bypass channel ~~(42)~~.

12. The method according to claim 10 or 11, characterized in that the cross-section of the at least one process pot channel ~~(40)~~ through which a flow passes is not actively changed.

13. The method according to any of claims 10 to 12, characterized in that the air pressure in the process chamber ~~(12)~~ is regulated such that an overpressure prevails in the process chamber ~~(12)~~.

14. The method according to any of claims 10 to 13, characterized in that a known, in particular constant volume flow of air is extracted from the process chamber ~~(12)~~ via the exhaust air device ~~(14)~~, in particular wherein the volume flow extracted by the exhaust air device ~~(14)~~ is smaller than the volume flow of air supplied to the process chamber ~~(12)~~.